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Current and past trends in tobacco and e-cigarette use and the impact of control measures: an analysis of survey data and other evidence

Authors: Amelia Benson[a], Muslihah Albakri[a], Dr Priya Khambhaita[a], Klaudia Walewska-Lubian[a], Sally McManus[a], Imogen Martin[a], Crescenzo Pinto[a], Emily Sawdon[a], Frances Shipsey[a], Sarah Tipping[a], Dr Karen Windle.[a]

[a] NatCen Social Research

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NatCen Social Research
35 Northampton Square
London EC1V 0AX
T 020 7250 1866
www.natcen.ac.uk

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Contributions

Amelia Benson was the research lead for work strand four. She authored the discussion for Chapter 9 and co-authored the overall report discussion in Chapter 11.

Muslihah Albakri provided statistical analysis for work strands one and two. She co-authored Chapter 7 with Sarah Tipping.

Dr Priya Khambhaita was the research director for this report.

Klaudia Lubian provided statistical analysis for work strand three. She co-authored Chapter 8.

Sally McManus provided statistical support for work strand three. She co-authored Chapter 8.

Imogen Martin, Crescenzo Pinto, Emily Sawdon, Katie Ridout, Claire Lapham and Frances Shipsey were researchers for work strand four. Imogen, Crescenzo and Emily co-authored Chapter 9. Frances authored the glossary and acted as report proof-reader.

Sarah Tipping provided statistical analysis for works strands one and two. She authored Chapter 6 and co-authored Chapter 7 with Muslihah Albakri.

Dr Karen Windle was the principal investigator for this project report. She authored the executive summary, lay summary, introduction, discussion, and conclusions.

1 Table of contents

2 Tables and figures, abbreviations and glossary

2.1 List of tables

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2.3 Abbreviations

ASH	Action on Smoking and Health
BMI	Body mass index
CDC	Centers for Disease Control and Prevention
COPD	Chronic obstructive pulmonary disease
DEBRA	Deutsche Befragung zum Rauchverhalten (German Study on Tobacco Use)
DePICT	Description des Perceptions, Images, et Comportements liés au Tabagisme
DHSC	Department of Health and Social Care
E-cigarette	Electronic cigarette
ENDS	Electronic nicotine delivery system
EPPI-Centre	Evidence for Policy and Practice Information and Co-ordinating Centre
EU	European Union
EU TPD	European Union Tobacco Products Directive
EU-SILC	European Union Statistics on Income and Living Conditions
FCTC	WHO Framework Convention on Tobacco Control (FCTC)
GCSE	General Certificate of Secondary Education
GHQ	General Health Questionnaire
HA	Housing association
HISB	Health information seeking behaviour
HSE	Health Survey for England
ITC Project	International Tobacco Control Policy Evaluation Project
ITC4	International Tobacco Control Four Country Project
ITS	Interrupted Time Series
ITSA	Interrupted Time Series Analysis
LA	Local authority
LGBT	Lesbian, gay, bisexual, and transgender
NDSHS	National Drug Strategy Household Survey
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health Research
NS-SEC	National Statistics Socio-economic Classification
NUTS	Nomenclature of territorial units for statistics
ONS	Office for National Statistics
OR	Odds ratio
POS	Point(s) of sale

PSU	Primary sampling unit
REA	Rapid evidence assessment
SALSUS	Scottish Schools Adolescent Lifestyle and Substance Use Survey
SD	Standard deviation
SDD	Smoking, Drinking and Drug Use Among Young People in England
SDQ	Strengths and Difficulties Questionnaire
SE	Standard error
SF-12	Short Form Survey
SHeS	Scottish Health Survey
SPSS	IBM SPSS Statistics
TCS	Tobacco Control Scale
TPD	European Tobacco Products Directive
TPRPS	Tobacco Products and Risk Perceptions Survey
TUS-CPS	Tobacco Use Supplement - Current Population Survey
UK	United Kingdom
US FDA	United States Food and Drug Administration
USA	United States of America
USoc	Understanding Society
WAY	What About Youth (WAY) study
WHO	World Health Organization

2.4 Glossary

abstrackr	A software application used for initial screening of academic papers by title and abstract only. Uses machine learning to display more relevant papers first.
abstract	A short summary at the start of a research paper, indicating methods, topic and findings.
affect	Feelings, emotions and moods caused by specific stimuli. In the context of tobacco, this refers to the feelings, emotions and moods caused by use of tobacco products.
atomiser	The part of an e-cigarette that is used to vaporise e-liquid. Coils inside the atomiser heat the e-liquid and produce a smoke-like vapour breathed in by the user.
biennial	Every two years.

binary variable	A variable measured with only two possible values, for example hot and cold, 0 and 1, or happy and unhappy. More complex variables (such as a happiness scale from 1-7) are sometimes re-coded as binary values, for simplicity during analysis.
bivariate analysis	The analysis of two variables for the purpose of determining the statistical relationship between them.
brandsharing	In the context of tobacco, the practice of advertising indirectly by using tobacco branding on non-tobacco products or services. Also known as brandstretching.
causal link	The connection between a cause and an effect.
cessation	Stopping or quitting. In the UK, smoking cessation services are provided through the Stop Smoking Service.
cig-alike	An e-cigarette manufactured to appear like a conventional tobacco cigarette.
cohort studies	A type of study repeated over time (longitudinal) where a group (cohort) of individuals is selected at one time point and followed prospectively at different time intervals. Cohort effects are sometimes observed when a particular shared characteristic of the cohort, for example birth year, impacts the outcome of interest.
confidence interval	In statistical analysis, a confidence interval is the range of values within which the 'true' population value is estimated to be.
confounding factor	A variable or factor, not in itself of interest to a research project, which is mixed in with the relationship between other variables so that the precise nature of their relationship is not clear.
controlling for	In statistical modelling with multiple variables and factors, keeping one variable constant in order to examine and test the relationship and effect between other variables of interest in the model.
correlation	In statistics, the association or relationship between two variables, not necessarily causal. For example, the rings in a tree trunk increasing with the age of the tree is an example of positive correlation.
cross-sectional survey	A survey of one group of people at a specific point in time. Cross-sectional surveys may be repeated, for example annually, but the participants are not the same people each time.
data	Information or facts such as measurements, counts, observations, survey responses or interview conversations. Often used for information collected for or used in research.

dataset	A collection of data or information such as all the responses to a survey or all the recordings from a set of research interviews.
demographic	A particular section of the population. Also refers to characteristics of an individual of interest for statistical research, such as age, gender, and ethnicity.
derived variable	A variable that was not directly asked in a survey, but created at analysis stage, for example by merging two or more variables.
descriptive analysis	Producing statistics that summarise and describe features of a dataset such as the mean, and the range and distribution of values for variables.
Directive (European Union)	A legislative act requiring that all EU countries achieve a particular result, while leaving countries free to choose how they do so, usually within a deadline of two years.
disposable	A single use e-cigarette which is not refillable or rechargeable; some e-cigarette types such as pod systems contain both re-usable and disposable components.
distribution	A statistical function that shows the possible values for a given variable and how often they occur.
dual user	Someone who uses two types of tobacco or nicotine product, for example cigarettes and e-cigarettes.
e-cigarette	Electronic cigarette, an electronic device used to inhale vapour, sometimes flavoured. E-cigarettes may or may not contain nicotine and are non-combustible devices.
electronic nicotine delivery system	Often abbreviated to ENDS. A generic term for a variety of electronic devices for consuming nicotine.
e-liquid	The liquid used in e-cigarettes. Contains propylene glycol and vegetable glycerine and may also contain nicotine and / or flavourings.
ethnicity	Ethnicity refers to specific ethnic groups. Within the UK, the Office for National Statistics uses the following ethnic groups: White; Mixed or Multiple Ethnic; Asian / Asian British; Black / African / Caribbean / Black British; and Other. This report replicates this where possible.

EU27	From 1 January 2007-30 June 2013, refers to the 27 member states of the European Union including the United Kingdom; from 1 July 2013 Croatia joined the EU as the 28th member; in the years immediately prior to 31 January 2020, EU27 may refer to the European Union countries other than the United Kingdom; following the UK's departure from the EU in 2020, there are 27 EU member states. In this report the analysis of smoking in Europe (detailed in Appendix E) refers to EU27 and includes the UK but excludes Croatia.
ever use	Whether or not someone has ever used a tobacco or nicotine product, defined in a variety of ways by different surveys and studies.
exclusion	Being barred from school permanently or temporarily (fixed period).
F	In statistical modelling, the *F*-test is used to test the significance of the entire model and how well the model fits the data.
free school meals	Children whose household income is below a certain level are eligible for free school meals. Eligibility for free school meals is therefore often used as an indicator of social and economic deprivation.
Gini coefficient	A statistical measure of economic inequality, measuring income distribution or wealth distribution in a population.
grey literature	Publications and documents that are not issued by academic or commercial publishers. Examples include reports, working papers, policy documents and other research, produced and issued by government bodies, and non-governmental organisations.
heterogenous	Mixed or diverse.
hypothesis	In scientific research, a proposed explanation for a phenomenon, which can be tested.
initiation	Starting, for example starting to smoke.
interaction	In multivariate analysis, when the effect of one variable on an outcome is found to be conditional on the state of another variable.
interrupted time series analysis	Analysis of trends over time, comparing the effects of an intervention at a point in time with the expected trends if the intervention had not taken place. See Sections 6.2.2 and 6.3.4 for more information.
intervention	A specific planned measure, for example a law or a health campaign.
JUUL	A brand of e-cigarettes originating from the USA.

limiting long-term illness	An ongoing illness that an individual perceives as limiting their day-to-day activities for a sustained period.
longitudinal surveys	Repeated surveys that study the same people over time.
mean	Average as commonly understood - based on adding all the values in a sample divided by the number of members of the sample.
median	Average based on the mid-point of all values in a sample arranged in order. Used in preference to the mean when data contains extreme values, for example annual income.
metabolite	The waste product of something after being broken down by the body's metabolism. In the context of smoking and e-cigarette use, tobacco-specific and / or nicotine metabolites in the urine can be used to measure levels of consumption.
mixed methods research	Using more than one type of research method in a study, for example survey data and research interviews.
model	A representation of how concepts or phenomena relate to each other by applying statistical theory to test relationships and interactions. Used to test hypotheses and answer research questions.
multivariate analysis	Statistical analysis of the multiple relationships between more than two variables.
n	The number of observations or cases in a sample. For example, a survey may have *n*=2,300 respondents, while a qualitative study may be based on *n*=9 participants. During analysis *n* may become smaller, for example if not all respondents answer a particular question, or when analysing responses from a subset of the full sample.
nationally representative	Surveys based on statistically reliable methods of sampling can provide statistics that are representative of a wider population, for example the whole country, and the report should state what the likely margin of error is.
Newey-West standard error	A function that produces a more robust estimate of standard error in certain statistical models.
nicotine	A toxic oily liquid with addictive properties found in tobacco. Often but not always an ingredient in the e-liquid used in e-cigarettes and vape devices.
nicotine replacement therapy	Treatment for smoking addiction through use of nicotine patches or nicotine chewing gum.

null hypothesis	In statistical testing of hypotheses about relationships between variables, the hypothesis that there is no relationship (null) and that any observed relationship has occurred by chance in the sample. If the null hypothesis is rejected, the research hypothesis may be accepted.
NUTS classification	A standardised system for dividing the economic territory of the EU into units at different levels for use in collecting and analysing EU regional statistics and for policy development. For example, the UK is divided into 41 NUTS2 regions.
observational study	Research that measures or records without intervening or experimenting.
odds ratio	Used to compare the relative odds of something for one subgroup (for example women) compared to a reference group (for example men). If the odds ratio value is greater than 1, the odds of the outcome occurring in that subgroup are higher.
outcome variable	The variable of interest, representing the phenomenon that a research study seeks to explain, and which may be predicted or determined by other factors through a causal link or other relationship. Also known as response variable or dependent variable.
Poisson modelling	In statistical modelling, testing the probability of something occurring at intervals of time.
poly-tobacco use	Use of more than two different products, e.g., cigarettes, cigars, pipes, hookah, e-cigarettes or smokeless tobacco.
power	In statistical modelling, the strength of an association between variables.
pragmatic trials	Clinical research that measures the likely effectiveness of an intervention in clinical practice by reflecting real world variation between patients, in contrast to clinical research conducted under ideal experimental conditions.
predictor variable	One or more factors which may explain or predict variation in a phenomenon of interest, through their association with it. Also known as covariates, factors or explanatory variables.
prevalence	The extent to which something occurs in a population or group, often expressed as a percentage.
propylene glycol	An ingredient used in e-liquid to produce a smoke-like vapour.
prosocial	Behaviours that are oriented towards helping other people and society.

p-value	Used as a measure of statistical significance. Low p-values indicate that results are very unlikely to have occurred by random chance. $p<0.05$ is a commonly cited value, indicating a less than 5% chance that the results obtained were by chance. Research findings can be accepted with greater confidence when even lower p-values are cited, for example $p<0.01$ or $p<0.001$.
qualitative research method	Used to explore how and why, rather than what and how much/how many. Useful for understanding lived experiences and motivations of people.
quasi-experimental studies	Research that involves some element of experimentation or intervention but takes place in a real world setting (rather than a lab) where not everything can be controlled. This has implications for the conclusions that can be drawn.
quitter	Someone who has given up smoking or using other tobacco or nicotine products.
R	An open source software environment for statistical computing and graphics.
random effects regression	In statistical analysis, taking account of factors at different levels, which might impact the outcome, for example the factor of teachers on students' attainment. In the context of this study, used to analyse the effects of household characteristics on smoking in children.
randomised controlled trial	A clinical study to test the efficacy of a new intervention (such as a treatment or drug), in which participants are randomly assigned to two groups: the intervention group receives the treatment, while the control group receives either nothing, a placebo, or the standard current treatment. Clinicians and participants are ideally not informed who is allocated to each group.
rapid evidence assessment	A form of literature review characterised by focused research questions and a limited scope of search, including limiting searches to certain time points and / or certain databases.
refillable	A re-usable e-cigarette device such as tank system where the e-liquid tank can be re-filled.
regression analysis	Statistical analysis of the relationships between variables. Examples include linear regression where two variables are tested to see whether they vary in step with each other or logistic regression where the likelihood of an outcome is predicted.

regulations	Legal rules. In the UK's Westminster system, regulations are commonly used as the mechanism for implementing or updating the detailed provisions authorised by an Act of Parliament.
relationship	The link or association between two or more variables and which is explored and tested by statistical analysis. Also known as association or (of two variables) correlation.
re-starter	Someone who has taken up smoking or using other tobacco or nicotine products again after having previously quit.
risk factor	A factor that increases the likelihood of risk faced by an individual.
sample	A subset (for example of individuals), selected from a larger population. If the sample is selected to be representative of the population, research findings can be regarded as generally applicable beyond the research study sample.
screening	Evaluating research publications for inclusion in an evidence review, eliminating those that do not meet pre-defined criteria for substantive topic or for quality.
secondary data analysis	Analysis of data or information that has previously been collected - for example census data, administrative data, or responses from nationally representative surveys.
second-hand smoke	Smoke inhaled by breathing in another person's smoke exhalation rather than by directly smoking oneself.
sexual and gender minority	Sexual minority refers to homosexual, bisexual and other minority sexual orientations, (as distinct from the heterosexual orientation of the majority of people); gender minority refers to people identifying as transgender or non-binary, as distinct from those who identify as the gender that corresponds with the sex allocated at birth (known as cisgender).
snus	An oral tobacco product widely used in Sweden and Norway.
socioeconomic status	Social and economic characteristics of a person (based on measures of education level, income, and occupation) often used alongside demographic characteristics (such as age, gender, ethnic group) in research studies to highlight inequalities and differences.

Spearman's Rank correlation coefficient	Measures the strength of a correlation between two variables and whether the association is positive or negative. This statistic can range from -1 for a perfect negative correlation, through 0 for no correlation to 1 for a perfect positive correlation.
SPSS	Software application (IBM SPSS Statistics) for analysing quantitative data.
standard deviation	A measure of the spread or dispersion of values for a variable around the mean (average). Low standard deviation indicates that values are clustered around the mean, while a high standard deviation shows that there is a wider range of values.
standard error of the mean	Used in statistical analysis to measure how precise the estimate of the mean for a given sample is.
statistical significance	Statistical significance indicates that the result or difference obtained following analysis is unlikely to be obtained by chance (to a specified degree of confidence) and that the finding can be accepted as valid. A study's defined significance level is the probability of the study rejecting the null hypothesis (that there is no relationship between two variables), demonstrated by the p-value of the result.
Stop Smoking Service	Smoking cessation services, including advice, support and nicotine replacement therapies, offered locally in the UK by the NHS.
survey	A research instrument used to collect data by asking scripted questions or using lists or other items to prompt responses. Can be conducted in person face-to-face, by telephone, or by postal or web-based questionnaire.
systematic review	A type of literature review that uses systematic methods to collect secondary data. It is characterised by an appraisal of the weight of evidence and by synthesising findings qualitatively or quantitatively.
t	A specific point in time, for example when used to compare something at one point in time (*t*) with the same thing at a subsequent point in time (*t+1*).
take up	Starting to use a tobacco or nicotine product.
tank system	An electronic nicotine delivery system or vape kit, made up of separate components including a refillable e-liquid tank.
tenure	Housing arrangement or status of an individual, for example owner occupier, private renter, or local authority or housing association renter.

tertile	The lower, middle or upper third of an ordered set of values for a variable; also, the lower or upper point dividing the values into thirds.
time-to-first-use	How long a user waits (for example in minutes), before smoking the first cigarette of the day (or first puff of the day in the case of e-cigarette users). One way to measure nicotine dependence.
tobacco	The common name for plants containing nicotine; products made from the leaves of the tobacco plant for use in smoking or in non-combustible products. In the context of this report, sometimes used in contrast to non-tobacco nicotine products such as e-cigarettes and ENDS.
Tobacco Control Scale	A national indicator of the extent to which countries implement policies designed to reduce smoking.
tranche	A portion.
vape	Use an e-cigarette or vape device which can typically produce a cloud of vapour which is sometimes flavoured.
vape device	An electronic device such as an e-cigarette which can be used to inhale and exhale vapour formed by heating an e-liquid to form an aerosol.
vape liquid	Fluid used to fill a vape device. May contain nicotine or other substances and can be flavoured. Vape liquid may also be referred to 'e-liquid'.
vaporiser	A device used to heat a liquid (containing nicotine or other substances) to create a vapour for inhaling.
variable	A variable is defined as any individual or thing that can be measured. For example, the number of cigarettes smoked per day is a variable used in this report.
Wald test	A test of statistical significance for individual variables in a model. If a variable is not significant it can be removed from the model because it does not add anything to the explanation.
wave	A round of a repeated survey. For example, a survey which runs every two years for a 10-year period has waves 1 to 5.
weight of evidence	An approach used to rate academic papers by quality and relevance to research aims and objectives.
weighting	During analysis of survey data, adjusting for over- or under-representation of particular groups, to ensure that the results are representative of the wider population.

work strand — A part of the work in a larger project such as a research project.

3 Executive and lay summary

3.1 Executive summary

Introduction and background

While the proportion of the population who smoke cigarettes has fallen by more than half in the last 40 years in Britain, from 46% in 1974 to 14.7% in 2018, smoking remains one of the key preventable causes of early death in the developed world. Globally, smoking will be responsible for eight to ten million deaths per year by 2030. In contrast to the reduction in smoking, electronic cigarette (e-cigarette) use increased sharply between the introduction of e-cigarettes in 2008 until 2014 and currently reaches an estimated 3.6 million people in the UK.

In the UK, a range of tobacco control legislation has been introduced within the last decade, including measures which prevent the open displays of tobacco in shops and smoking in private vehicles carrying under 18s. This legislation forms part of a broader approach to tobacco control which, alongside wider regulatory and public health initiatives, aims to reduce smoking prevalence and minimise tobacco-related harms for both smokers and non-smokers. This has included the adoption of a regulatory framework around e-cigarette use which aims to balance the risks of this product with its potential benefits as a smoking cessation tool, introducing legislative measures such as limiting sales to over 18s while allowing advertising / promotion of the product in limited circumstances.

Research questions, work strands and methods

The programme of work reported here set out to explore the impact and consequences of policy changes implemented over the last decade, focused toward tobacco consumption and supply in England and Scotland. Four core research questions guided this research:

1. Have the prevalence, intensity and attitudes towards smoking in the UK changed with the implementation of recent tobacco regulations? Do effects vary across characteristics such as age, ethnicity, socioeconomic status or gender?

2. What are the characteristics of individuals who start or stop smoking?

3. How does the UK compare with other European countries in terms of trends in smoking consumption? How do inequalities in smoking in the UK compare to those in other countries?

4. What can current literature and available data tell us about the use of e-cigarettes?

To respond to these questions, a multi-method approach was delivered across four work strands:

- **Work strand one** explored trends in smoking prevalence, intensity and attitudes in England and Scotland through analysis of four national surveys (Health Survey for England (HSE), the Scottish Health Survey (SHeS), the Smoking Drinking and Drug Use among Young People Survey (SDD), and the Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS)), alongside analysis of the impact of specific pieces of tobacco control legislation enacted between 2007–2011.

- This analysis was supported by findings from **work strand three**, to ensure that the impact of socioeconomic inequality on smoking prevalence (alongside that of legislative controls) was addressed. Applying the Eurobarometer Survey as well as two country-level indicators (the Tobacco Control Scale and the Gini Coefficient), this work strand examined the relationship between prevalence of smoking, the extent of tobacco controls, and the level of social inequality.
- **Work strand two** applied the Understanding Society survey (USoc) to deliver a comprehensive profile of adults who take up, quit or re-start smoking; and children who smoke. In addition, this analysis explored the use of e-cigarettes among adults and children. This profiling is important given that tobacco controls could have heterogeneous effects depending on the characteristics of individuals, such as socioeconomic status, ethnicity, age, and educational level.
- **Work strand four** complements the analysis of USoc data on e-cigarettes, delivering a Rapid Evidence Assessment (REA) which details the current literature on e-cigarette consumption in the UK and abroad, as well as an assessment of the impact of restrictive and non-restrictive legislation on e-cigarette use.

Findings

Tobacco smoking among adults

Our analysis reflected much of the literature in demonstrating the influence of demographic and socioeconomic factors on smoking behaviours. In exploring smoking prevalence through the HSE and SHeS we found that:

- Men are more likely to smoke when compared with women. The rate of smoking has decreased more steeply in women between 2008 and 2016, although differences were found between England and Scotland.
- The greatest decline in smoking over time was seen in age groups 16–24.
- In England, individuals without a degree were twice as likely to smoke as those with a degree, although no similar association was found in Scotland.
- In both countries, unemployed people were more likely to smoke than those in employment.
- Health may be a precipitating factor for not smoking; those with a known heart condition were consistently less likely to smoke than those without any such diagnosis.

In looking at those adults that quit, take up or re-start smoking in USoc, demographic and socioeconomic characteristics were again seen to influence behaviours. In particular:

- Those more likely to quit included: ‘lighter smokers’; those who were employed; those holding a degree; those who were married or in a civil partnership; and those living in a two-person household.
- While health diagnoses encouraged quitting behaviours, the effect of such new diagnoses as ‘levers’ for behaviour change were time-limited.
- Those more likely to start smoking included: young people (aged 16–24); single individuals; those who were unemployed; those who had no qualifications; and those who were living in households with other smokers.
- While there has been a decline in the number of smokers overall, the age group 16-24 was the most likely to start smoking, and to re-start smoking.

- Those in professional and managerial occupations were less likely to re-start than those in other occupation types, and health conditions were also found to be a protective factor.

Tobacco smoking among children and young people

When analysing data from the SDD (age 11-15) and SALSUS (age ~13 and 15) we found that:

- The proportion of young people smoking had fallen over the last decade, although young people in Scotland seemingly smoked more heavily than those in England.
- Smoking increased with the age of the child.
- Smoking behaviours were seemingly carried out in full knowledge of the harms that cigarette smoking can cause, with nearly all young people recognising that smoking causes lung cancer and heart disease.
- However, such perceptions seemed to be tempered by other beliefs. In England (in 2008), almost two-thirds of young people agreed that smoking helps people relax if they feel nervous, and over one-fifth that smoking keeps people slimmer.
- Fewer young people (when compared with adults) reported a willingness to stop smoking.
- Legislation appeared to have an impact on access to tobacco for children and young people. SDD and SALSUS data showed that the number of children being able to purchase cigarettes halved between 2006 and 2016, with access to cigarettes from vending machines falling from 14% to almost zero, indicating that legislation may have been impacting on behaviours, despite any models being non-significant.

Demographic and socioeconomic characteristics were again central to smoking behaviours. USoc data, which captures smoking behaviours of children aged 10–15, demonstrated that:

- Family characteristics seemed to be crucial, with children more likely to smoke if their parents currently smoked or had smoked in the past. Girls were more likely to smoke if their father had no formal qualifications, was in a routine or lower supervisory role, or was unemployed. Children in owner-occupied accommodation were far less likely to smoke.
- Family relationships were central to smoking behaviours, with girls more likely to smoke if their father was not present in the household, but even more likely to smoke if their father was present but the girl perceived they did not speak to the father about things that mattered.
- Boys whose fathers had poor mental health were five times more likely to smoke, compared with boys whose fathers did not have any mental health conditions.
- Children were more likely to smoke if they perceived that their family was unsupportive or disinterested.

One limitation of the data on young people which should be noted is that the surveys sampled different ages of children, as shown above.

E-cigarette use among adults (16+)

- Prior literature has shown that e-cigarette use increased sharply following the introduction of e-cigarettes in 2008 but has remained steadier in recent years. Our analysis of USoc data showed a small increase in e-cigarette use, with around 3% of adults starting to use e-cigarettes between Wave 8 (2016–2018) and Wave 9 (2017–2019). E-cigarettes may have been used as a route to stop smoking, with those who used e-cigarettes twice as likely to have stopped between Wave 8 and 9 as those who smoked traditional cigarettes. However, of those who used e-cigarettes at Wave 8, almost two-thirds still used these at Wave 9.

- In exploring the demographic and socioeconomic characteristics of those that used e-cigarettes only, or used them alongside their tobacco smoking, we found that the normally accepted narrative of smoking behaviours (i.e., strongly linked to deprivation and social inequality) were reversed.
- For example, USoc data showed that men were more likely than women to vape, users of e-cigarettes tended to be younger, and sexual and gender minorities were more likely to be e-cigarette users (reflecting the profile of tobacco smokers). However, e-cigarette users were also more likely to be employed in managerial and professional occupations; married or in civil partnerships; and with better health.
- When we looked at the international literature selected through the REA, the picture was a little more complicated with some of the studies refuting the findings from our analysis of USoc. However, the literature did highlight that individuals who used e-cigarettes were more likely to be white, employed and identify as being lesbian, gay bisexual or transgender.

E-cigarette use among children and young people

- From our secondary analysis of USoc, we found the overall proportion of current young users of e-cigarettes (age 10-15), both regular and infrequent use, increased only slightly between the two waves; with fewer than 1% using e-cigarettes at least once a week. Reflecting tobacco smoking behaviours, the rate of e-cigarette use did increase with age. Studies included in the REA also indicated that the prevalence of e-cigarette use in the UK may have been substantially lower when compared with North America.
- The evidence suggested that the use of e-cigarettes by children and young people in the UK was yet to be the epidemic perceived by the wider media. However, USoc data suggesting that over one-fifth of boys and just under one-fifth of girls aged 15 had ever used e-cigarettes was of concern given that, as yet the short and long-term health impacts were unknown.

The impact of policy and legislation on tobacco and e-cigarette use

We explored prevalence of current smokers, and the mean number of cigarettes smoked per day alongside the dates of implementation for the Smoke-free Regulations in 2007, and the Tobacco Advertising and Promotion Regulations in 2012. No impact of the legislation on smoking behaviours was found.

The impact of the Protection from Tobacco (Sales from Vending Machines) legislation (2011) on the prevalence of smoking by children and the number of cigarettes smoked per day was also explored and no statistically significant impact was found. However, SDD and SALSUS data showed that the number of children being able to purchase cigarettes halved between 2006 and 2016, with access to cigarettes from vending machines falling from 14% to almost zero, indicating that legislation may have been impacting on behaviours, despite any models being non-significant. The most common means of young people getting cigarettes in 2016 was being given them by family and friends.

While specific single pieces of legislation may not be effective alone, the cumulative impact of the number and extent of legislative actions around smoking is likely to be having an impact on prevalence and consumption.

3.2 Lay summary

Introduction

While tobacco smoking has halved over the last four decades, we also know that it remains one of the key causes of early death in the developed world. In addition, the use of e-cigarettes is rising and there is concern about the take up of e-cigarettes from those with no history of tobacco smoking. In the last 10 years, a range of legislation, regulation and accompanying public health initiatives have been put in place to try and support people to reduce or stop smoking. However, we know little about how effective this legislation has been in changing smoking behaviours.

Our work set out to look at the impact of the policy changes made in England and Scotland as well as across European countries to reduce smoking behaviours. In addition, we explored the international literature on e-cigarettes to identify if restrictive legislation had reduced or stopped e-cigarette use.

In this study, we were guided by four overarching research questions:

1. Have the prevalence, intensity and attitudes towards smoking in the UK changed with the implementation of recent tobacco regulations? Do effects vary across characteristics such as age, ethnicity, socio-economic status or gender?
2. What are the characteristics of individuals who start or stop smoking?
3. How does the UK compare with other European countries in terms of trends in smoking consumption? How do inequalities in smoking in the UK compare to those in other countries?
4. What can current literature and available data tell us about the use of e-cigarettes?

Methods

To find out if legislation has been effective in changing cigarette or e-cigarette use, we carried out an analysis of five different surveys that looked at cigarette smoking behaviours across adults as well as children. Of these, four looked at smoking behaviours in England and Scotland, while the fifth explored behaviours across Europe. Within the surveys in England and Scotland, we looked at smoking behaviours against three different pieces of legislation to see how (and if) the legislation had changed tobacco smoking behaviours. We also carried out an analysis of a further survey that reported over a number of years, enabling us to assess how things changed over time. Finally, we carried out a review of the international literature to again see who was using e-cigarettes and what legislation may be effective in controlling their use.

Findings: Adults (16+) and cigarette smoking

We found demographic (e.g., sex, age, marital status) and socioeconomic characteristics (e.g., housing type, employment) to be central to who smoked tobacco cigarettes. This is reflective of much of the prior research that has been carried out. Men were still more likely to smoke than women and were more likely to smoke heavily. Those without educational qualifications were more likely to smoke as were those who were unemployed.

In terms of quitting smoking, heavy smokers were less likely to quit, as were those with fewer qualifications or those who were unemployed. Those who were married or in a civil partnership were far more likely to quit than those who were separated or divorced. We also found that a new health diagnosis affected people’s behaviours, with those diagnosed with e.g., a heart condition, high blood pressure or cancer, far more likely to quit smoking.

Younger people (aged 16–24) were more likely to start smoking, along with those that were unmarried, unemployed, and those who had few or any educational qualifications. In contrast, those individuals who lived in a two-person household where the other individual was a non-smoker were less likely to start smoking. Younger people were more likely to re-start smoking after stopping, as well as those who were unmarried or lived in a household with another smoker.

Findings: Children and cigarette smoking (10–15 year olds)

The number of children smoking has fallen over the last decade. Where children were smoking, we found that this increased with age, with one-fifth of children aged 15 reporting that they had smoked cigarettes. We found that children were aware of the dangers that tobacco could cause; nearly all children in England and Scotland (that responded to the surveys) recognised that smoking causes lung cancer or heart disease.

While boys started smoking earlier than girls, girls smoked more at ages 14–15. Children and teenagers were more likely to smoke if their parents currently smoked or had smoked in the past. Girls were more likely to smoke if their father had no formal qualifications, was in a routine or lower supervisory role, or was unemployed. Those children that lived in council or rented accommodation were far more likely to smoke than children living in other types of housing tenure. Family relationships were crucial in protecting children from starting (and continuing smoking), for example girls were more likely to smoke if their father was not present in the household.

Findings: Adults (16+) and e-cigarettes

To understand the increase in e-cigarette use in recent years, two waves of the survey Understanding Society (USoc) were analysed. One wave was given to respondents between 2016–2018 while the second was given in 2017–2019. There was a small increase in e-cigarette use over this time period (0.06%), with 3% of adults starting to use e-cigarettes.

Using other scientific studies, we looked at the pattern of e-cigarette use among those who used both tobacco cigarettes and e-cigarettes. We found that between 0.8% and 27% of tobacco users across different countries currently or regularly used e-cigarettes. In contrast to tobacco smoking, different demographic and socioeconomic characteristics of e-cigarette users were found. Those who used e-cigarettes were more likely to be white, employed, in managerial and professional occupations, to be married, and to report better health. Tobacco smoking was usually more associated with deprivation, including unemployment and poor health.

Findings: Children (10–15 years) and e-cigarettes

To explore the use of e-cigarettes among children, the same survey waves of the survey USoc were used. The proportion of current e-cigarette users increased only slightly from 1.24% to 1.29% over the time period. The rate of e-cigarette use increased with age and over one-fifth of boys (22%) and just under one-fifth of girls (19%) reported that they had ever used e-cigarettes. Analysis of the use of e-cigarettes by children and teenagers who had previously smoked identified that over three-quarters (77.6%) had ever used e-cigarettes, while over one-fifth (22.4%) had used these in the past 30 days. Few children used e-cigarettes alongside tobacco smoking, with less than 1% of boys and girls using both.

Impact of policy and legislation on cigarette and e-cigarette use

In analysing the range of legislation that has been issued across the UK and Europe, we found that none of the legislation explored had an identifiable direct impact on tobacco smoking behaviours of adults. While our analysis indicated a gradual decrease in the number of current smokers as well as the number of cigarettes smoked in a day, there was no 'step-change' following the enactment of any regulations. A similar picture was found when looking at smoking among children and legislation on sales from vending machines.

Analysis across Europe found that countries with greater tobacco control and less social inequality had a lower number of smokers. However, we found that it was the levels of social inequality that had the most immediate impact on changing smoking behaviours, with legislation taking between five to seven years to have an effect.

In terms of e-cigarette use, there was some indication that more restrictive regulations or policies led to lower social acceptability of e-cigarette use in public. However, those who were former or current tobacco cigarette smokers were less likely to follow restrictive regulations. It is likely that e-cigarette use reduction was due to a combination of statutory enactments alongside well-funded and well-publicised public health campaigns.

Throughout our analysis, the importance of demographic and socioeconomic factors has proven to be 'stronger' in reducing smoking than any resulting single policy. Despite the many policies that have been put in place to reduce tobacco smoking, no single policy that we explored seems to have had a specific impact. Rather, there are indications that it is the cumulative impacts of these policies, alongside health campaigns (e.g., 'Stoptober') that has resulted in the overall reduction in smoking.

Conclusion

Given that the known profile of smokers contrasts strongly with that of e-cigarette users, it is unlikely that policies suitable for tobacco smokers can be simply transferred to address the rise in e-cigarette use. However, such findings do not lead to the recommendation that restrictive policies should not be used in any approach to reduce tobacco smoking or e-cigarette use. Rather, policy and practice need to reflect the complex nature of smoking.

Any future legislation needs to be accompanied by well-known and well-funded public health and primary care-based interventions, (e.g., Stop Smoking Services prescribing) that reflect the profile of the population highlighted in this study and are flexible enough to reflect and respond to the different patterns of smoking over the life-course (i.e., take up, quitting or re-starting). Such legislation needs to be undertaken with policies that reduce social inequalities.

4 Introduction

4.1 Study aims

Although the proportion of the population who smoke cigarettes has fallen by more than half in the last 40 years in Britain, from 46% in 1974 to 14.7% in 2018,[1] smoking remains one of the key preventable causes of early death in the developed world.[2] Many initiatives have been implemented in recent years to create public awareness of the risks of tobacco consumption and to reduce harms caused by smoking. Such policies have been designed and implemented by policy makers to reduce incentives for people to take up smoking or to encourage them to quit, with the aim of reducing damages to public health from smoking. After a decade of active policy making, it is imperative to take stock of the effects of recent legislation and identify the impact on public health, particularly on the consumption of tobacco and e-cigarette products. This research explores the consequences of several policy changes regarding tobacco consumption and supply in England and Scotland, which have been implemented over the last decade.

Our research project was originally designed to answer the following research questions:

1. Have the prevalence, intensity and attitudes towards smoking in the UK changed with the implementation of recent tobacco regulations? Do effects vary across characteristics such as age, ethnicity, socioeconomic status or gender?
2. What are the characteristics of individuals who start or stop smoking?
3. Has second-hand smoke exposure among young people decreased with recent tobacco regulations?
4. How does the UK compare with other European countries in terms of trends in smoking consumption? How do inequalities in smoking in the UK compare to those in other countries?
5. What can current literature and available data tell us about the use of e-cigarettes?

A multi-method approach was planned to answer these questions, using the five work strands listed below:

- **Work strand one:** an analysis of over time trends in smoking prevalence, smoking intensity and attitudes towards smoking, to provide understanding of how changes in smoking trends may potentially be attributed to recent tobacco control legislation;
- **Work strand two:** a comprehensive profiling of new smokers and quitters; understanding that recent tobacco controls could have heterogeneous effects depending on the characteristics of individuals, such as socioeconomic status, ethnicity, age, and educational level. This includes a profile of inequalities in smoking, how these inequalities have developed over time and the extent to which recent policy has affected inequality in smoking;
- **Work strand three:** an investigation into how recent legislation has affected exposure to second-hand smoke – particularly among vulnerable populations such as children and young people;

- **Work strand four**: an international review of changes to tobacco control legislation in European countries. In doing so we will be able to explore how trends in smoking prevalence and social inequalities in smoking in the UK compare to those in other countries; and
- **Work strand five:** a systematic review of the current literature and data on e-cigarette use.

However, owing to changes in prioritisations and in agreement with NIHR, **work strand three** was not completed as it was perceived that a strong evidence base around this question was already in existence. To present the data most effectively in this report, the remaining work strands have been renumbered as follows:

- **Work strand one:** an analysis of over time trends in smoking prevalence;
- **Work strand two:** a comprehensive profiling of new smokers and quitters;
- **Work strand three**: an international review of changes to tobacco control legislation in European countries; and
- **Work strand four**: a systematic review of the current literature and data on e-cigarette use.

This report details the methods and findings from each work strand, bringing together the conclusions from these distinct work strands to present a policy-driven discussion on changes to tobacco and e-cigarette consumption as a result of the introduction of tobacco control measures.

4.2 Background

4.2.1 Policy and legislative context

Tackling the tobacco epidemic is a major global public health priority. Considerable progress has been made in many countries since the harms of tobacco were first recognised, resulting in a steady reduction in smoking rates, although continued action is needed. It is widely understood that this progress has been achieved not through any one single intervention but through a concerted and comprehensive approach which is (a) sustained over several decades, (b) acts at population level rather than individual level, and (c) involves multiple different policies and interventions, including: taxation and price; reducing availability; restricting advertising; packaging; exposure to second-hand smoke; provision of smoking cessation support; and education.[3]

The UK is currently recognised as being at the forefront of global tobacco policy, with one of the most comprehensive set of tobacco control measures in the world. This position has been achieved through the incremental adoption of several evidence-informed policies over the past four decades. It has been argued that it is the cumulative weight of measures dealing with price, promotion, education, health warnings, second-hand smoke exposure, packaging, retailing and access that has contributed to the progress made, rather than any single policy.[4] Over the same time period, the tobacco industry has demonstrated that it evolves and innovates in response to tobacco control measures: as one area of its activity is restricted, such as advertising in the early 2000s, increased effort is put into other areas such as packaging. This emphasises the need for tobacco control to continue to evolve through the constant introduction of new policy measures.

In attempting to evaluate the contribution of different policies to this progress, it is important to note a number of factors. Firstly, policies may vary in the time taken to produce change. While changes in some outcomes may be detected relatively quickly after a policy is implemented (for example, reductions in exposure to second-hand smoke after smoke-free policies come into force), many public health outcomes may take several years before they are detected (for example, reductions in youth uptake of smoking following restrictions on advertising); some policies may take a generation for the full effect to be felt.

Secondly, policies may act synergistically, meaning that a policy which is introduced is potentially reinforced by, and reinforces, the effects of other policies which are in force at the same time. Thirdly, there is a potential important interaction between policies and social norms: tobacco control policies act on social norms regarding tobacco, but changes in social norms can also create the conditions for new policies to be implemented (for example, policymakers may have more confidence to introduce a measure if they are reassured through public opinion surveys that it would be supported by a substantial proportion of the population). Capturing these processes and effects is particularly challenging.

The next section of the report provides an overview of legislative and policy initiatives in the UK, Europe and worldwide in the past two decades. See Appendix A for details of the legislation and rules discussed in the report.

Worldwide

The core treaty addressing global tobacco use is the *WHO Framework Convention on Tobacco Control* (FCTC). This was drafted under the auspices of the World Health Organization (WHO) to recognise that: the spread of the tobacco epidemic is a global problem that requires international cooperation; cigarettes and other tobacco products are highly addictive; the impact of tobacco has a greater impact on minority groups, including young people, indigenous people, women, and people living in poverty; and advertising, promotion and sponsorship are particularly concerning for governments.

The FCTC has been approved by 181 parties, including 168 countries, and covers over 90% of the world population.[5] To support countries to enact the recommendations laid out in the FCTC, WHO launched the MPOWER programme, a six-part framework designed to offer best practice for countries seeking guidance on actions that can be taken to reduce tobacco consumption and mitigate its harms.[6] The six components recommend governments to:

- **Monitor** tobacco use and prevention policies;
- **Protect** people from tobacco smoke;
- **Offer** help to quit tobacco use;
- **Warn** about the dangers of tobacco;
- **Enforce** bans on tobacco advertising, promotion and sponsorship; and
- **Raise** taxes on tobacco.

As a result of these recommendations, Levy et al.[7] found that, with 43 countries worldwide adopting at least one of these policy recommendations between 2014 and 2016, a total of 14.6 million smoking-attributable deaths were avoided in the same time period, highlighting the success of these policies in mitigating the impact of smoking on health.

European Union

As a member of the European Union until 2020, UK tobacco control policies have been influenced by directives enacted by the European Council and European Parliament. A ‘directive’ is a legislative act that sets out a goal that all EU countries must achieve, although each member state is able to design their own legislation to enact the directive.

Advertising and promotions
The EU regulates tobacco advertising and sponsorship across its member states. In 1989, the *Television without Frontiers Directive (89/552/EEC)* banned tobacco advertising on television. This was updated in 2010 to include all audiovisual media, e.g., product placement in television and film (*Audiovisual Media Services Directive (2010/13/EU))*.

In 2003, the *Tobacco Advertising Directive (2003/33/EC*) also introduced an EU wide ban on cross-border tobacco advertising and sponsorship. The ban covers print media, radio, internet and sponsorship of events involving several EU countries, such as the Olympic Games and Formula 1 races. This includes the ban of all free tobacco at these events.

Packaging
In 2014, the *European Tobacco Products Directive (2014/40/EU)* (EU TPD) was passed, which came into force in May 2016. This directive was created to support member states in applying tighter controls on the sale of tobacco and e-cigarettes. Among other items, this directive included:

- A ban on flavoured cigarettes and roll-your-own tobacco (including menthol);
- Minimum pack sizes for roll-your-own tobacco (30g) and cigarettes (20 cigarettes);
- A ban on ‘misleading’ labelling, such as ‘organic’ or ‘natural’;
- An increase in the size of combined health warnings, which have to cover 65% of the packet on the front and back;
- The introduction of health warning labels for e-cigarette packaging;
- Maximum nicotine levels for commercially available e-cigarettes (20mg/ml of nicotine or lower);
- Maximum sizes for e-cigarette refill containers (10ml); and
- Mandatory safety and quality requirements for e-cigarettes and refill containers.

The *Tobacco and Related Products Regulations 2016* formally adopted this EU directive into UK law.

The UK

The UK is a signatory to the FCTC and has also enacted the directives described above from the EU. In addition to this, the UK has passed several key pieces of legislation, with some differences between Scotland, England, Wales and Northern Ireland, which are discussed in this section. Legislation primarily falls into one of four domains: advertising and promotions; packaging; youth; and public spaces. This section highlights the Acts passed over the past two decades, which are implemented through Regulations and Orders; further information can be found in Appendix A.

Advertising and promotions
All EU directives relating to tobacco advertising have been implemented within the UK, meaning that tobacco advertising is not permitted in print, commercial or online media, and sponsorship of events and sports is also banned. For example, the *Tobacco Advertising and Promotion Act 2002* banned the advertisement, promotion and sponsorship of tobacco products in the UK, with limited exceptions, which fulfilled the *Tobacco Advertising Directive* (2003/33/EC).

The *Tobacco Advertising and Promotion (Point of Sale) Regulations 2004* restrict the size, format and content of tobacco advertisements which may be published at point of sale and on certain tobacco vending machines across England, Wales and Northern Ireland. Equivalent legislation was passed for Scotland as the *Tobacco Advertising and Promotion (Point of Sale) (Scotland) Regulations 2004*.

The *Health Act 2009* banned the open display of tobacco and smoking-related products in the UK, including cigarettes, packets of roll-your-own tobacco, filters and papers. This was followed by the *Tobacco and Primary Medical Services (Scotland) Act 2010*, which similarly banned these displays.

Sales from tobacco vending machines have also been banned across the UK. In England, this was under the *Protection from Tobacco (Sales from Vending Machines) (England) Regulations 2010*; in Wales under the *Protection from Tobacco (Sales from Vending Machines) (Wales) Regulations 2011*; in Northern Ireland under the *Protection from Tobacco (Sales from Vending Machines) Regulations (Northern Ireland) 2012*; and in Scotland under the *Tobacco and Primary Medical Services (Scotland) Act 2010*.

Finally, in Scotland, further legislation has been passed regarding the advertising of e-cigarettes: The *Health (Tobacco, Nicotine etc. and Care) (Scotland) Act 2016* gives the Scottish government powers to regulate e-cigarette advertising and branding.

Packaging

Packaging legislation over the past two decades has led to significant reformatting of tobacco and e-cigarette packaging. The *Tobacco Products (Manufacture, Presentation and Sale) (Safety) Regulations 2002* (came into force from 31 December 2002 through 1 January 2007) required further health warnings to be available on tobacco packaging and banned statements on packaging which suggest that the product is less harmful than others. This was updated in 2007 with the *Tobacco Products (Manufacture, Presentation and Sale) (Safety) (Amendment) Regulations 2007* (came into force 1 October 2008) to require colour photos on all packets.

In addition to the requirements in the *EU TPD*, such as the requirement for 65% of the front and back of the packet to carry a health warning, the UK also introduced the *Standardised Packaging of Tobacco Products Regulations 2015* (came into force 20 May 2016). This requires plain packaging for all tobacco sold in the UK, in one colour (Pantone 448C) with only permitted text, such as the brand and product type, included.

These measures were not fully in force during the period examined by the analysis and this should be borne in mind when considering the impact of the UK's packaging legislation.

Young People

Across all four countries of the UK, the minimum age for purchasing tobacco is 18. This was introduced in England and Wales under the *Health Act 2006* and was enforced from July 2007. In Scotland, this became an offence from 2010 under the *Tobacco and Primary Medical Services (Scotland) Act 2010* and in Northern Ireland from 2008 under the *Children and Young Persons (Sale of Tobacco etc.) Regulations (Northern Ireland) 2008.*

In Scotland, the *Health (Tobacco, Nicotine etc. and Care) (Scotland) Act 2016* also makes it illegal to sell e-cigarettes to under-18s; this was banned in England and Wales under the *Children and Families Act 2014.*

Public places

The *Health Act 2006* made it an offence in England and Wales to smoke in places of work, in businesses which are open to the public, and other places as required. This banned smoking within pubs and restaurants, on public transport, and in offices, factories and other work environments (notably, prisons remain an exception to the ban). This commenced in England in July 2007 and in Wales in April 2007. In Northern Ireland, a similar ban was passed under the *Smoking (Northern Ireland) Order 2006*, which was enforced from April 2007, and in Scotland, under the *Smoking, Health and Social Care Act 2005*, which was enforced from April 2006. The *Health (Tobacco, Nicotine etc. and Care) (Scotland) Act 2016* also banned tobacco smoking on hospital grounds in Scotland from April 2016.

The *Children and Families Act 2014* made it illegal in England and Wales to smoke in a private vehicle with children under the age of 18, or for drivers to allow someone else to smoke in their vehicle with children present.

4.3 Patient and public involvement

This project primarily used secondary data analysis, including analysis of data from the Health Survey for England (HSE), the Scottish Health Survey (SHeS), Smoking, Drinking and Drug Use among Young People in England (SDD), the Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS), and Understanding Society (USoc). In addition, a Rapid Evidence Assessment (REA) was conducted to better understand the consumption of e-cigarettes since 2010. As our project focused on using population-level statistics for policy research, as opposed to using individual-experiences or health outcomes for medical research, it was agreed with the National Institute for Health Research (NIHR) that a patient and public involvement group would not be required for this research.

However, to ensure our output would be of use to policymakers, government agencies and researchers, an Advisory Group was established to represent these stakeholders in our project design, analysis and reporting. The Advisory Group met three times during the project and provided invaluable guidance on data sources, methods of analysis and document reviews, including a review of search terms used for the REA. We thank our Advisory Group for all their input over the lifespan of this project. Further details of the Advisory Group members can be found in Appendix B.

4.4 How the research addresses equality and diversity issues

Our research project contributes to the promotion of equality and reduction of inequalities in health care by using secondary data analysis to identify the groups in society who have benefited the most and least from tobacco control legislation. This included analysis within the UK and in Europe. Identifying which demographic and socioeconomic groups in society continue to smoke tobacco and, the reasons for doing so, is vital to support public health efforts to reduce smoking across the broader UK population. In addition to reported demographic and socioeconomic characteristics, the analysis focused on deprivation by area, to provide as broad an evidence base as possible.

In addition to findings from the secondary data analysis, we have explored health deprivation through the REA focused on e-cigarette use. This REA presents findings related to e-cigarette consumption among groups with different demographic and socioeconomic characteristics. By identifying the consumers of e-cigarettes and their relationship with tobacco, we have been able to identify those groups who may require additional public health support to stop smoking. The implications of these research findings on equality and diversity are addressed in Chapter 11, Discussion and conclusion.

4.5 Project scope

As identified in our research questions above, this project focused primarily on the impact of a number of policies designed to reduce the prevalence and harms associated with tobacco. Several areas of related research were therefore out of scope for inclusion as part of this project. This includes cannabis smoking, the use of illicit tobacco, and heated non-combustible tobacco products.

5 Methods

5.1 Overview

As presented in Chapter 4, four core research questions guided this research:

1. Have the prevalence, intensity and attitudes towards smoking in the UK changed with the implementation of recent tobacco regulations? Do effects vary across characteristics such as age, ethnicity, socio-economic status or gender?

2. What are the characteristics of individuals who start or stop smoking?

3. How does the UK compare with other European countries in terms of trends in smoking consumption? How do inequalities in smoking in the UK compare to those in other countries?

4. What can current literature and available data tell us about the use of e-cigarettes?

To respond to these questions, a multi-method approach was delivered across four work strands. The research questions were each developed into more specific, distinct research aims, as shown at Table 5:1 below. Each work strand then involved the application of different data sources to address these distinct but complementary research aims. As shown at Table 5:1, work strands one, two and three primarily involved application of large survey datasets and quantitative methods to examine national and international trends and relationships. In work strand four we applied REA methodology to investigate a relatively new aspect of nicotine and tobacco use behaviours, namely e-cigarette use. An overview of methods is provided at Table 5:1, with more detail available along with our findings in Chapters 6–9.

The findings from the separate work strands were then brought together through the matrix detailed at Chapter 10, which categorises findings into themes including overall trends in smoking behaviours and e-cigarette use behaviours as well as the impact of legislation and policies. Outcomes from the matrix were taken forward in Chapter 11, Discussion and conclusion.

Table 5:1 Summary of methods and data sources

	Work strand 1	Work strand 2	Work strand 3	Work strand 4
Research aims	• Investigate trends in prevalence, intensity of and attitudes towards smoking in England and Scotland. • Examine variations in trends between those with different demographic, socioeconomic and health characteristics. • Investigate relationship between changes in prevalence and intensity, and implementation of tobacco control legislation.	• Identify which demographic, socioeconomic and health characteristics are associated with changes in smoking behaviour - specifically take up, quitting and re-starting - in the UK. • Examine the behaviours and characteristics of e-cigarette users.	• Compare the UK with other European countries in terms of prevalence of smoking and two country-level factors associated with smoking behaviour: the extent of tobacco control legislation and social inequalities.	• Identify characteristics of e-cigarette consumers and consumption patterns • Identify which national policies and / or health campaigns have been the key drivers of changes (if any) to the consumption patterns for e-cigarettes.
Data sources	• Health Survey for England (HSE), the Scottish Health Survey (SHeS), the Smoking Drinking and Drug Use among Young People Survey (SDD) and the Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS)	National longitudinal survey data from the Understanding Society (USoc) Survey (adults and children / young people)	• Eurobarometer Survey • Tobacco Control Scale scores (TCS)[i] • Gini coefficient from Eurostat database[ii].	Academic databases (e.g., Embase and Medline) and grey literature (including WHO Regional Office for Europe and Grey Matters)
Methods	• Descriptive analysis applied to provide a visual representation of trends over time. • Interrupted Time Series analysis (ITSA) conducted to assess the impact of legislation at various points in time.	• Descriptive analysis applied to examine the relationship between smoking behaviours and demographic, socioeconomic, health and other characteristics. • Logistic regressions performed to further investigate the impact of these factors on specific smoking behaviours (while controlling for other factors)[iii].	• Descriptive analysis applied to identify change over time in smoking prevalence, TCS scores, Gini coefficient and the three-way relationship between these factors. • Regression models used to better understand the significance of interactions between these factors.	• Rapid Evidence Assessment (REA): systematically selected synthesis of the literature, applying a limited number of databases and adhering to a time-limited period.
Details	See **Chapter 6** for more detail on methods and findings.	See **Chapter 7** for more detail on methods and findings.	See **Chapter 8** for more detail on methods and findings.	See **Chapter 9** for more detail on methods and findings.

[i] Level of tobacco control policies implemented in a country.
[ii] Statistical measure of economic inequality.
[iii] Logistic regressions provide a better understanding of the nature of the relationship between each characteristic and smoking as it allows these relationships to be investigated while controlling for other characteristics.

6 Smoking prevalence, intensity and attitudes in England and Scotland

6.1 Background

6.1.1 Research aims

Within this chapter we present the findings from **work strand one**, exploring the prevalence, intensity and attitudes towards smoking in England and Scotland. Secondary analysis of English and Scottish survey data was carried out to compare two countries with similar economic, demographic and cultural profiles, but with different tobacco control policy implementation schedules.

The overarching aims were to:

- Investigate the prevalence, intensity of and attitudes towards smoking in England and Scotland;
- Examine variations in prevalence, intensity and attitudes by demographic, socioeconomic and health characteristics, including age, gender, education and employment in England and Scotland;
- Examine trends in young peoples' smoking and tobacco consumption in England and Scotland by a range of demographic and socioeconomic characteristics; and
- Consider how prevalence and smoking intensity has changed with the implementation of recent tobacco regulations.

6.1.2 Research objectives

The specific objectives of work strand one were to present temporal trends (2008 to 2016) in the adult populations (16 years and above) of England and Scotland in:

- Prevalence of tobacco smokers;
- Demographic, socioeconomic and health profile of smokers;
- Average number of cigarettes smoked;
- Average age of smoking initiation; and
- Prevalence and characteristics of people wanting to cease smoking.

Temporal trends (since 2006) are also presented for young people in England (11–15 years) and Scotland (13 and 15 years) in:

- Prevalence of tobacco smokers;
- Demographic, socioeconomic and health profile of smokers;
- Average number of cigarettes smoked;
- Average age of smoking initiation;
- Access to cigarettes;
- Attitudes towards and beliefs about smoking; and
- Willingness to cease smoking.

A further objective is to consider the role of the implementation of new regulation on these trends.

6.2 Methods

Both descriptive analysis and Interrupted Time Series Analysis (ITSA) were conducted.[8] The descriptive analyses produced temporal trends in smoking prevalence and attitudes among young people and adults in England and Scotland. Variation in trends was examined by demographic, socioeconomic and health-related factors. As England and Scotland share similar legislative contexts, but different legislative implementation schedules, comparing them provides some indication of the potential effect of legislation. While there are many similarities between the two countries, there remain a number of underlying demographic, socioeconomic, and cultural differences that need to be acknowledged when interpreting findings.

The ITSA provides further insight on the potential impact of smoking legislation on smoking rates in England and is described in more detail below in Section 6.3.4. A technical note on the ITSA is provided in Appendix C.

6.2.1 Data sources and samples

The comparisons between England and Scotland focus on the following four populations:

- Adults in England;
- Adults in Scotland;
- Young people in England; and
- Young people in Scotland.

Adults in England

The trends in smoking among adults in England were investigated using the Health Survey for England (HSE).[iv] The HSE is a series of annual cross-sectional surveys that include detailed information on smoking behaviour and attitudes towards smoking. These questions were asked of all respondents aged 16 and over.

Adults in Scotland

Smoking behaviour and attitudes towards smoking among adults (aged 16 and over) in Scotland were examined using the Scottish Health Survey (SHeS).[v] Like the HSE, the SHeS is a series of annual cross-sectional surveys that include questions on smoking and other behaviours linked to health.

Comparing adults in England and Scotland

SHeS began in 2008. For this reason, the analysis focuses on 2008 to 2016, a period with comparable data collection in both countries using the same smoking questions.

[iv] https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england
[v] https://www.gov.scot/collections/scottish-health-survey/

Young people in England

Many tobacco control measures seek to reduce young people's access to products. Smoking, Drinking and Drug Use among Young People in England (SDD)[vi] is a repeated cross-sectional survey of secondary school pupils in England. Although most participants were aged 11–15, a small proportion in the relevant school years would have been under 11 or over 15 (about 4% in 2006). Exact age was not available in the datasets after 2006, so any students aged 10 or 16 could not be excluded from the analysis. The survey was conducted annually from 1982 to 2014, and then biennially. Detailed questions about smoking were not asked in every wave.[vii] This analysis draws on data from 2006 to 2014 and 2016.

Young people in Scotland

The Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS)[viii] includes questions about smoking. It is a survey of secondary school pupils in Scotland, focusing on those in Secondary 2 and Secondary 4 classes. The survey was conducted in 2006, 2008, 2010, 2013 and 2015.

Comparing young people in England and Scotland

Although the ages covered by the two surveys of young people differ,[ix] both can provide robust and nationally representative estimates of smoking trends among secondary school pupils. While directly comparable years of data collection are available for SDD and SALSUS for 2006 to 2010, general trends from 2010 can also be compared. Directly comparable smoking questions were asked on the Scottish and English adult surveys, however the questions asked on the Scottish and English child surveys often diverged. Question wording is provided alongside reporting of results, and these differences should be borne in mind when making comparisons.

Table 6:1 summarises the surveys used as data sources and their coverage.

Table 6:1 Summary of the data sources

Dataset	*Country*	*Age of respondents in years*	*Years*
HSE	England	16+	2008–2016
SHeS	Scotland	16+	2008–2016
SDD	England	11–15	2006–2014, 2016
SALSUS	Scotland	13 and 15	2006, 2008, 2010, 2013, 2015

For the ITSA, data from the HSE and SDD were used to examine the extent to which specific changes in smoking legislation may have impacted on smoking. These

[vi] https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england
[vii] https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england/2016
[viii] https://www.gov.scot/collections/scottish-schools-adolescent-lifestyle-and-substance-use-survey-salsus/
[ix] Young people in the SDD were primarily aged 11–15 years while those in SALSUS were in Secondary 2 and Secondary 4 classes in Scotland (mostly aged 13 and 15 years). It was not possible to directly compare ages of young people or create sub-samples from each dataset based on age as the age variable as not available in all waves of the archived datasets.

datasets were selected because the number of available data points intersected well with the timing of the legislation examined in the analyses.

6.2.2 Analytical approach

Descriptive analyses

Descriptive analyses were conducted in SPSS v21. The prevalence of current smokers (overall and by specific characteristics) were graphed so that the temporal trends could be visualised. To capture smoking intensity, mean and median average number of cigarettes smoked by current smokers were calculated, as well as the proportion of current smokers smoking at different daily thresholds (up to 10, 10 to 19, 20 or more a day). Further information can be found in Appendix C.

Trend testing
Linear trends over time were tested using linear regression. Ordinary Least Squares regression was used to fit the straight line through the time points that best explained the trend. The slope of this line was then tested using a t-test to determine whether the slope was statistically different to zero. The results indicate whether the observed behaviour had increased significantly over time (a positive trend) or whether the observed behaviour had decreased significantly over time (a negative trend).

Weighting
Analyses using HSE and SHeS data were weighted to adjust for sample design and patterns of non-response, and to ensure the samples were nationally representative of adults aged 16 and above living in England and Scotland respectively. No weights were available for the SDD prior to 2010: the achieved samples in each wave were considered broadly representative of the national population of 11 to 15 years old. However, weights were developed and have been applied to analyses using SDD data from 2010 onwards. Analyses using SALSUS were weighted.

Measures applied in the analysis
Table 6:2 and Table 6:3 summarise the sociodemographic and smoking variables used in the analysis.

Table 6:2 Variables used in HSE and SHeS analysis

Category	Variable	*Description*
Socio-demographic	Gender	Male / female
	Age	Age in 10-year bands (from 16–75 and over)
	Education	Whether has a degree (or equivalent)
	Employment status	Whether in paid employment
	Heart problems	Whether has a long-term heart or circulatory system-related illness
Smoking	Smoker status	Never smoked / ex-occasional smoker / ex-regular smoker / current smoker
	Smoke now	Whether currently smokes cigarettes
	Quantity	Usual number of cigarettes smoked a day
	Type of cigarette	Tipped / hand rolled / untipped
	Pick up smoking	Age started smoking
	Aspirations to quit	Whether would like to cease smoking

Table 6:3	Variables used in SDD and SALSUS analysis		
Category	*Variable*	*Description*	*Comments*
Socio-demographic	Gender	Male / female	
	Free school meals	Whether entitled to free school meals	Not available in SDD in 2016
	Truancy	Whether ever played truant	Not available in SDD in 2016
	Excluded from school	Whether ever been excluded from school	Not available in SDD in 2016
Smoking	Smoker status	Never smoked / ex-occasional smoker / ex-regular smoker / current smoker	
	Access to cigarettes	Where usually get cigarettes from	SDD also asks about perceived ease of buying cigarettes from shops
	Quantity	Number of cigarettes smoked in the last week	
	Family attitudes towards smoking	What participants think their families feel about smoking	
	Young people's attitudes towards smoking	Attitudes towards cigarettes and smoking	SDD and SALSUS questions on attitudes towards smoking are different and so are reported on separately
	Smoking initiation	Age when started smoking	Not available in SALSUS
	Aspirations to quit	Whether would like to give up smoking	

Interrupted Time Series Analysis (ITSA) and tobacco control legislation

The potential impact of specific smoking legislation on smoking prevalence and intensity was examined using ITSA. This analysis focused on England only because HSE and SDD data were collected over a longer time period, making them more suitable for multivariate analysis. HSE data collection is continuous, enabling the analysis by quarter within each year suitable for an ITSA.

A time series is a sequence of observations, taken repeatedly over time. In an interrupted time series (ITS), repeated measures of a particular outcome (in this case, smoking rates) are used to examine temporal trends which are interrupted by an intervention at one point in time.[8] ITSA works by identifying whether an event, in this case, the introduction of legislation, causes a change in the trend line; in that it causes the behaviour that is being observed over time to either increase or decrease. The models are used to test whether the slope of the trend line fitted for the time period that occurs after the event is significantly different to the slope of the trend line fitted in the period prior to the event. A significant difference in these two slopes indicates a change in behaviour that may be attributed to the legislation.

In this study, the ITS is used to examine two outcomes from 2005 to 2016: 1) number of current smokers, and 2) average number of cigarettes smoked in a day, and how these outcomes might have changed after the implementation of several pieces of smoking-related legislation. Using the ITS, we can investigate the potential impact of each piece of legislation on smoking rates and smoking intensity.

The three pieces of legislation considered were selected because of their scale and potential reach; **and each are listed in Table 6:4**.

Table 6:4 Summary of legislation used for the ITSA

Dataset	*Legislation*	*Date of implementation*	*Outcome variable*
HSE	Smoke-free Regulations[x]	July 2007	Prevalence of current smokers
HSE	Smoke-free Regulations	July 2007	Mean number of cigarettes smoked per day
SDD	The Protection from Tobacco (Sales from Vending Machines) (England) Regulations 2010	October 2011[xi]	Prevalence of current smokers
SDD	The Protection from Tobacco (Sales from Vending Machines) (England) Regulations 2010	October 2011	Mean number of cigarettes smoked per day
HSE	The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012	April 2012	Prevalence of current smokers
HSE	The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012	April 2012	Mean number of cigarettes smoked per day

There were a number of reasons for choosing these three pieces of legislation. Firstly, the *Smoke-free Regulations* **required all workplaces and enclosed public places to be smoke free**, with the objective of protecting both employees and the public from the effects of second-hand smoke.[xii] Regulating smoking in public places, including workplaces, bars, cafes and restaurants and on public transport, is a key element of tobacco control measures; indeed, it is the second highest scoring domain in the Tobacco Control Scale (TCS),[9] the international measure of tobacco control measures by country. There is evidence from the TCS methodology paper[10] which indicates that smoke-free workplaces protect non-smokers and discourage smokers, with one report suggesting that between 1993 and 2001, smokers in workplaces that became smoke-free were nearly twice as likely to stop smoking than those in workplaces that did not become smoke-free.[11] This suggested that there would be a clear possibility of measuring a distinct change in prevalence as the result of introducing these regulations. These regulations were also seen as hugely important by public health officials, described as "*one of the biggest public health interventions of the past 15 years*",[12] while accompanied with a high level of public debate and publicity. This visibility may have prompted smokers to change their habits around the same time period of the legislation, further suggesting that a short-term impact might be evident in the data.

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[x] These encompass the *Smoke-free (Vehicle Operators and Penalty Notices) Regulations 2007,* the *Smoke-free (Penalties and Discounted Amounts) Regulations 2007* and the *Smoke-free (Premises and Enforcement) Regulations 2006*.
[xi] Several other pieces of smoking legislation were implemented in 2011 such as The *Tobacco Advertising and Promotion (Display) (Regulations) 2010* in October 2011 and the *Health Act 2009* in November 2011.
[xii] http://www.smokefreeengland.co.uk/thefacts/the-regulations/

The *Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012* **banned the display of tobacco products in large shops and supermarkets**, aiming to prevent tobacco advertising from attracting new young smokers. Similar to smoke-free regulations, a ban on openly displaying and advertising tobacco products is a key component of the TCS,[9] reinforcing the importance of these measures in addressing the prevalence of cigarette smoking. Evidence from Australia cited by the World Health Organization[13] indicated that over one-quarter of smokers purchased cigarettes on impulse after seeing a cigarette display; this indicated that point of sale displays have an immediate impact on purchasing behaviour, and thus, smoking behaviour. In addition, this policy was implemented several years following the Smoke-free Regulations (2007); it was felt that the time gap made it more likely to identify the impact of the display regulations on smoking prevalence as distinct from changes resulting from the Smoke-free Regulations.

The *Protection from Tobacco (Sales from Vending Machines) (England) Regulations 2010* **banned the sale of cigarettes from vending machines** to reduce young people's access to such products. The choice of vending machine regulations as the third piece of legislation for analysis related to the predicted impact of this legislation on smoking by children; as detailed in this report, SDD data found that 14% of young people in 2006 reported accessing tobacco from vending machines. This was disproportionately high in comparison to their market share, which was reported as less than 1% by the National Association of Cigarette Machine Operators, suggesting that the prevalence of smoking among children and young people would substantially change following the vending machine regulation implementation. It was also theorised that this impact would be visible in the short-term, thus ensuring the legislation's suitability for analysis using the ITSA method. This legislation also complemented the *Smoke-free Regulations* and *Display Regulations* in providing insights to smokers at different life stages, from child to adult.

The outcome measures were chosen for their relevance to the interventions; two of the 'interventions' focused on restricting purchase (*Vending Machines*) or advertising (*Display Regulations*) which were theorised to reduce the likelihood of buying tobacco. The decrease in purchase would, theoretically, then impact on both **the mean number of cigarettes smoked**, and **prevalence of smoking**. Similarly, restricting the location of smoking (through the *Smoke-free Regulations)* could also be assumed to decrease the mean number of cigarettes smoked and the overall prevalence.

If the legislation is approached as an intervention, the period in which the legislation was passed can be considered the 'intervention phase'. Wagner et al.[14] suggest excluding the outcome values during the lag-period or intervention period. Using this approach, the smoking rates and tobacco consumption (mean number of cigarettes smoked) were compared for the 'pre-intervention' and 'post-intervention' phases. The HSE and SDD data used in the analyses were weighted to ensure that the sample was nationally representative of adults and young people in England respectively.

As the implementation date of the Smoke-free Regulations was July 2007, HSE data from 2005 were included to capture the 'pre-intervention' phase of this, the first of the three regulatory measures.

Results of the ITSA are presented below in Section 6.3.4.

Limitations

As a rapid succession of changes in tobacco control legislation took place from 2005 to 2016 it is not possible to definitively establish a causal link between any one piece of legislation and changes in tobacco consumption. Many factors will influence smoking behaviour, including lagged effects of previous legislation and the cumulative impact of the multiple pieces of legislation passed within this period. Other factors include changes in attitudes, awareness and acceptability, tobacco prices and austerity, e-cigarettes, and the availability and effectiveness of smoking cessation services nationally and in specific regions. It is also not possible to establish a 'counter-factual' model; i.e., the impact that 'doing nothing' may have had on smoking prevalence.

6.3 Results: England and Scotland

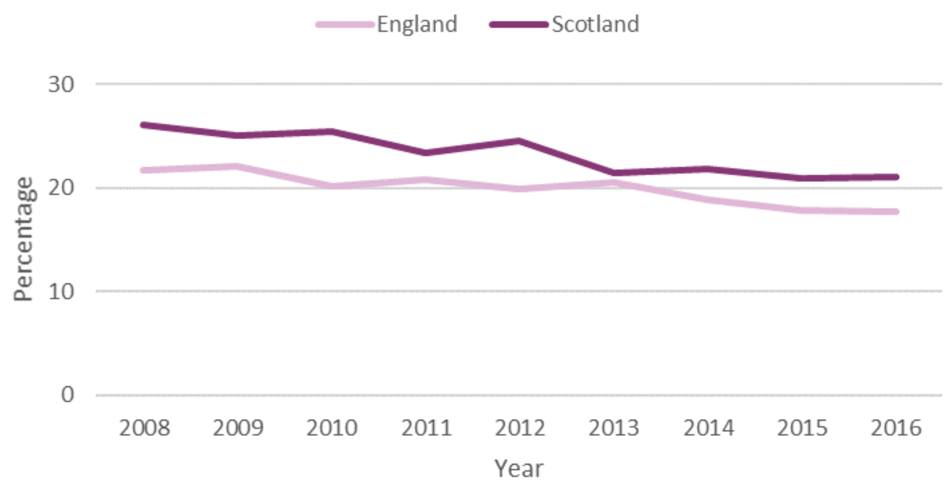
6.3.1 Smoking in adults in England and Scotland

This section presents the results of the descriptive analyses of temporal trends in smoking among adults in England and Scotland. Smoking trends are examined by a range of demographic, socioeconomic and health-related factors. The rate of change for each behaviour was formally tested using linear regression models, the results of these trend tests are presented in Appendix C.

Prevalence of smokers

The prevalence of smoking in England and Scotland has shown significant decline between 2008 and 2016 (Figure 6:1). However, the rates of smoking among adults in Scotland remained higher than that for England. In 2008, 22% of adults in England and 26% in Scotland were current smokers, falling to 18% in England and 21% in Scotland in 2016.

Figure 6:1 Prevalence of current smokers among adults in England and Scotland



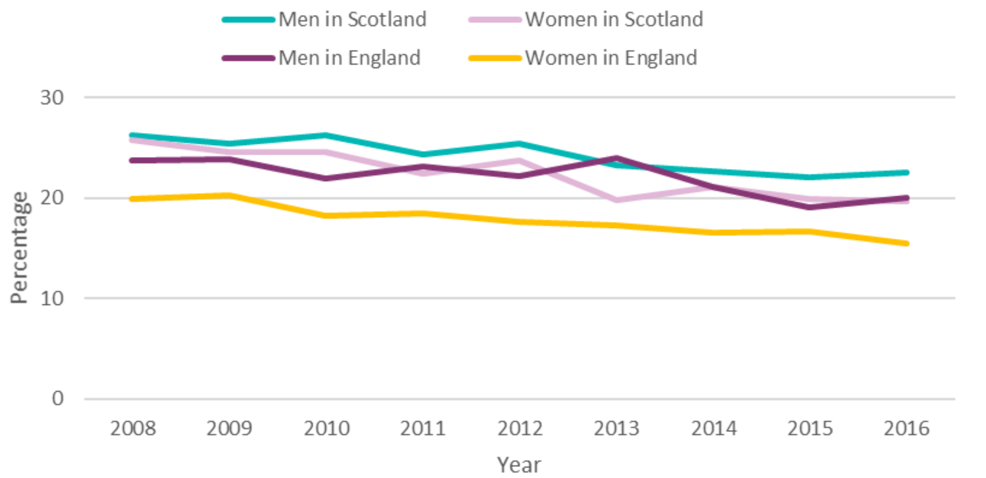
Unweighted base: HSE in 2016 (n= 7,959) SHeS in 2016 (n=4,298)

While smoking rates have fallen significantly, the proportion of people to have never smoked remained relatively stable in both countries between 2008 to 2016 (England: 48% in 2008, 52% in 2016; Scotland: 48% in 2008, 50% in 2016).

Smoking trends varied by several demographic and socioeconomic characteristics including gender, age, education, employment and health.

Rates of smoking have declined significantly for both men and women in both countries, but more rapidly for women (Figure 6:2). In Scotland, the smoking rate for women fell from 26% in 2008 to 20% in 2016. Despite this decline, in 2016 the proportion of women in Scotland who smoked (20%) remained higher than that for women in England (16%), and about the same as that for men in England.

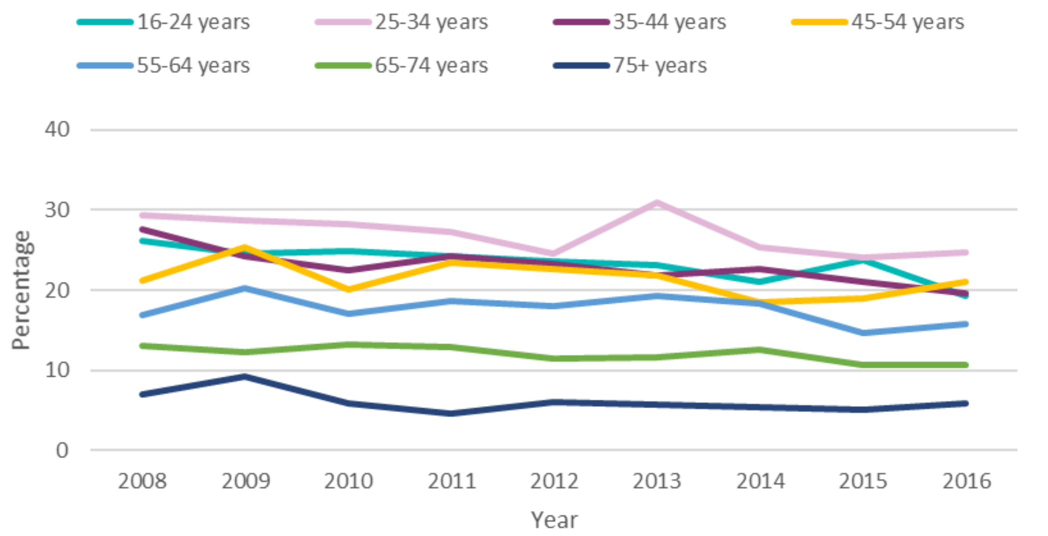
Figure 6:2 Prevalence of current smokers among adults in England and Scotland, by sex



Unweighted base: HSE in 2016 (n= 7,959) SHeS in 2016 (n=4,298)

In England, smoking rates have consistently been lowest in the oldest age groups (7% of people aged 75 or more in 2008; 6% in 2016), and highest among those aged 25–34 (29% in 2008; 25% in 2016) (Figure 6:3). However, the younger age groups saw larger decreases in smoking over time; there were significant decreases in smoking among the three youngest age groups. The decline over time was particularly pronounced in 16–24 year olds (26% in 2008; 19% in 2016) and those aged 35–44 years (28% in 2008; 20% in 2016). There was also a significant decrease among those aged 65–74 years.

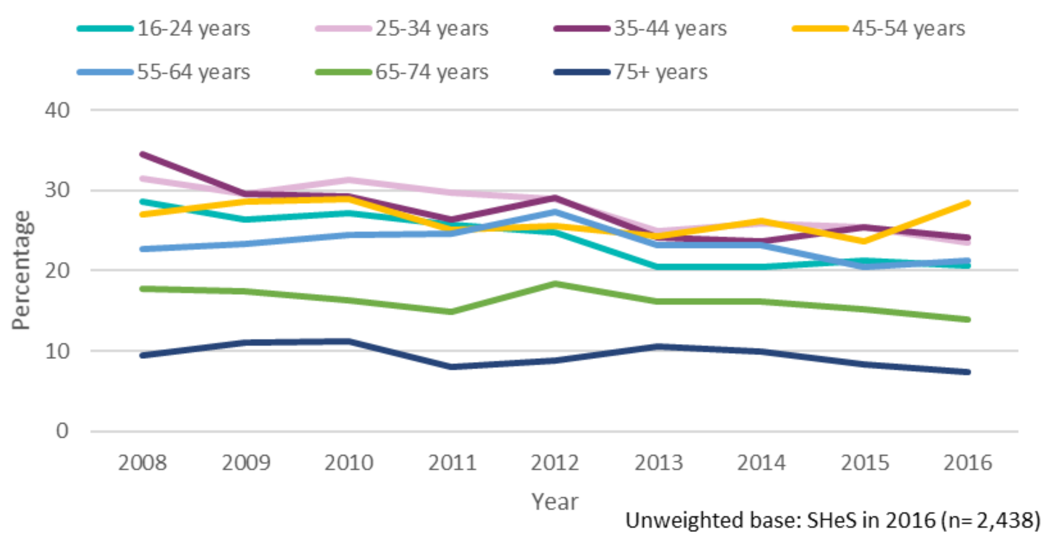
Figure 6:3 Prevalence of current smokers among adults in England, by age



Unweighted base: HSE in 2016 (n= 7,959)

Reflecting those changes in England, there has been a general decline in smoking across most age groups in Scotland (Figure 6:4), particularly among the three younger age groups. In Scotland the age group most likely to smoke has changed over time. In 2006 those aged 25–44 had the highest prevalence of smokers, while by 2016 45–54 year olds were the most likely to smoke, suggesting a birth cohort effect.[xiii] As with England, the 65–74 year olds also saw their smoking rates decline significantly.

Figure 6:4 Prevalence of current smokers among adults in Scotland, by age



Smoking rates varied by educational level in England but not Scotland. In England, in 2016, people without a degree (21%) were about twice as likely to smoke as those with a degree (11%), while in Scotland there was no significant association. In both countries, unemployed people were more likely to smoke (2016: 20% in England, 22% in Scotland) than those in paid employment (2016: 17% in England, 20% in Scotland).

Health related differences were also observed. People without a known heart condition (2016: 18% in England; 22% in Scotland) were consistently more likely to smoke than those who had received some form of diagnosis (2016: 13% in England and 20% in Scotland). This finding reflects the change in behaviour (such as stopping smoking) that may occur when people receive a diagnosis and / or become unwell.

Number of cigarettes smoked

Current smokers were asked about the number of cigarettes they usually smoked a day. Alongside the decline in smoking prevalence, among current smokers the median number of cigarettes smoked in England and Scotland also fell (Figure 6:5 below): from a mean of 13 cigarettes per day in 2008 to 11 in 2016 in England. In Scotland, the

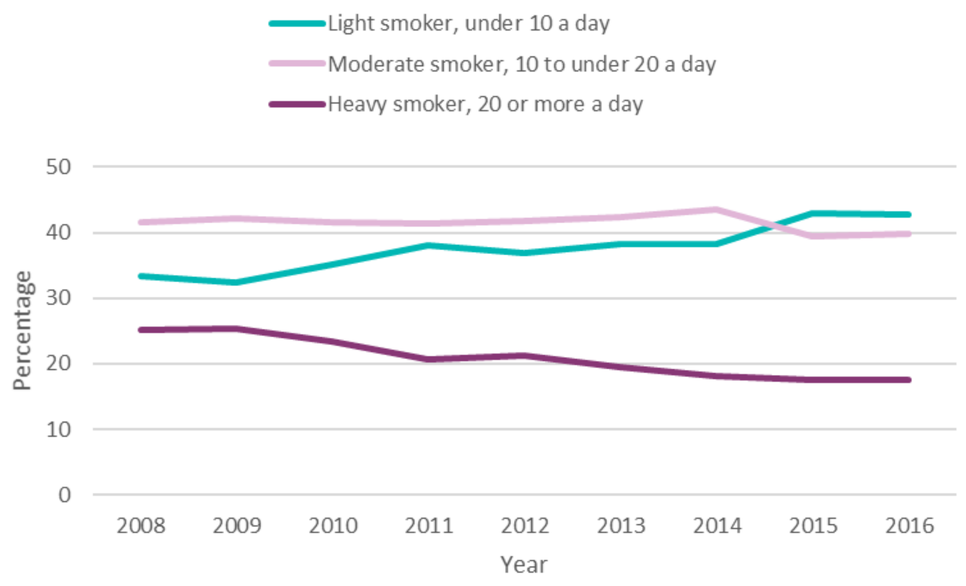
[xiii] Both age analyses are subject to cohort effects which increase in magnitude over the study period. This is because we have 9-year age bands and a study period of 8 years. Therefore, the smoking profile of one age group will increasingly shape the profile of its adjacent age group over time. Assuming very little smoking cessation over the study period in the 35–44 age group, this cohort effect may explain the uptick in smoking in 45–54 years, given smoking was most prevalent in the 35–44 group in 2008 (i.e., the behaviours of the 35–44 years group have gradually moved into the 45–54 years group).

median number was slightly higher than that in England (15 cigarettes in 2008 to 13 cigarettes in 2016).

Smokers were grouped according to the usual number of cigarettes they smoked a day into light smokers (less than 10 cigarettes a day), moderate smokers (10-20 cigarettes) and heavy smokers (more than 20). In England in 2016, 43% of smokers smoked fewer than 10 cigarettes a day.

While the proportion of smokers smoking heavily fell by a significant amount (from 25% in 2008 to 17% in 2016), the proportion smoking lightly increased, also by a significant amount. The proportion of smokers smoking at moderate levels remained broadly stable (41% in 2008, 40% in 2016).

Figure 6:5 Average number of cigarettes smoked per day among smokers in England

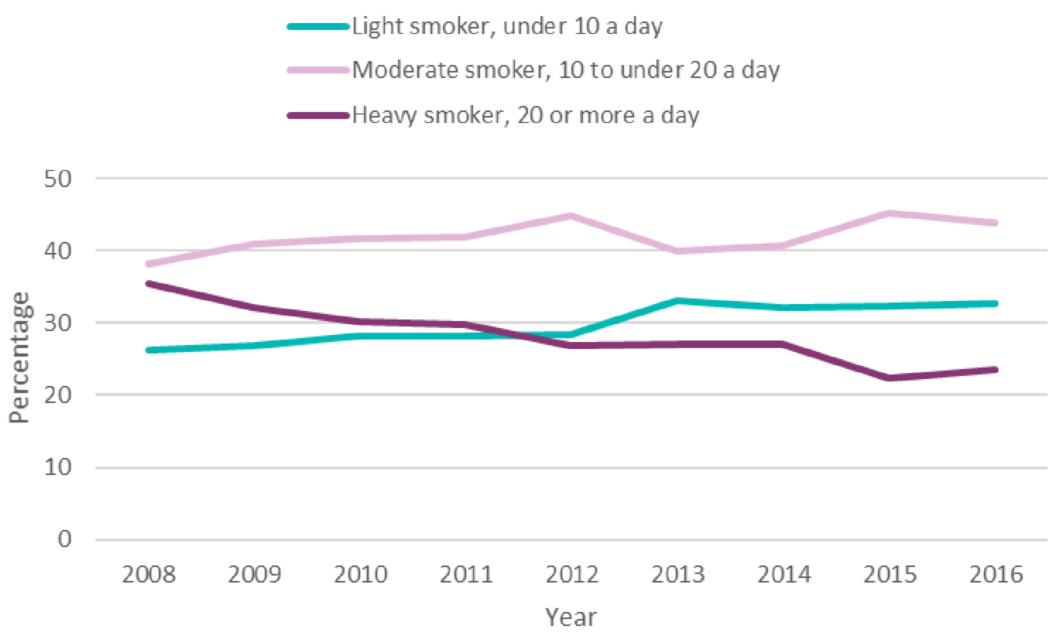


Base: All HSE respondents who smoked (2016; n=1,358)

In Scotland, not only were people more likely to smoke than in England, they also smoked with greater intensity. While in 2016, smokers in England were most likely to smoke lightly, in Scotland they were most likely to smoke at moderate levels (Figure 6:6 below). The fall in heavy smoking (from 35% in 2008 to 23% in 2016) and increase in light smoking (from 26% in 2008 to 33% in 2016) was evident and significant in both countries, providing further indication that smokers are reducing the intensity of their tobacco consumption.[xiv]

[xiv] The potential role in these trends of replacement with e-cigarette use is discussed in the REA in Chapter 9.

Figure 6:6 Average number of cigarettes smoked per day among smokers in Scotland



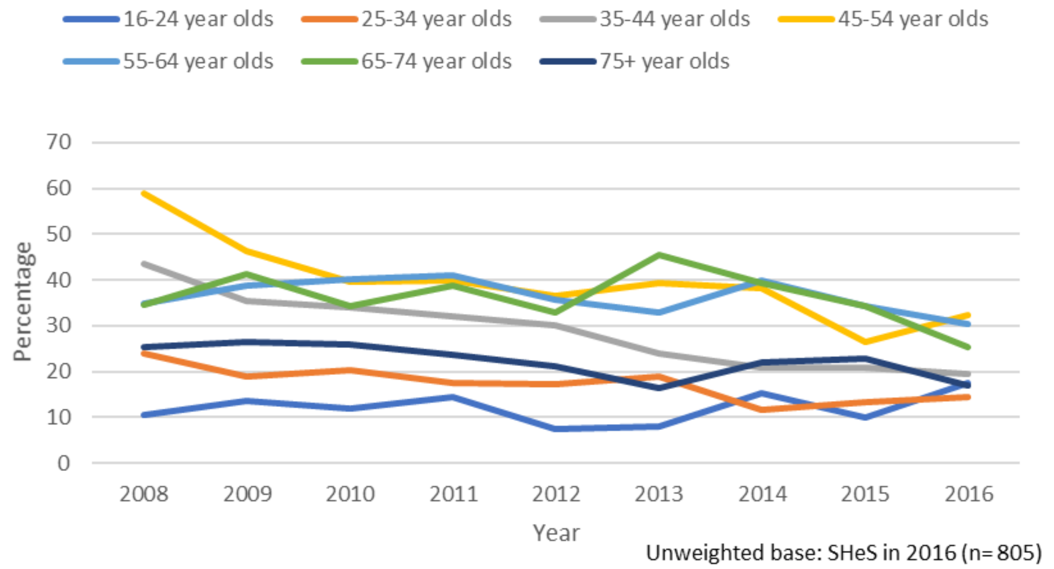
Unweighted base: All SHeS respondents who smoked (In 2016; n= 805)

Men were more likely to smoke than women, and male smokers were also more likely to smoke heavily than female smokers. In England, rates of heavy smoking fell by about one-third in both men (29% in 2008, 20% in 2016) and women (21% in 2008, 14% in 2016). A corresponding rise in the proportion of smokers smoking lightly was significant in men (31% in 2008, 42% in 2016). By 2016, male (42%) and female (43%) smokers were equally likely to smoke lightly, indicating a narrowing of the gender difference in smoking intensity.

Changes over time in smoking intensity were less pronounced in Scotland. In contrast to England, reductions in smoking intensity were more evident in female smokers than male. In 2008, 35% of female and 36% of male smokers smoked heavily, falling to 17% of women and 30% of men in 2016. Furthermore, female smokers in Scotland (35%) remained significantly more likely to smoke lightly than male smokers (30%).

Among smokers, the fall in smoking heavily and rise in smoking lightly was evident in all age groups. In England, the increase in the proportion of smokers smoking lightly was particularly notable among 16–24 year olds (45% in 2008 to 60% in 2016). In Scotland the proportion of 35–44 year old smokers smoking lightly almost doubled (21% in 2008, 40% in 2016). Figure 6:7 shows how in Scotland, the fall in heavy smoking was particularly evident in 25–34 year olds (24% in 2008, 14% in 2016), 35–44 year olds (44% in 2008, 20% in 2016) and 45–54 year olds (59% in 2008, 32% in 2016). The rate of decline was significant for all three groups.

Figure 6:7 Proportion of adult smokers in Scotland who smoke heavily



Differences in smoking intensity by education and health were evident in England, but not Scotland. In England in 2016, smokers with a degree and those with a heart condition were significantly more likely to smoke lightly (59% and 28% respectively) than smokers without a degree (39%) and those without a heart condition (44%).

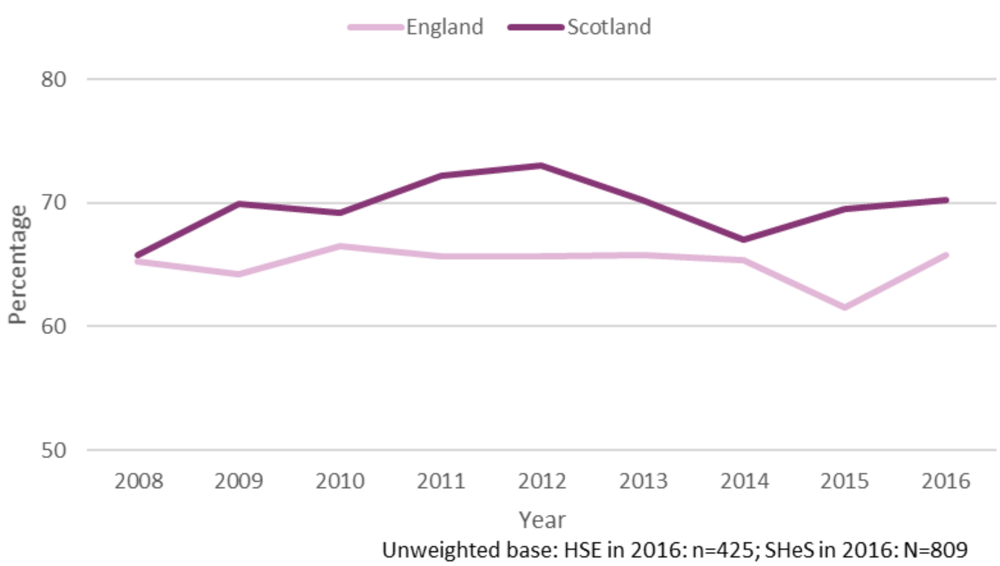
Age when started smoking

In England and Scotland, for both women and men, the median age of starting smoking remained at 16 years. The proportion of smokers to start before age 18 also remained stable in England (65% in 2008, 63% in 2016) and Scotland (63% in 2008, 65% in 2016). No significant variation in age of starting smoking was found by demographic, socioeconomic or health-related factors, indicating that anti-uptake interventions ought to be population wide rather than targeted.

Willingness to stop smoking

The proportion of smokers indicating a desire to stop smoking remained quite stable over time (England: 62% in 2008, 67% in 2016; Scotland: 66% in 2008, 73% in 2016). The slope of the fitted trend line was not significantly different to zero in either England or Scotland; neither country saw a significant increase (or decrease) in the proportion of smokers willing to quit. Smokers in Scotland were more likely to indicate a willingness to stop smoking than smokers in England (Figure 6:8). Given the higher prevalence of smoking in Scotland and the greater willingness to stop, the population impact of smoking cessation action could potentially be greater in Scotland than in England.

Figure 6:8 Proportion of adult smokers who were willing to give up smoking



In England, a desire for smoking cessation was greater in those with a heart condition (51% in 2008, 71% in 2016) and in those who were employed (68% in 2008, 70% in 2016) than in those without a heart condition (62% in 2008, 67% in 2016) and those who were unemployed (55% in 2008, 61% in 2016). In Scotland, willingness to stop was not associated with demographic, socioeconomic or health-related factors.

Summary

The proportion of adults smoking has declined significantly over time in England and Scotland. This reduction has been evident across demographic and socioeconomic groups, although important differences between groups remain. Smoking rates were still higher in men than women, in people without a degree than those with, and in unemployed people compared with those in employment.

In addition to falls in the prevalence of smoking in both countries, the average number of cigarettes smoked per day also saw a significant rate of decline and dropped from 13 cigarettes in 2008 to 11 in 2016 in England, and from 15 to 13 in Scotland. There has been a corresponding and significant decrease in the proportion of smokers smoking heavily, and an increase in the proportion smoking lightly. This suggests that alongside fewer people smoking, some heavy smokers transitioned to smoking lightly.

No variations emerged among smokers to indicate groups more likely than others to start smoking at an earlier age. In line with the decline in smoking, more than 60% of current smokers in both countries reported that they would like to stop smoking.

6.3.2 Smoking in young people in England and Scotland

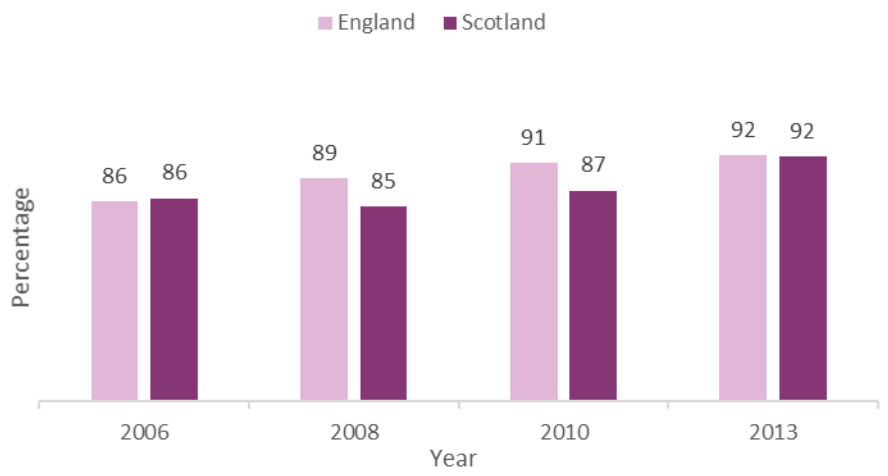
This section presents the results of the descriptive analyses of smoking trends for young people in England and Scotland using data from SDD and SALSUS. Smoking behaviour and attitudes are examined by gender, receipt of free school meals, truancy and other factors. As with the adults, the trends were tested using regression analysis to assess whether the rate of decline was statistically significant.

Temporal trends in England span 2006 to 2016,[xv] while data points for Scotland were available for 2008, 2010, 2013 and 2015. Comparisons between SDD and SALSUS can be made for specific years 2006–2010, with general trends possible for after 2010. The sample of young people in England were mostly aged 11–15 (including 12 and 13 year olds), while in Scotland the sample mostly consists of 13 and 15 year olds.

Prevalence of smokers

The proportion of young people smoking has fallen over time in England and Scotland (Figure 6:9). In England, the prevalence of regular smokers dropped from 9% in 2006 to 3% in 2016. The proportion of young people who did not smoke at all rose consistently from 2006. In Scotland, the prevalence of regular smokers also decreased, from 9% in 2006 to 5% in 2015.[xvi]

Figure 6:9 Proportion of young people who did not smoke in England and Scotland



Unweighted base: SDD in 2013 (n=5,121) SALSUS in 2015 (n=24,798)

No significant variations in smoking prevalence emerged by gender, free school meals entitlement, or by truancy among young people in England or Scotland.

Number of cigarettes smoked

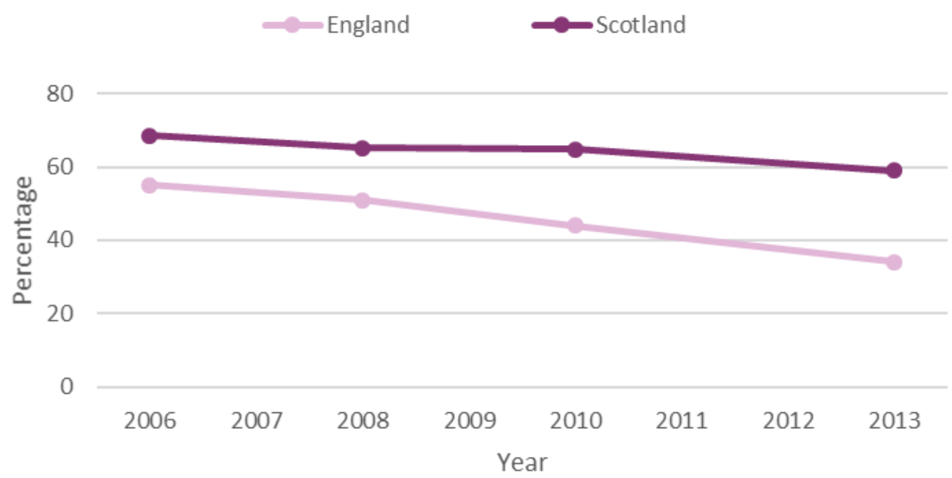
Young people who smoked were asked how many cigarettes they smoked per week. There were differences between the two countries in the mean number of cigarettes smoked, although it should be noted that these may be attributable to the different ages of the samples. Both groups saw a significant degree of decline in the number of cigarettes smoked. Young people who smoked in Scotland were more likely to smoke seven or more cigarettes per week than young smokers[xvii] in England (Figure 6:10). This gap has widened since 2008, with now only a minority of young smokers in England smoking at this level.

Although data were not available for equivalent recent years, this trend appears to have continued. In 2016, 64% of young smokers in England smoked less than seven cigarettes a week, compared to 47% of their peers in Scotland as of 2015. These

[xv] The SDD data analysed is from 2006-2016, with the exception of 2015 when the survey was not carried out.
[xvi] In Scotland, the sample is aged 13 and 15 while in England, the sample is 11-15. While we are unable to meaningfully compare prevalence for these two groups, their temporal trends can be compared.
[xvii] 'Young smokers' is used here as a shorthand to indicate young people who report any current smoking.

smoking intensity patterns among young people broadly mirror those of adult smokers; smokers in Scotland tended to smoke more cigarettes than their counterparts in England.

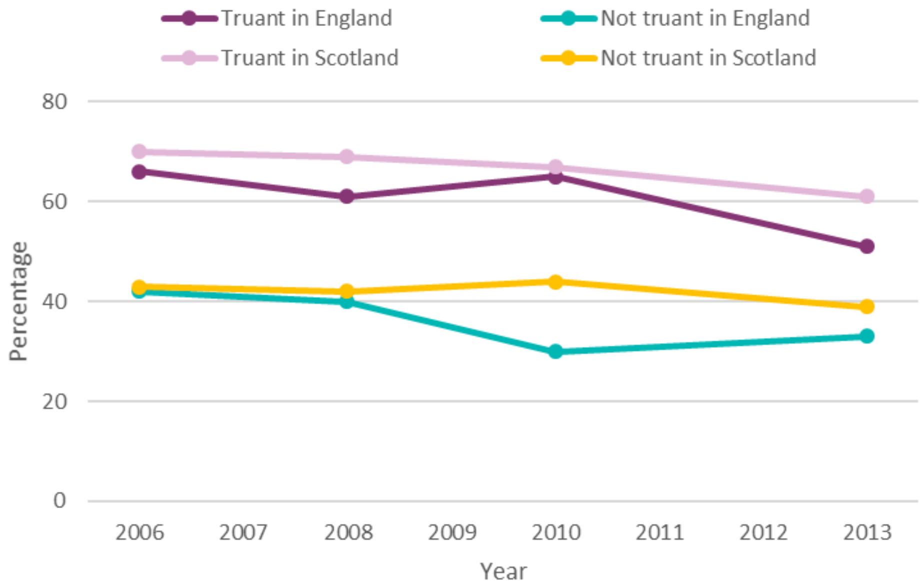
Figure 6:10 Proportion of young smokers who smoked seven or more cigarettes in the past week



Unweighted base: All respondents who smoked (2013: SDD n=389; SALSUS n=2,222)

Truancy was associated with smoking intensity in both countries. Young smokers who had played truant from school tended to smoke more cigarettes than their peers who had not played truant (Figure 6:11). While all groups saw some decline in the rate of smoking, the decline was greatest for those playing truant, particularly those in Scotland who played truant.

Figure 6:11 Proportion of young smokers in England and Scotland who smoked seven or more cigarettes in the past week by truancy[xviii]



Unweighted base: All respondents who smoked (HSE 2013; n=6743; SHes 2013; n=2222)

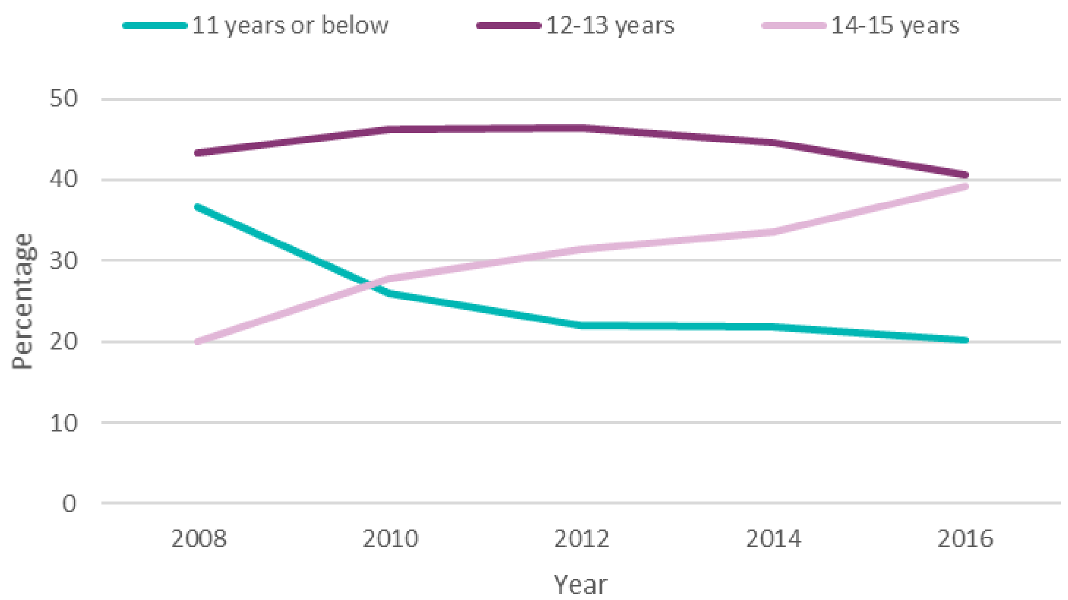
Smoking intensity was not clearly associated with gender in England. However, in Scotland, boys (71% in 2006; 57% in 2015) were consistently more likely to smoke more than seven cigarettes a week than girls (67% in 2006; 48% in 2015).

Age when started smoking

Young smokers were consistently most likely to have started smoking aged 12–13 (Figure 6:12). The proportion starting earlier fell significantly between 2008 and 2016, and the proportion starting later increased, also at a significant rate. This indicates that the age of starting smoking has risen over the study period.

[xviii] There is no data on truancy in 2015 from the SDD so the graph presents data from 2008 to 2013.

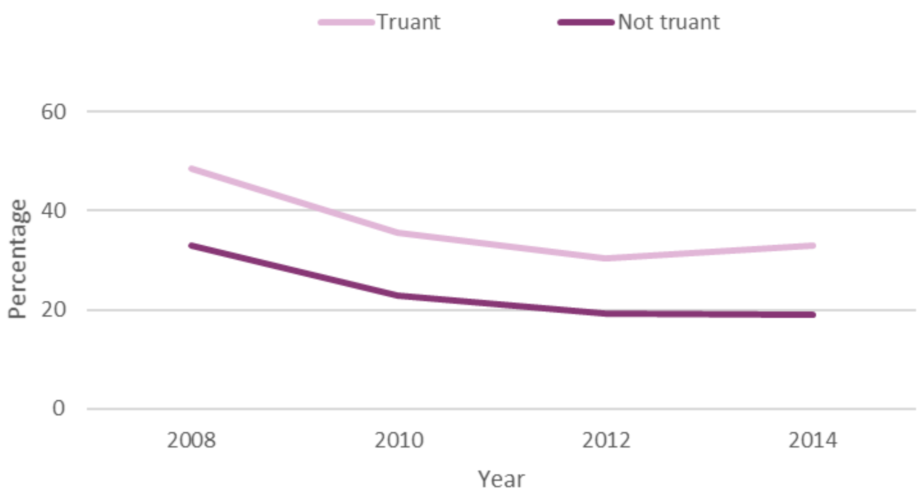
Figure 6:12 Age at which young people started smoking in England[xix]



Unweighted base: SDD respondents who smoked (2016; n=2,164)

The proportion of young people to start smoking by age 11 declined both among those who played truant and in those who had not, although inequalities between these groups persist (Figure 6:13).

Figure 6:13 Proportion of young smokers in England who started smoking at age 11 years by truancy



Unweighted base: SDD respondents who smoked (in 2014; n=825)

[xix] This question was asked in the SDD (England) in alternate years from 2008 to 2016.

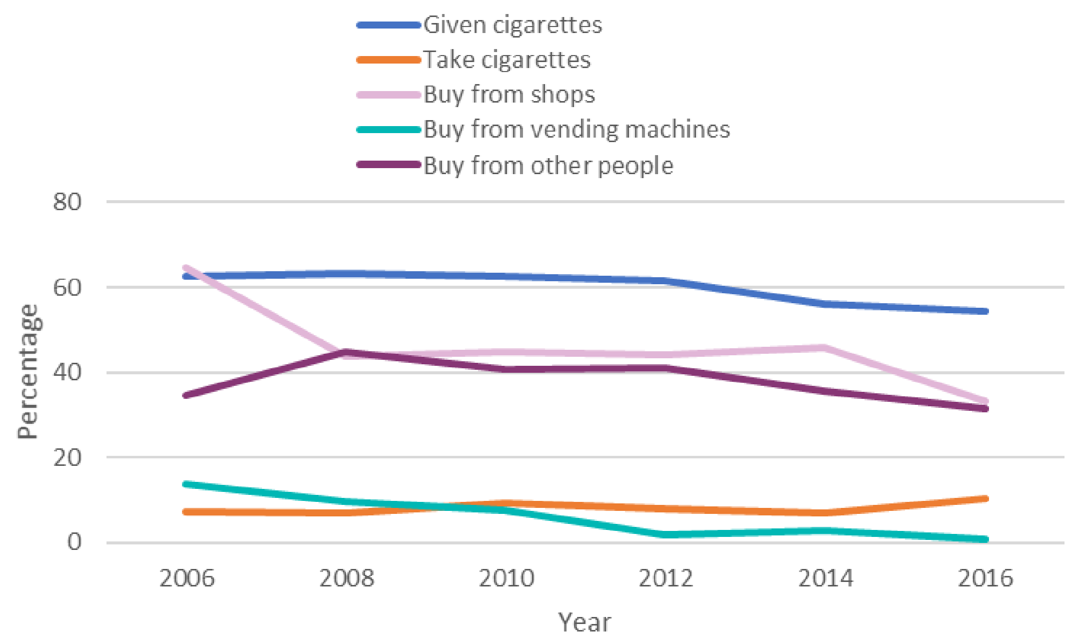
Young people who had been excluded[xx] from school were more likely to have started smoking at a young age than those who had not been excluded. In 2014,[xxi] one-third (33%) of excluded young smokers had started smoking at age 11, compared to around one-fifth (19%) of young smokers who had not been excluded. No significant differences in smoking initiation age emerged by gender or free school meal entitlement.

Usual sources of cigarettes in England

Young people who smoked were asked how they usually got their cigarettes. Options included buying cigarettes from shops, from other people including family and friends, from vending machines, getting them from family or friends, or taking them.[xxii]

The most common means of getting cigarettes reported by young smokers in England was receiving them from other people including family and friends (Figure 6:14). This proportion declined steadily between 2006 and 2016 with more than half of young smokers accessing cigarettes this way (63% in 2006; 54% in 2016).

Figure 6:14 Usual sources of cigarettes for young smokers in England



Unweighted base: All SDD who smoked; in 2016 (n=290)

The sharpest falls were for buying cigarettes from shops and vending machines, both options saw a significant degree of decline between 2006 and 2016. The proportion buying from shops dropped between 2006 and 2008 and again between 2014 and 2016. Access in this way fell from 63% in 2006 to 33% in 2016. Cigarette access via vending machines fell from 14% to 1% over the same period. Although there appeared to be an increase in young people 'taking' cigarettes (7% in 2006; 10% in 2016) this was not statistically significant. A small minority of young smokers reported buying cigarettes online (about 1% from 2006-2016).

[xx] Exclusion here is defined as permanent and fixed-period. Legally, a pupil is either in school full-time or they are excluded from school.
[xxi] Questions on truancy, exclusions from school and free school meals in the SDD were asked from 2006-2014. In the 2016 survey, these questions were removed.
[xxii] The option for 'taking cigarettes' in the SDD does not elaborate on where or from whom these cigarettes are taken. Similarly, in SALSUS the option is 'I take cigarettes without asking'.

Being given cigarettes remained the primary means for young smokers sourcing cigarettes in England from 2006 to 2016. The prevalence of this did not vary by gender, free school meal entitlement, or experience of truancy. However, young smokers who had truanted (47% in 2014) were consistently more likely to buy cigarettes from shops than peers who had not truanted (41% in 2014) over time.

The *Protection from Tobacco (Sales from Vending Machines) Regulations 2010* was passed in October 2011 in England to ban the sale of tobacco from vending machines. The main objective of this legislation was to prevent children and young people from obtaining cigarettes.[15] The decline in young smokers reporting having accessed cigarettes in this way, from 8% in 2010 to 2% in 2012 after the legislation had been implemented, is consistent with the legislation having had an effect.

The proportion of young smokers reporting that it was difficult to source cigarettes from vending machines appeared to increase from 17% in 2006 to 25% to 2010. However, likely due to small sample size, this did not reach statistical significance. Data from 2010 onwards, after the legislation was passed, are not available.

Several pieces of tobacco legislation and regulatory codes targeting young people were implemented during this time, such as the *Health Act (2006)*, the *Ofcom Broadcasting Code (2009)*, and the *UK Code of Broadcast Advertising (2010)*. These may also have contributed to the steep fall in young people buying cigarettes from shops (65% in 2006; 33% in 2016). Young people who smoked were increasingly likely to find it hard to buy cigarettes from a shop. About one-quarter (24%) reported finding it hard to buy cigarettes in a shop in 2006, compared to 44% in 2016.

Some young people found shop purchases easier than others. In 2016, 70% of young smokers who had truanted said it was easy to buy cigarettes from a shop compared to 54% of young smokers who had not truanted. Fewer young people attempted to buy cigarettes from shops as this became harder. The proportion of young smokers attempting to buy cigarettes in a shop in the past year fell from 81% in 2006 to 48% in 2016. Furthermore, in 2016 about three-quarters (73%) of young smokers trying to buy cigarettes in a shop were refused, an increase from 62% in 2006.

While the findings suggest that access to cigarettes has been considerably restricted, over half of respondents felt that it was easy to buy cigarettes from a shop in 2016 (56%) or a vending machine (75% in 2010[xxiii]). This is likely to reflect changing expectations about ease of purchase, as indicated by the increasing proportion of young people not attempting a shop purchase and the majority of those who tried buying cigarettes from a shop being refused.

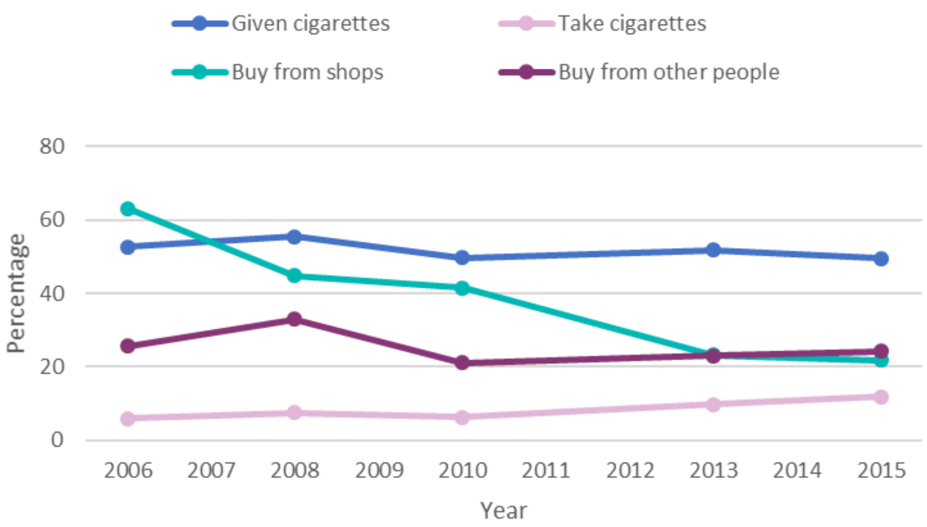
Usual sources of cigarettes in Scotland

The ways in which young people who smoke in Scotland accessed cigarettes broadly mirrored that in England. About half of young people who smoked in Scotland were given cigarettes by other people including their family and friends (Figure 6:15). This was the primary source of cigarettes from 2008 (53% in 2006; 49% in 2015).

As was the case in England, sourcing cigarettes from shops fell at a significant rate, from 63% in 2006 to 22% in 2015. Steep reductions occurred between 2006 and 2008 and between 2010 and 2013. There was also a small but significant increase in the proportion of young people who had taken cigarettes without asking from 2006 (6%) to 2015 (12%).[xxiv]

[xxiii] 2010 was the latest data point available on the ease of buying cigarettes from vending machines.
[xxiv] The option in the questionnaire was ‘I take cigarettes without asking’. However, it does not explain where or from whom young people in Scotland were taking these cigarettes.

Figure 6:15 Usual sources of cigarettes for young smokers in Scotland



Unweighted base: All SALSUS who smoked in 2015 (n=1,516)

As in England, a small minority of young people in Scotland bought their cigarettes online (around 1% from 2006 to 2015). This suggests that during this period in both countries, despite new ways of sourcing cigarettes, the most popular means to getting them continued to be being given them by other people including family and friends. In both countries, approximately half of young people who smoked accessed cigarettes in this way (England 2016: 54%; Scotland 2015: 49%).

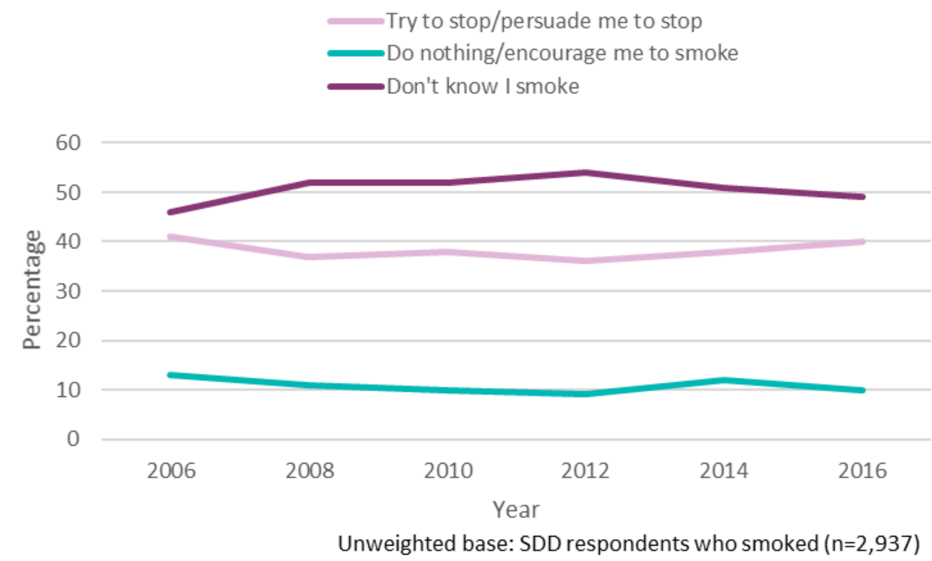
There were no variations by gender, free school meal entitlement, or truancy in likelihood of young people who smoked being given cigarettes. However, young people who had played truant (25–35%) were more likely to buy cigarettes from others than their peers who had not truanted (16–26%). They were also consistently more likely to buy cigarettes from shops than their peers, although in both groups buying cigarettes from shops was in decline.

Family attitudes towards smoking

Participants were categorised into three groups: non-smokers, smokers whose families knew that they smoked, and smokers whose family were unaware (secret smokers). SDD included questions on family attitudes to smoking for smokers and secret smokers, while SALSUS had similar questions for non-smokers and smokers.

In England, perceived family attitudes towards smoking did not change significantly over time. About half of young people who smoked said their families did not know they smoked (secret smokers). About 40% of young people who smoked said their families would stop them or try to persuade them to stop smoking (Figure 6:16).

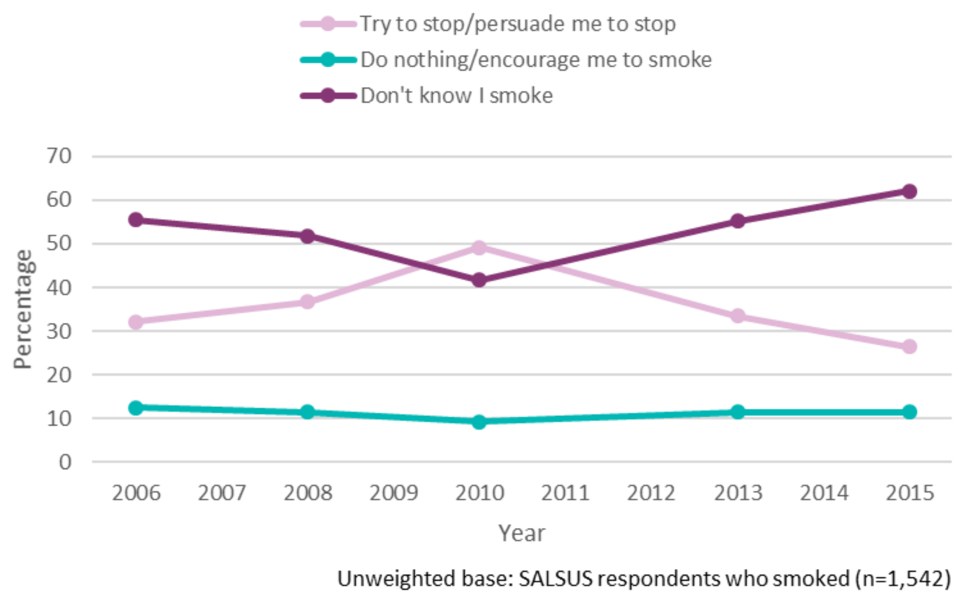
Figure 6:16 Perceived family attitudes towards smoking among young smokers in England



Family attitudes towards smoking as perceived by young people who secretly smoked also remained stable over the years. An overwhelming majority of young people reported that their families would stop them or persuade them to stop smoking (98% in 2006; 100% in 2016). Meanwhile, a small proportion said their families would encourage them to smoke or do nothing if they found out (2% in 2006; 0% in 2016). There were no differences in family attitudes of smokers and secret smokers across gender, free school meal entitlement, and truancy in England.

In Scotland, perceived family attitudes towards smoking were characterised by variation in the proportion of secret smokers over time, a pattern not observed in England (Figure 6:17). However, like England, the changes over time were not statistically significant.

Figure 6:17 Perceived family attitudes towards smoking among young smokers in Scotland



While there were no gender differences in perceived family attitudes towards smoking in England, girls in Scotland (29–44%) were consistently less likely to say that their parents would stop them or try to persuade them to stop, compared to boys (30%–54%). Girls in Scotland were also more likely to be secret smokers than their male counterparts. The gender gap did not markedly change during the study period.

Family attitudes towards smoking in Scotland was only asked of secret smokers in 2006 and 2008. However, the great majority of this group expected that, if their parents knew they smoked, they would stop them or try to stop them smoking (98% in 2006; 97% in 2008).

Between 2006 and 2008, nearly all young people (99%) who did not smoke reported that if they started smoking, their parents would stop them or try to persuade them to stop smoking.[xxv]

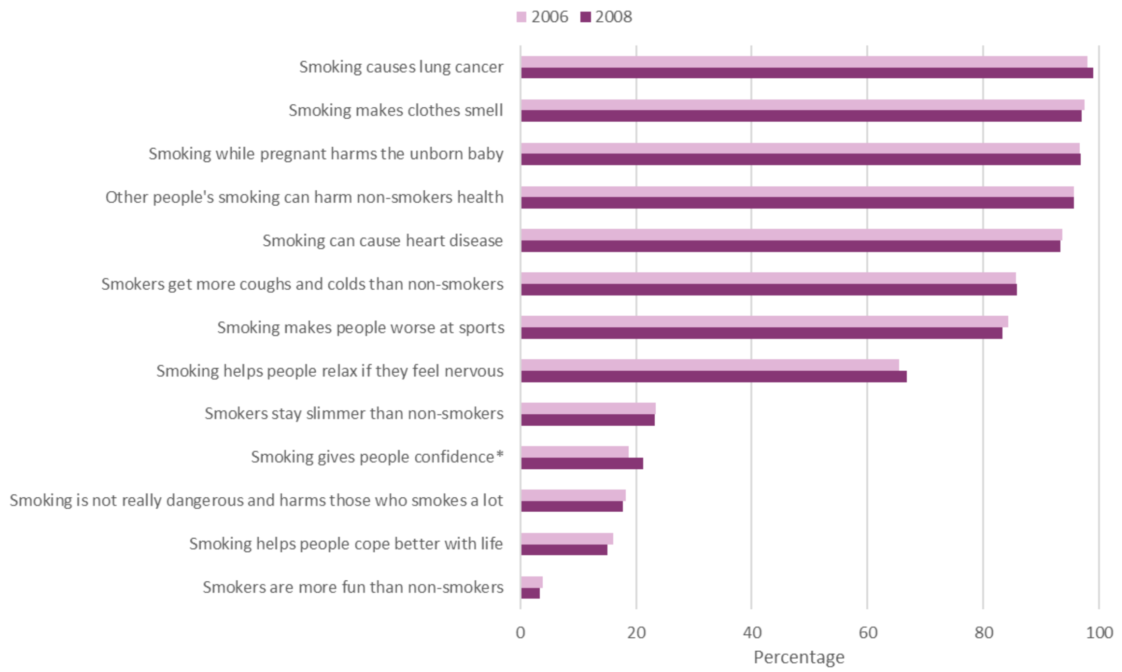
Young people's attitudes towards smoking

In both surveys participants were presented with a series of statements about smoking and asked to rate the extent to which they agreed with them. The statements in SDD and SALSUS are not the same, and therefore were not comparable. Young people's attitudes towards smoking are therefore examined in each country separately.

Attitudes towards smoking in England

Young people's attitudes towards smoking were included in the 2006 and 2008 SDD. Overall, young people in England did not hold positive attitudes towards smoking (Figure 6:18). Nearly all young people recognised the negative effects of smoking on health (99% in 2008 agreed that smoking causes lung cancer). However, two-thirds (67%) of young people (in 2008) agreed that smoking helps people relax if they feel nervous, and over one-fifth felt that smoking keeps people slimmer.

Figure 6:18 Young people's attitudes towards smoking in England



Unweighted base: All respondents in SDD in 2008 (n=7,582)
* p<0.05

[xxv] This question was asked in SALSUS in 2006 and 2008 only.

There were no significant changes in attitudes during this short two-year period. The only exception was a slight but significant increase in reporting that smoking gives people more confidence (19% in 2006, 21% in 2008). Smokers and non-smokers were equally likely to agree with this statement.

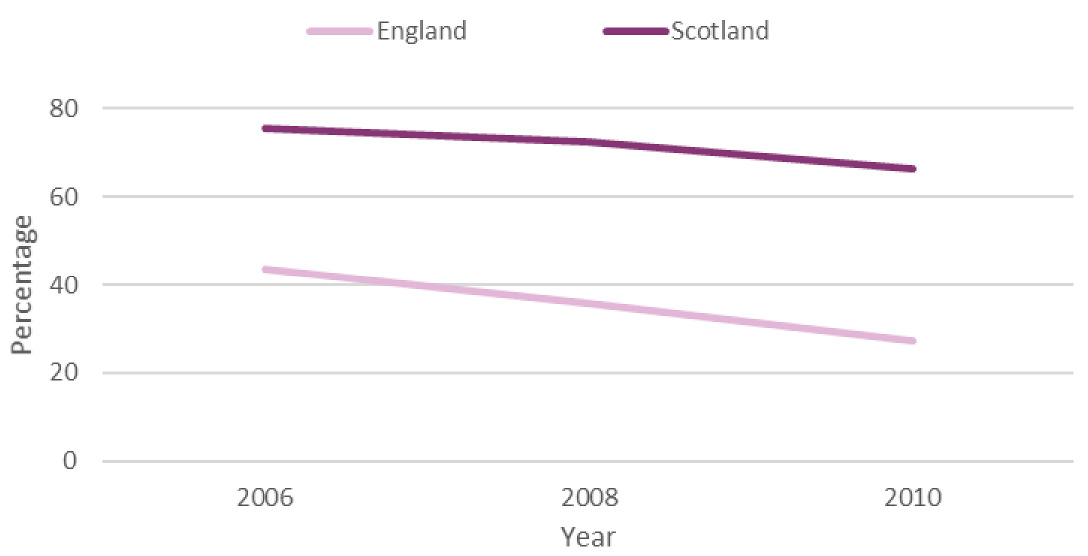
Attitudes towards smoking in Scotland
In Scotland, young people's attitudes towards smoking were tracked from 2006 to 2015, however the wording of the sixteen attitudinal questions was altered in 2013 when a distinction between 'strongly' and 'tend to' agree / disagree was introduced. This affects the time series and makes comparisons over time problematic.

The figures for the time period before the change in question wording, and for which the data overlaps (2006–2008), indicate that attitudes in the two countries are roughly similar; over 95% in both countries said smoking was harmful for non-smokers, over 90% of young people in both England and Scotland said smoking caused heart disease, over 80% of young people in both countries said smoking was likely to give colds. Similarly, during this time period, just under 20% of young people in both England and Scotland said that smoking was not dangerous[xxvi].

Willingness to stop smoking

In both England and Scotland, of those young people that smoked, fewer reported a willingness to stop smoking in 2010 compared with 2006 (Figure 6:19). This fall was more pronounced in England (43% in 2006; 27% in 2010) than Scotland (76% in 2006; 66% in 2010). In 2010, young smokers in Scotland were more than twice as likely to say they would be willing to stop smoking than their peers in England.

Figure 6:19 Proportion of young smokers who were willing to give up smoking



Unweighted base: SDD in 2010 (n=355) SALSUS in 2010 (n=1,749)

[xxvi] The figures for 2008 were: 92% in Scotland and 93% in England said smoking caused heart disease; 96% in both countries said smoking was harmful to non-smokers; 83% in Scotland and 86% in England said smoking caused colds; and 15% in Scotland and 18% in England said smoking was not really dangerous.

These findings should be considered in the context of a higher prevalence of smoking seven or more cigarettes a week among young people in Scotland. The lower levels of willingness to smoke noted in England might result from there being a small group of ‘committed’ smokers who are less willing to stop, while the higher prevalence of young smokers in Scotland may give scope for a wider range of attitudes to smoking. The findings suggest that as smoking prevalence declines in young people, those who continue to smoke may be the least willing to stop.

Young people who smoked were less likely to report willingness to stop than adults who smoked. In 2016, 66% of adults in England were willing to give up smoking compared to 25% of young people. And in 2015, 70% of adults in Scotland were willing to stop smoking compared with 51% of young people.

Willingness to stop smoking differed according to receipt of free school meals and truancy. In 2014, young smokers in England receiving free school meals (19%) and those who had truanted (22%) were less willing to give up smoking compared to their peers who were not eligible for free school meals (30%) and compared to those who had not truanted (33%).

Similarly, in Scotland, in 2015, young people who had truanted (49%) were also less willing to stop smoking than their peers who had not truanted (58%).

6.3.3 Summary of smoking trends in young people

The key trends on smoking among young people in England and Scotland included:

- The prevalence of smoking fell among young people in England and Scotland. The proportion who were regular smokers dropped from 9% in 2006 to 3% in 2016 in England, and from 9% in 2006 to 5% in 2015 in Scotland;
- The most common means for young people to get cigarettes was being given them by other people, including family and friends. In both countries, about half of young people who smoked accessed cigarettes in this way;
- In England, about half of young people who smoked were ‘secret smokers’, who believed that their family did not know that they smoked. Most young people in both countries agreed that, if their families knew they smoked, the families would try to stop or persuade the young person to stop smoking;
- Young people’s attitudes towards smoking in England remained broadly stable over time, with most young people acknowledging the negative effects of smoking on health;
- In Scotland, attitudes towards smoking have become slightly less negative and fewer young people thought that smoking negatively impacted health outcomes; and
- The proportion of young smokers who were willing to stop smoking was lower than for adults in England and in Scotland. In 2016, 66% of adult smokers in England reported being willing to stop smoking, compared with 25% of young smokers. In 2015, 70% of adult smokers in Scotland were willing to stop, compared with 51% of young smokers.

6.3.4 Interrupted Time Series Analysis (ITSA)

Results

The ITSA was conducted to examine the potential impact of the pieces of legislation detailed in Table 6:4 above (see Section 6.2.2). These are summarised, alongside the key outcome measures and the results of the modelling, in Table 6:5.

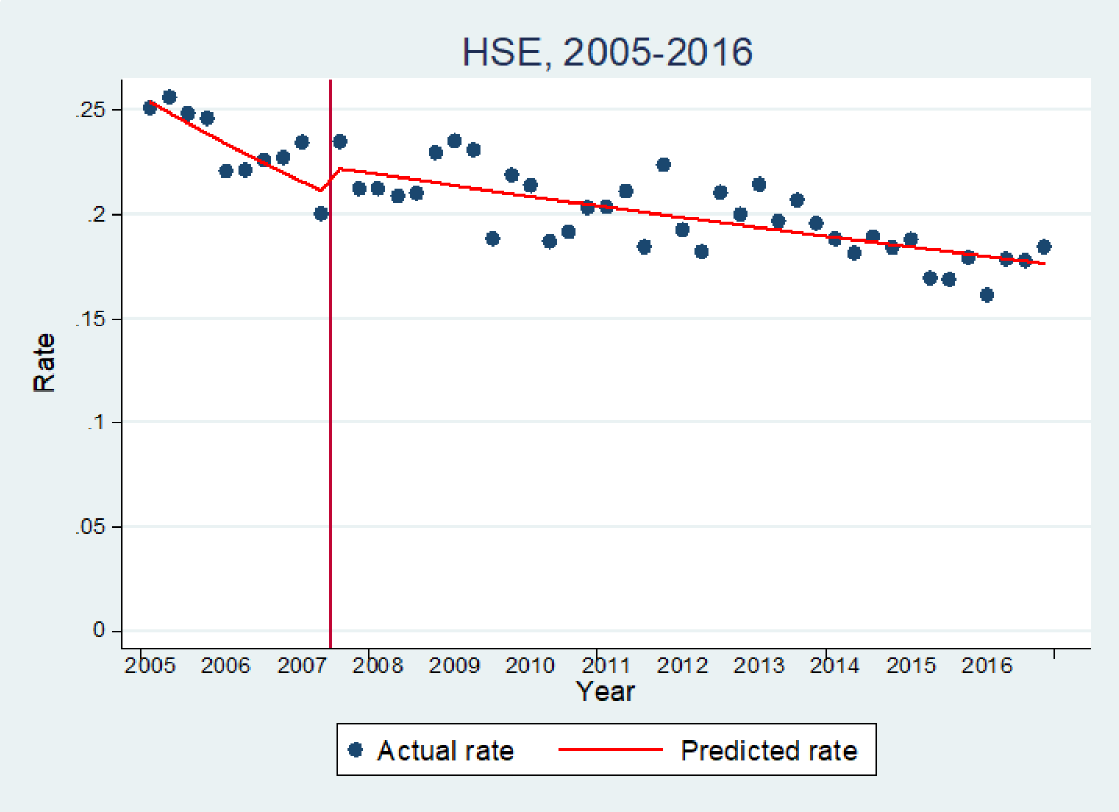
Table 6:5 Summary of ITS model results using HSE data

Legislation	*Outcome variable*	*Result*
The Smoke-free Regulations	Number of current smokers	Not significant
The Smoke-free Regulations	Mean number of cigarettes smoked in a day	Not significant
The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012	Number of current smokers	Not significant
The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012	Mean number of cigarettes smoked in a day	Not significant

Model 1: The Smoke-Free Regulations
The first model tested the potential impact of the Smoke-free Regulations on the **prevalence of current smokers** among adults living in England. This analysis did not detect a statistically significant effect. The models indicate a gradual decrease in smoking prevalence over time, rather than a step-change in response to this specific legislation. The fall in current smokers is non-linear, implying that the decline did not happen at the same rate over time. Instead, the rate gradually slowed over time.

In Figure 6:20, the vertical red line denotes the time of the intervention (in this case, the year when the Smoke-free Regulations were implemented). The horizontal red line in the graph shows the predicted outcome variable (prevalence of current smokers) across the time period and the blue dots denote the actual rate of current smokers from 2005 to 2016. Discontinuity in the outcome variable can be interpreted by comparing the rate of the outcome variable before and after the intervention (i.e., the horizontal red line).

Figure 6:20 ITS of the Smoke-Free Regulations by prevalence of current smokers including intervention and interaction variables

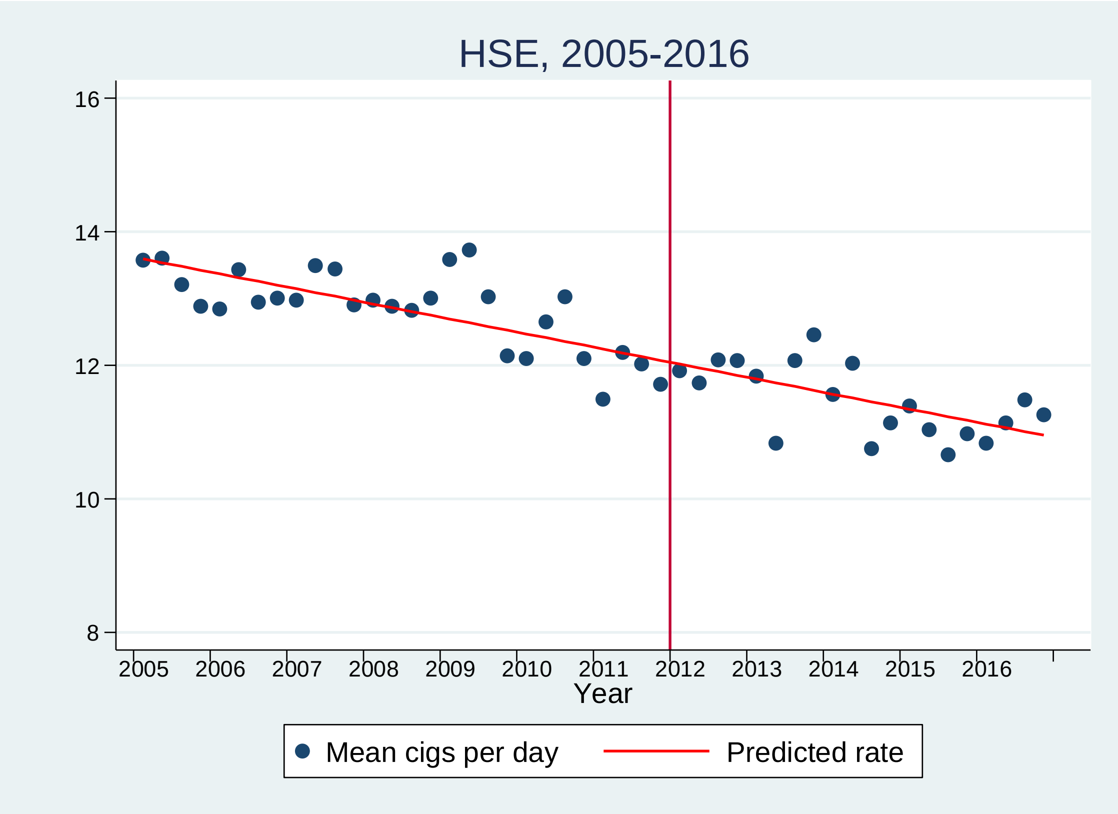


The models were replicated using Newey-regression models to examine the impact of the legislation on **mean number of cigarettes smoked**. This model on mean number of cigarettes was also non-significant.

The models for both outcome variables were also examined for men and women separately, as well as by age. These models were not significant, suggesting that this specific piece of legislation did not impact men and women differently, or different age groups differently.

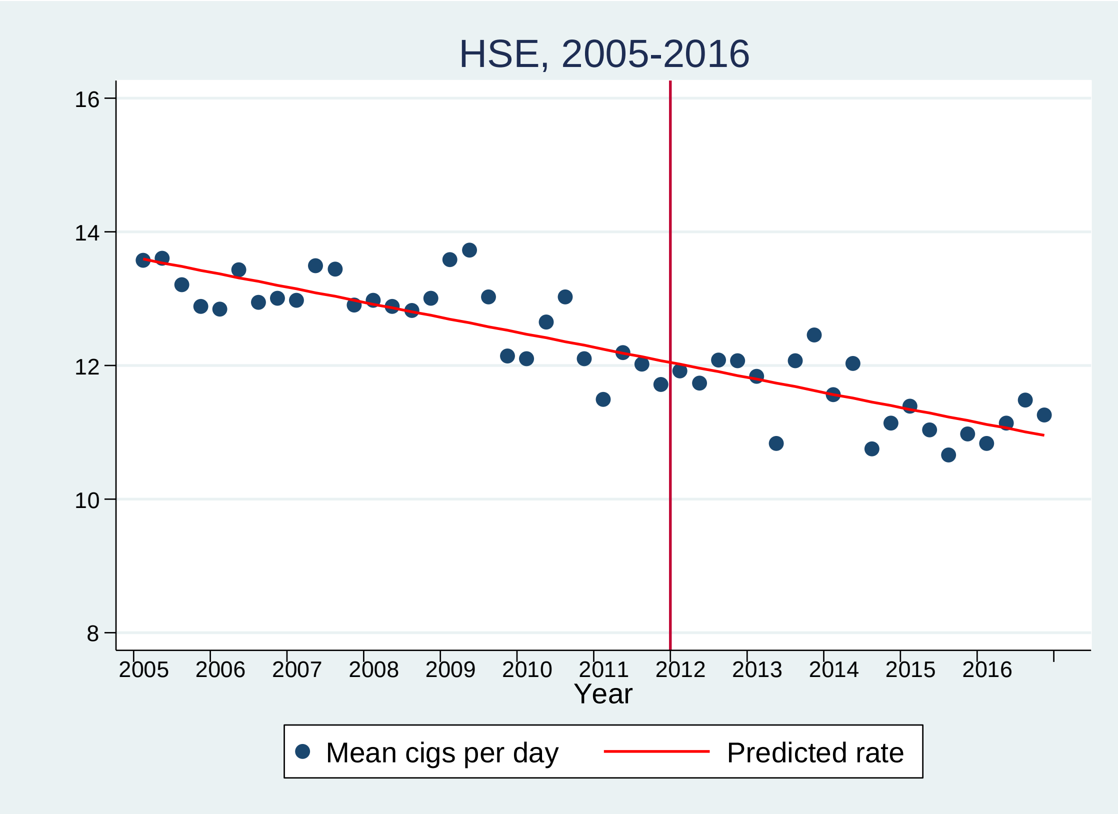
Model 2: The Tobacco Advertising and Promotion Legislation
The trends observed for the models for the Tobacco Advertising and Promotion legislation (Figure 6:21) broadly mirrored those for the Smoke-free Regulations, and there were no significant results. The model for this legislation was built in the same way as the model for the Smoke-free regulations. When examining the impact of the legislation on the **prevalence of current smokers** by gender and age, the model showed no statistically significant difference (p>0.05). This suggests that this legislation did not affect smoking behaviour differently according to a person’s age or gender.

Figure 6:21 ITS of the Tobacco Advertising and Promotion legislation by prevalence of current prevalence of smokers including intervention and interaction variables



These steps were repeated to investigate the impact of the legislation on the **mean number of cigarettes smoked** (Figure 6:22). The time variable was significant, suggesting that the average number of cigarettes smoked over time was in decline. However, the analysis did not indicate that these changes were due to the 2012 legislation as there was no significant change in the rate (discontinuity) over time.

Figure 6:22 ITS of the Tobacco Advertising and Promotion legislation by mean number of cigarettes smoked including intervention and interaction variables



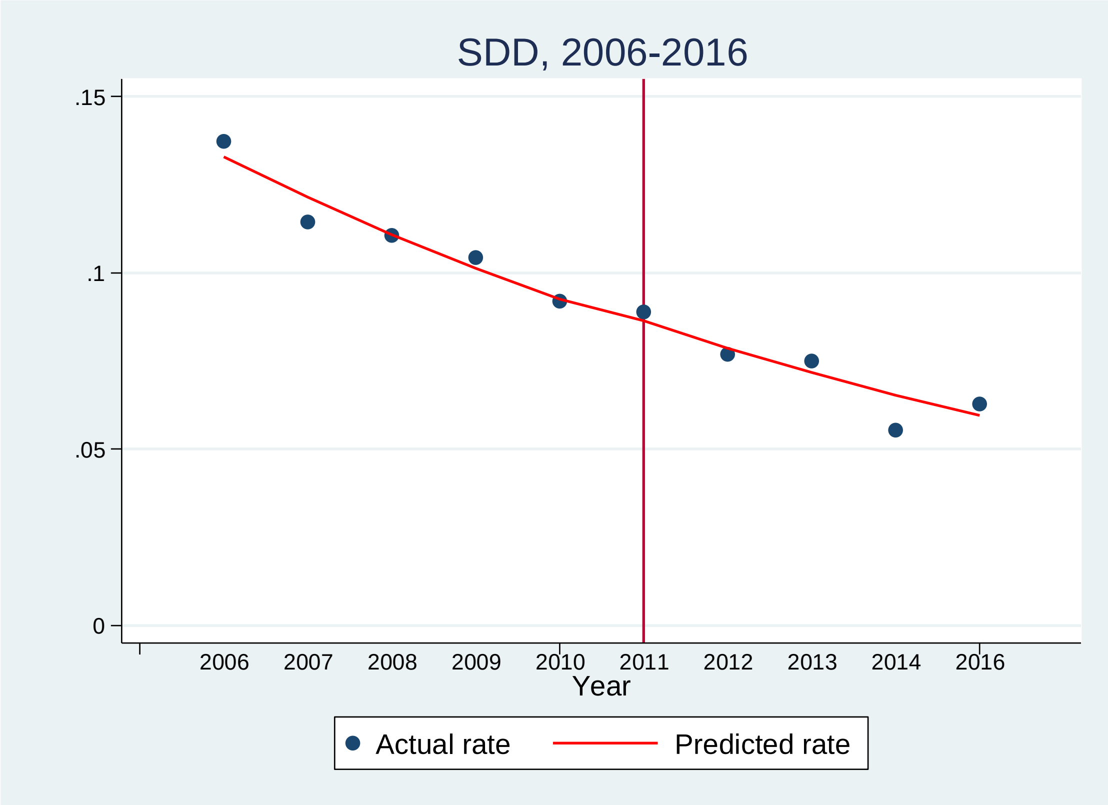
When taking into account the smoking rates by gender and age, the model also did not show any significant relationship between the legislation and smoking rates. This indicates that the legislation did not impact men and women differently, or different age groups differently. Given that the legislation was implemented in 2012, there was a more even spread of data points in the pre-intervention and post-intervention phases compared to the models on the Smoke-free Regulations. This analysis, therefore, provides a more robust picture of the trends.

ITSA using SDD data

The impact of the Protection from Tobacco (Sales from Vending Machines) legislation (October 2011) on young people was examined using data from the SDD. The outcome variables were like those used in the ITS analysis using the HSE data: prevalence of current smokers and the mean number of cigarettes smoked in a day.

The analysis using SDD data mirrored that which used HSE data. Poisson modelling was used to examine the relationship between the legislation and prevalence of current smokers. Although there was evidence of a decline in the number of young people who smoked over time, the model was not significant, suggesting that the legislation did not directly lower smoking prevalence (Figure 6:23).

Figure 6:23 ITS of the Protection from Tobacco (Sales from Vending Machines) legislation by prevalence of smoking among young people including intervention and interaction variables



Newey-regression models were also used to explore the impact of the legislation on the mean number of cigarettes smoked by young people in a day. However, results were non-significant.

Interpretation

The results did not provide evidence indicating that the legislation had significantly impacted smoking rates or average number of cigarettes smoked by adults or young people in England. However, the results have demonstrated some important trends. While the fall in the average number of cigarettes smoked was evident, the decline in the number of current adult smokers did not happen at the same rate over time. In fact, there is evidence suggesting that the rate of this decline gradually slowed.

Despite the non-significant findings, this does not mean that the legislation did not contribute to the general downward trend in smoking.

Given that several pieces of smoking legislation have been passed and implemented in quick succession and have targeted a range of areas (including sales, advertising, prices, areas in which smoking is permitted, and age restrictions), the cumulative impacts of these legislations are likely to have reduced smoking rates in England. This also suggests that the cumulative impact of these legislations may be a stronger predictor of smoking cessation than any single legislation.

6.4 Summary: Tobacco control in England and Scotland

A comparative analysis between England and Scotland was performed to isolate the effect of tobacco control legislation by looking at different timelines of legislation implementation.

- The findings indicated that smoking rates have been in decline among adults and young people in England and in Scotland. Smoking rates in Scotland were slightly higher than in England. Moreover, young people in Scotland tended to smoke more cigarettes on average than their peers in England. Such differences are potentially driven by underlying socioeconomic, cultural, and demographic differences between the two countries.
- There were similarities in the characteristics of smokers within both countries. In both England and Scotland, differences in smoking rates and intensity were observed in adults across demographic (gender), socioeconomic (education), and health (having a heart-related condition) factors. For young people, truancy was a consistent predictor of smoking trends.
- The analysis reveals that not only were fewer adults and young people smoking over time but those who did smoke were smoking fewer cigarettes. Most adults in England and Scotland who smoked also reported being willing to stop smoking altogether. This pattern, however, was not found among young people, who were much less likely to report willingness to stop smoking, relative to adults.
- Any comparison of changes in the attitudes of young people towards smoking are hampered by lack of data. Where data overlap (2006 and 2008) the attitudes of young people in both countries appear broadly comparable. Changes to question wording mean it is not possible to comment on trends over time in Scotland.
- While the ITSA did not show any significant relationship between each individual piece of legislation and smoking cessation or the average number of cigarettes smoked, this does not mean that they had no impact on smoking. Instead, it is likely that they have collectively and partially contributed to the general downward trends in smoking prevalence and intensity in young people and adults in England and Scotland. For example, the descriptive analyses showed that the proportion of young people buying cigarettes in shops and from vending machines had declined and that over time, young people in England were more likely to be refused cigarettes when attempting to buy them in shops. These patterns are consistent with relevant legislation having had intended effects.

Given that a series of different tobacco control measures have been passed and implemented in succession, it is likely that the cumulative impact of these, rather than a single policy, would have a stronger effect of changing smoking rates, trends and attitudes.

Work strand 1 – Comparison to existing research

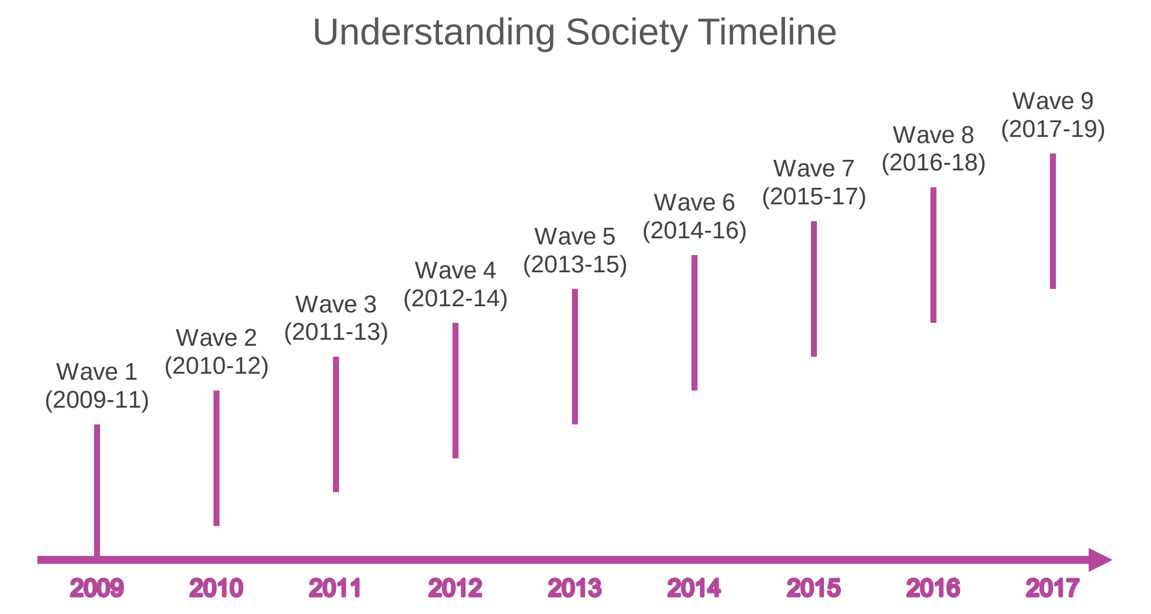
- The proportion of adult smokers and the average number of cigarettes smoked per day have decreased over time in England and Scotland. This finding is consistent with other studies that have also observed a downward trend in tobacco consumption in the last decade.[1]
- Despite a reduction in the consumption of tobacco products observed across all demographic and socioeconomic groups, there were still differences between groups. For example, men, individuals without a degree, and unemployed people were still more likely to smoke than women, individuals with a degree, and people in employment. The importance of demographic and socioeconomic factors to describe and predict the likelihood of smoking behaviours has been acknowledged in other studies.[16]
- The prevalence of young smokers dropped from 9% in 2006 to 3% in 2016 in England and from 9% in 2006 to 5% in 2015 in Scotland, accompanied by a lower willingness to stop smoking compared to the general population.
- For children in both countries, receiving cigarettes from others (including friends and family) was the most common way to source them, while purchasing cigarettes from shops and vending machines has sharply declined in the last few years. This finding diverged from what was previously observed in other studies[17] which did not find significant changes in how children obtained access to cigarettes. Marsh and colleagues[17] found that the main source of cigarettes for 92% of young smokers in New Zealand was non-commercial (including buying them from friends or other people), with one-third of the respondents also purchasing from commercial sources including vending machines, with little change between 2000 and 2008. This difference in finding may be due to specific cultural and socioeconomic differences between New Zealand and the UK, or to differences in how strictly age checking is implemented in the two countries.

7 Profile of starters and quitters

This chapter (**work strand three**) investigates the characteristics of different groups of smokers, specifically; adults who take up, quit, or start smoking again after previously quitting, and children who smoke. The aim is to identify which demographic, socioeconomic and health characteristics are associated with changes in smoking behaviour, both for adults and children. This is done using descriptive analyses and regression models. Take up and use of e-cigarettes among adults and children is also explored. See Appendix D for further details of the descriptive and multivariate outputs.

All analyses presented in this chapter use data taken from Understanding Society (USoc), the UK's Household Longitudinal Study.[xxvii] USoc follows up to 40,000 households and 100,000 individuals every year through face to face and web interviews and covers a wide range of topics. All adults in the household are invited to take part in an individual questionnaire that includes a self-completion module. Children aged 10 and over are given a separate self-completion questionnaire that contains questions about smoking. Further information about the data used in the analysis is presented in each sub-section below. Figure 7:1 provides a simplified timeline showing the start dates of USoc Waves 1–9.[xxviii]

Figure 7:1 Simplified timeline of Understanding Society Waves 1–9



7.1 Adult smokers

This section presents results from analysis of changes in smoking behaviour among adults (aged 16 years and over) living in the UK. The analysis uses data from Wave 2 and Wave 5 of USoc. Fieldwork for USoc is conducted over two years with Wave 2 data being collected between 2010 and 2011, and Wave 5 data being collected between 2013 and 2014. Wave 2 and Wave 5 were the only waves to include a detailed smoking module asked of adults. At both waves the relevant smoking questions asked of adults included:

[xxvii] Further details can be found at www.understandingsociety.ac.uk.
[xxviii] Timeline adapted from Understanding Society Timeline at: https://www.understandingsociety.ac.uk/documentation/mainstage/survey-timeline. [Cited 2020 Oct 14].

- Have you ever smoked a cigarette, a cigar or a pipe?
- Do you smoke cigarettes at all nowadays?
- Have you ever smoked cigarettes regularly?

The sample for this analysis includes individuals aged 16 years and over at Wave 2 who completed the smoking module at both waves. These data were used to examine the relationship between demographic, socioeconomic and health characteristics of people aged 16 years and over on three outcome variables:

1. Quitters: those who smoked at Wave 2 but did not smoke at Wave 5;
2. New starters: those who had never smoked at Wave 2 but smoked at Wave 5; and
3. Re-starters: those who were not current smokers at Wave 2 (but had previously smoked to some degree) and smoked at Wave 5.

The three outcomes are mutually exclusive; an individual cannot appear in more than one model.

The distribution of individuals in each of these groups is shown in Table 7:1 below. The rate of quitters at Wave 5 was higher than the rate of adults who had started smoking by Wave 5, either as new starters or as re-starters. This contributed to the overall downwards trend in smoking behaviour.

Table 7:1 Adults whose smoking status changed between Wave 2 and Wave 5

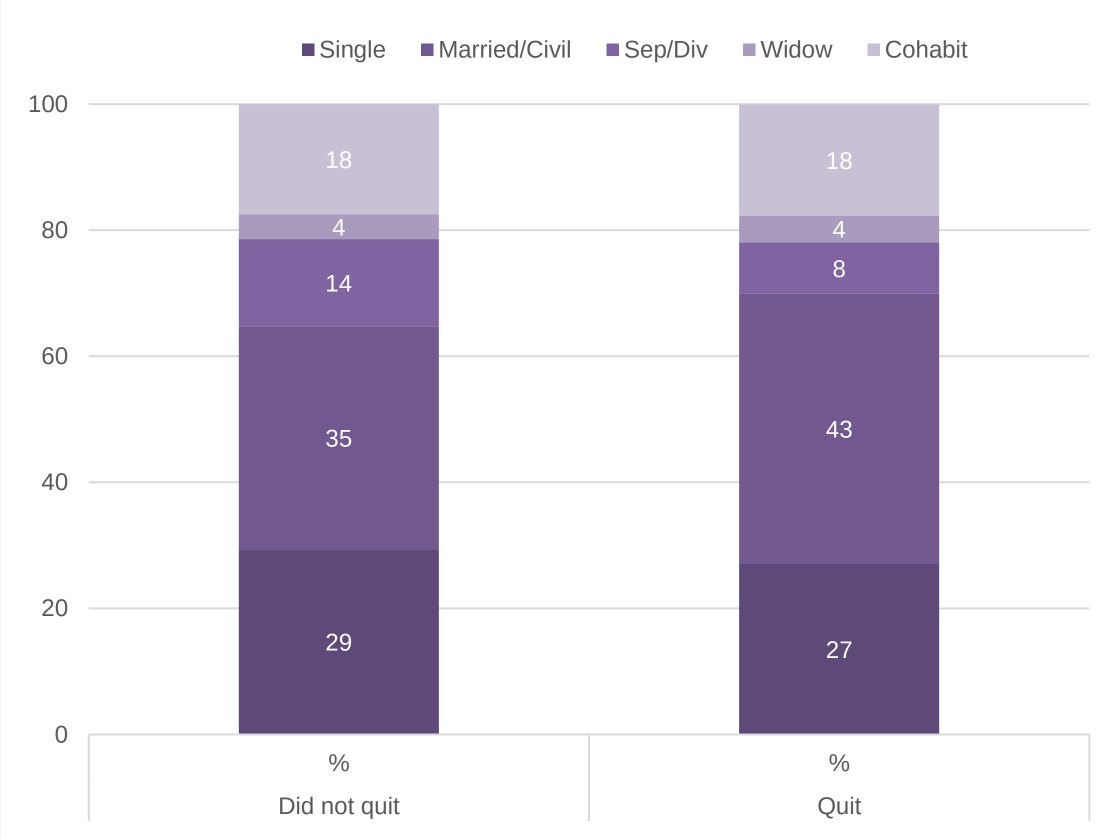
All individuals aged 16+ at Wave 2 who also responded at Wave 5	*USoc*
Quitters	%
Smoked at Wave 2, not current smoker at Wave 5	22.6
Smoked at both waves	77.4
Base: All smokers at Wave 2	*4991*
New starters	
Never smoked Wave 2, smoker at Wave 5	1.2
Never smoked at both waves	98.8
Base: All never smoked at Wave 2	*11537*
Re-starters	
Not current smoker at Wave 2, smoker at Wave 5	5.5
Not current smoker at both waves	94.5
Base: All not currently smoking at Wave 2	*9367*

7.1.1 Profile of adult quitters

There were significant demographic and socioeconomic patterns associated with quitting smoking between Waves 2 and 5, specifically, in terms of marital status, employment, social class and education.

People who were married or in a civil partnership were significantly more likely to quit smoking than those who were separated or divorced. Almost half (43%) of the quitters were married or in a civil partnership, while 35% of those who continued to smoke were married or in a civil partnership. Similarly, 8% of quitters were separated or divorced, compared to 14% of those who continued to smoke. This is shown in Figure 7:2.

Figure 7:2 Proportion of respondents who quit smoking by marital status



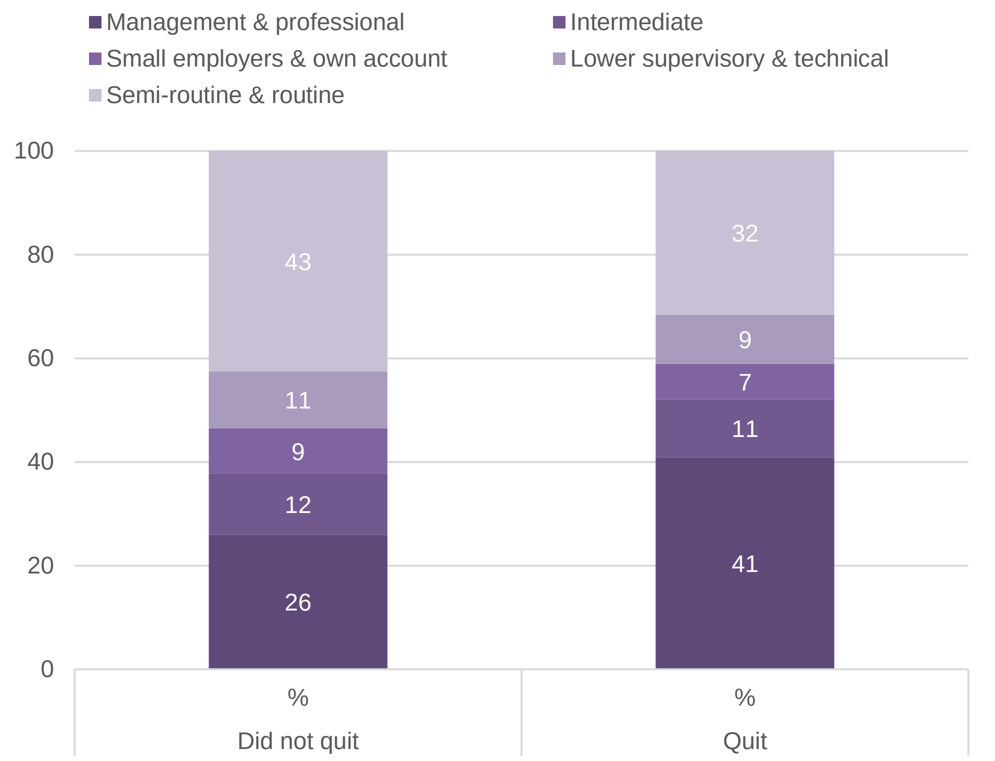
Base: All adults aged 16 and above

Respondents who were employed were more likely to quit smoking than those who were unemployed; 63% of quitters were employed, while 54% of those who continued to smoke were employed.

Of the respondents who were in work at Wave 2, there were some differences in smoking behaviour by socioeconomic class. Respondents working in managerial and professional occupations in Wave 2 were more likely to quit than those who were working in other socioeconomic classes[xxix]; 41% of quitters who were in work came from professional and managerial occupations, while 26% of those who did not quit came from these occupations. By contrast, 31% of quitters who were in work were from semi-routine and routine occupations relative to 43% of those who continued to smoke. This is shown in Figure 7:3.

[xxix] Socioeconomic class is based on the National Statistics Socioeconomic Classification (NS-SEC), five classes, based on current job.

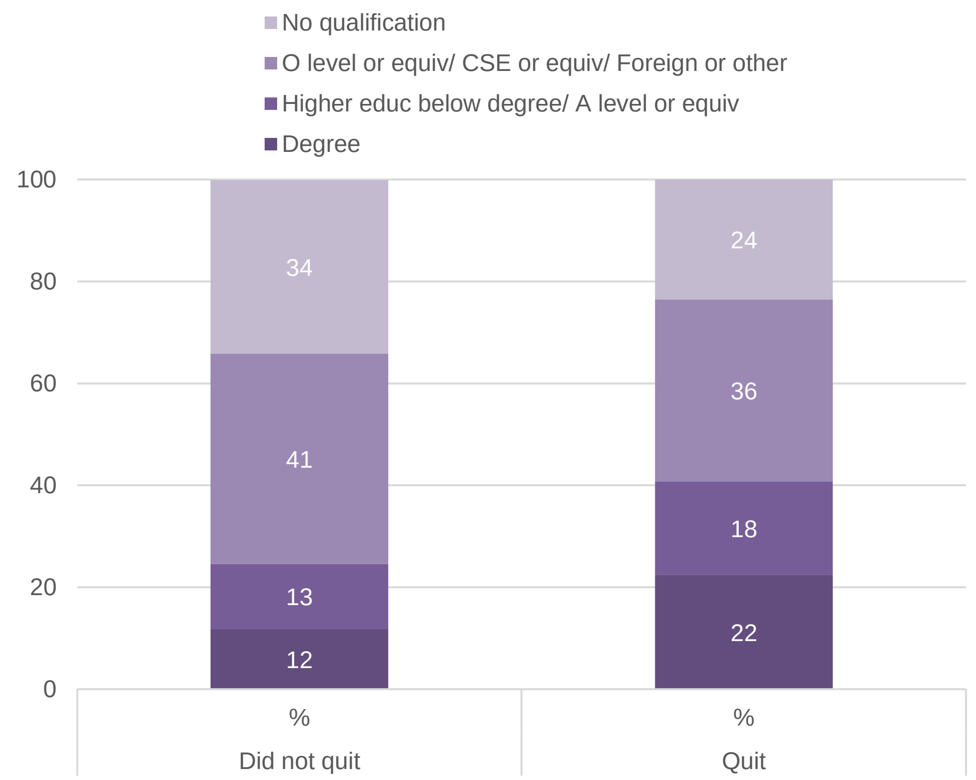
Figure 7:3 Proportion of respondents who quit smoking by socioeconomic classification



Base: All adults in work aged 16 and above

Those who quit smoking were more likely to have higher qualifications than those who continued to smoke; of those who quit, 24% held a degree, compared to 12% of those who continued to smoke. Similarly, 24% of those who quit had no qualifications, while 34% of those who continued to smoke had no qualifications. This is shown in Figure 7:4.

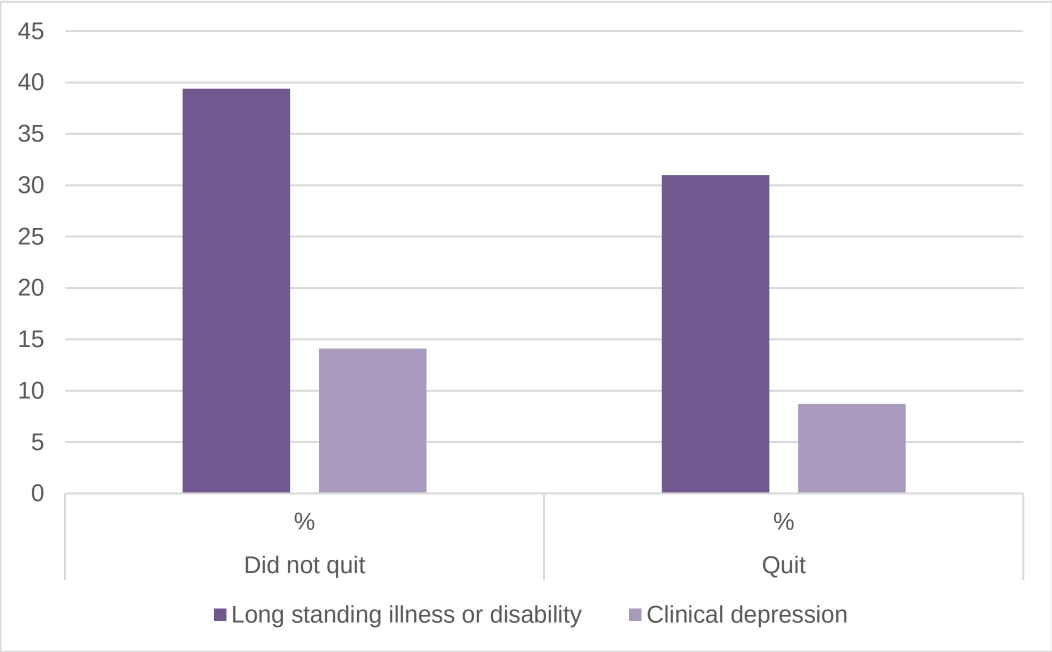
Figure 7:4 Proportion of respondents who quit smoking by highest qualification



Base: All adults aged 16 and above

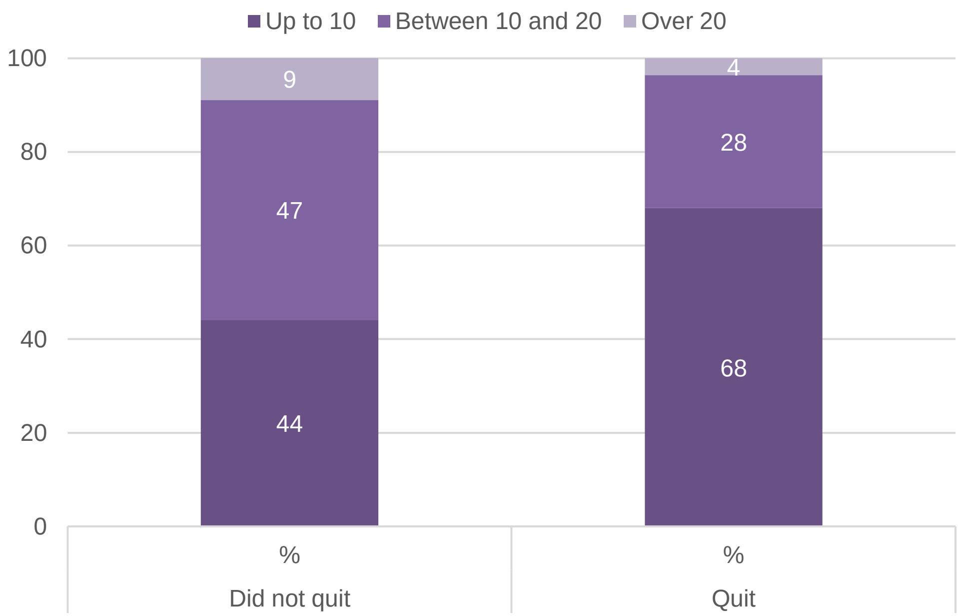
In terms of health outcomes, having a longstanding illness or existing clinical depression at Wave 2 was linked to a lower likelihood of quitting. Almost one-third of people with a longstanding illness quit smoking (31%), while 39% of those who continued to smoke had a longstanding illness. Similarly, 9% of those with clinical depression at Wave 2 quit smoking, relative to 14% of those who continued to smoke. These are shown in Figure 7:5 below.

Figure 7:5 Proportion of respondents who quit smoking by long-term illness and clinical depression



Heavy smokers were less likely to quit smoking. Respondents who smoked fewer cigarettes a day (up to ten) in Wave 2 were more likely to quit smoking by Wave 5: 68% of quitters smoked up to ten cigarettes a day in Wave 2; by contrast, 44% of those who did not quit by Wave 5 smoked up to ten cigarettes a day in Wave 2. This is shown in Figure 7:6.

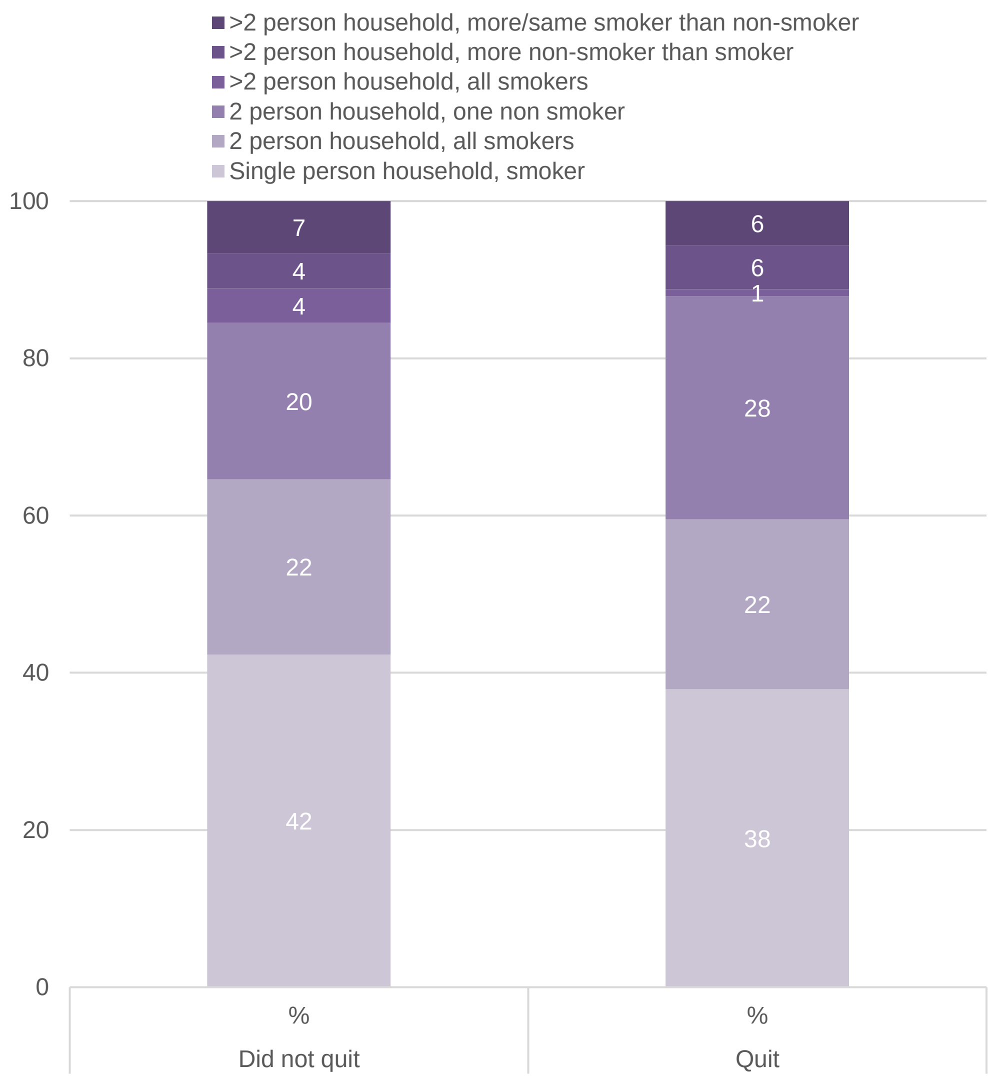
Figure 7:6 Proportion of respondents who quit smoking by number of cigarettes previously smoked per day



Base: All adults aged 16 and above

Household smoking behaviour also had an impact on the individual's smoking behaviour. Respondents who lived with a non-smoker were more likely to quit; 28% of people who quit smoking lived in a two-person household with a non-smoker, while 20% of those who continued to smoke lived in a two-person household with a non-smoker. (Figure 7:7).

Figure 7:7 Proportion of respondents who quit smoking by household smoking behaviour



Base: All adults aged 16 and above

7.1.2 Multivariate analysis of adult quitters

Multivariate analysis methods were used to further examine the relationship between demographic, socioeconomic and health factors and smoking cessation among adults. Logistic regression was used to look at the impact of different factors on quitting.[xxx] Such analyses ensure a better understanding of the nature of the relationship between each characteristic and smoking cessation, as it allows these relationships to be

[xxx] The models were run using '*SVY*' commands in Stata to allow clustering of individuals within households and local areas to be taken into account. Further details are provided in Appendix D.

investigated while controlling for other characteristics. See Appendix D for further details and Appendix table D:4 for the regression output table.

The descriptive analysis showed that the number of cigarettes smoked per day was strongly related to the likelihood of quitting. This association remained significant when other demographic and socioeconomic factors were taken into account. Heavy smokers remained less likely to quit; individuals who smoked fewer than ten cigarettes per day at Wave 2 were over three times more likely to quit by Wave 5 than those smoking more than twenty cigarettes per day at Wave 2.

Household smoking behaviour also remained significantly related to an individual's likelihood of quitting. Individuals were much more likely to quit if there were non-smokers in the household. However, the ratio of smokers to non-smokers was also an important factor. The presence of non-smokers in the household increased the likelihood of an individual quitting if the household was a two-adult household containing one non-smoking household member at Wave 2 (i.e., not the respondent), or if the household was a larger household, containing more than two adults, and containing a greater number of non-smokers than smokers. However, if the individual lived in a larger household where there were more smokers than non-smokers at Wave 2, or where there were more than two adults in the household and an equal number of smokers and non-smokers, then the presence of non-smokers no longer acted as a protective factor.

There were a number of health characteristics that were significantly related to smoking cessation and retained in the regression model. Individuals with an existing diagnosis of clinical depression at Wave 2 were less likely to quit, as were people with an existing limiting long-term illness at Wave 2. However, individuals who were given new diagnoses of certain health conditions between Wave 2 and Wave 5 were much more likely to quit. People who had a new heart condition diagnosed between Wave 2 and Wave 5 were more than four times more likely to quit in the same time period. In addition, those who had a new diagnosis of high blood pressure were nearly two times more likely to quit. Similarly, people diagnosed with cancer between Wave 2 and Wave 5 were two and a half times more likely to quit than those who did who were not diagnosed with these conditions. It should be noted that having any of these three conditions as an existing condition at Wave 2 was *not* significantly related to quitting. This suggests that a new diagnosis will encourage some individuals to quit, although it appears that this behaviour is 'time limited'; the individual either quits at the time of diagnosis, or their diagnosis does not appear to affect their smoking behaviours.

A new pregnancy was significantly related to quitting; women of childbearing age who became pregnant between Wave 2 and Wave 5 were more likely to stop smoking over the same period. However, the presence of children in the household, and whether or not the individual was a parent at Wave 2, were not significantly related to quitting and were not retained in the final model.

Finally, within this multivariate analysis, there were a number of socio-demographic characteristics that were significantly related to quitting. People who were separated or divorced at Wave 2 were less likely to quit than individuals who were married or in a civil partnership. Widows were least likely to quit. Individuals who had a degree were twice as likely to quit as individuals with no qualifications. Finally, individuals in managerial and professional occupations were more likely to quit than individuals who had never worked.

Age, gender, region or urban / rural status were not significant in the model. General health and measures of wellbeing, e.g., General Household Questionnaire (GHQ), Short Form Survey 12 (SF-12) and life satisfaction, were also tested in the model, both alongside and instead of the indicator for clinical depression; none were significant.

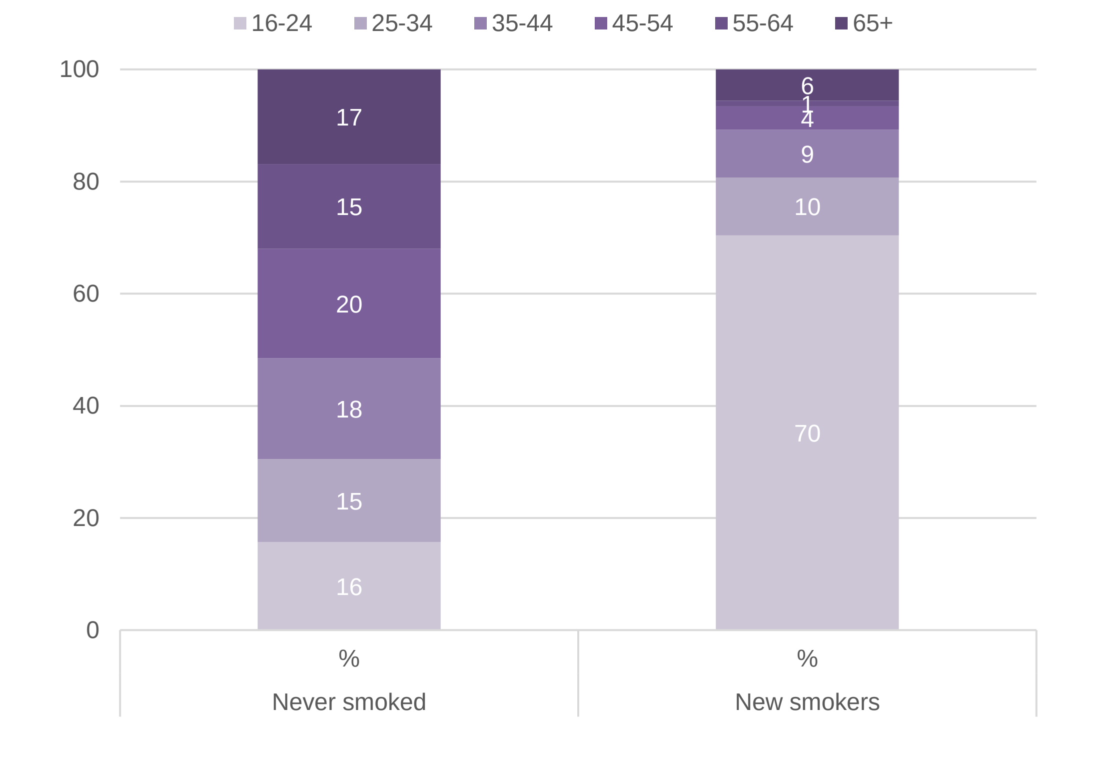
This suggests that, once other characteristics have been controlled for, only the most severe cases of poor mental health are related to a lower likelihood of quitting smoking. The model also tested an interaction between limiting long-term illness and poor mental health, this was also not significant.

7.1.3 Profile of adult new starters

This section explores the demographic, socioeconomic and health characteristics associated with the sub-group of respondents who did not smoke in Wave 2 but who took up smoking for the first time by Wave 5, hereby referred to as new starters.

The likelihood of taking up smoking for the first time was strongly related to age; with young people having far higher rates. Respondents aged 16 to 24 years made up more than two-thirds (70%) of those who started smoking, compared to 16% of those who never smoked. On the other hand, 6% of people who started smoking were aged 65 years and above while 17% of people who never smoked fell in this age group. This is shown in Figure 7:8.

Figure 7:8 Proportion of respondents taking up smoking by age

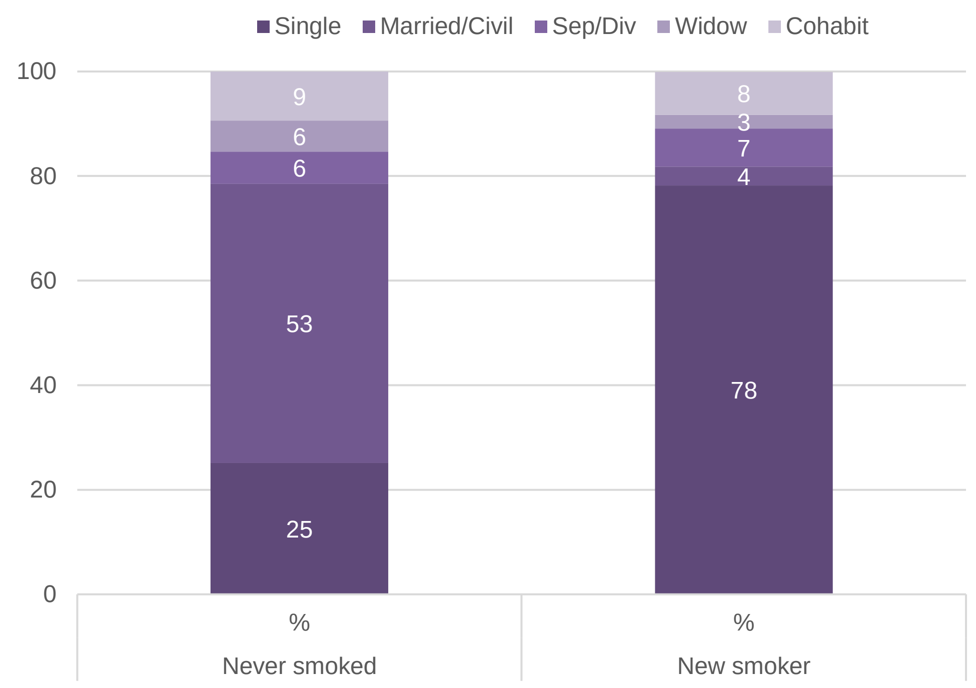


Base: All adults aged 16 and above

Respondents who were born in the UK were significantly more likely to start smoking than those born elsewhere; 97% of those who started smoking by Wave 5 were born in the UK, compared to 87% of those who had never smoked, who were born in the UK.

People who were single were more likely to be a new starter than those who were married or in a civil partnership. Single people made up more than three-quarters (78%) of new starters compared to 25% of respondents who had never smoked. Conversely, among those who started smoking by Wave 5, 4% were married or in a civil partnership, whereas among respondents who had never smoked, 53% were married or in a civil partnership. This is shown in Figure 7:9 below.

Figure 7:9 Proportion of respondents taking up smoking by marital status

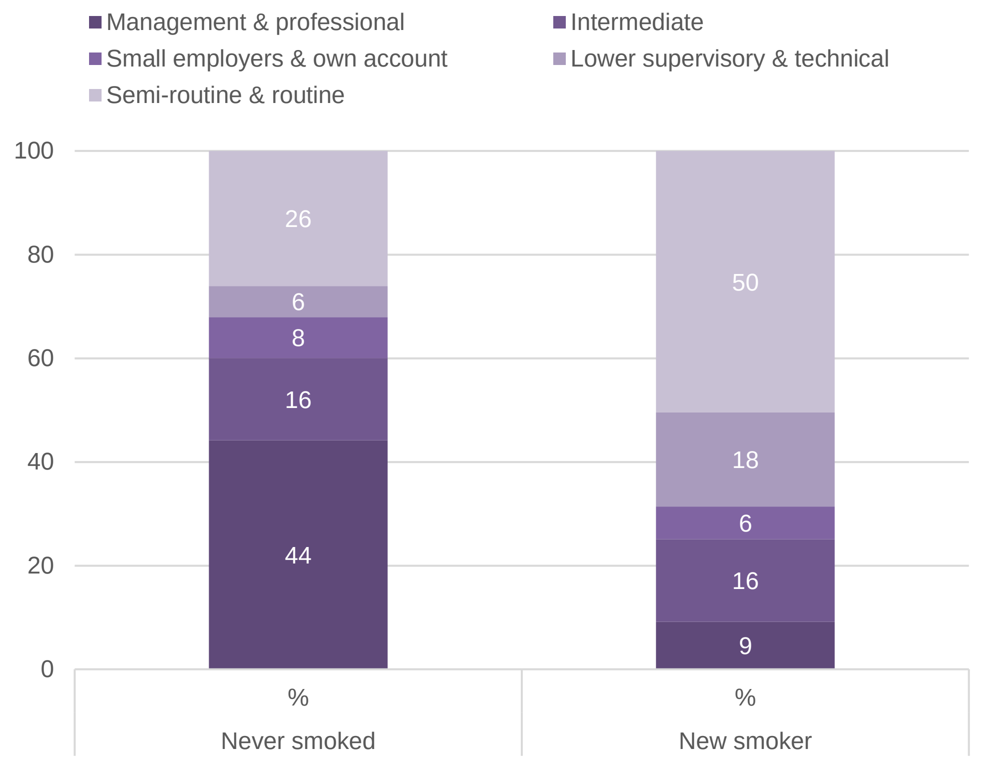


Base: All adults aged 16 and above

Socioeconomic patterns were also observed. Respondents who were unemployed were significantly more likely to take up smoking than those in employment; 70% of new starters were unemployed compared to 40% of respondents who never smoked being unemployed.

Of those who worked, people in semi-routine and routine occupations were most likely to take up smoking compared to those in managerial and professional occupations. More than half (50%) of new starters were from semi-routine and routine occupations; by contrast, 26% of those who had never smoked were from semi-routine and routine occupations. This is shown in Figure 7:10.

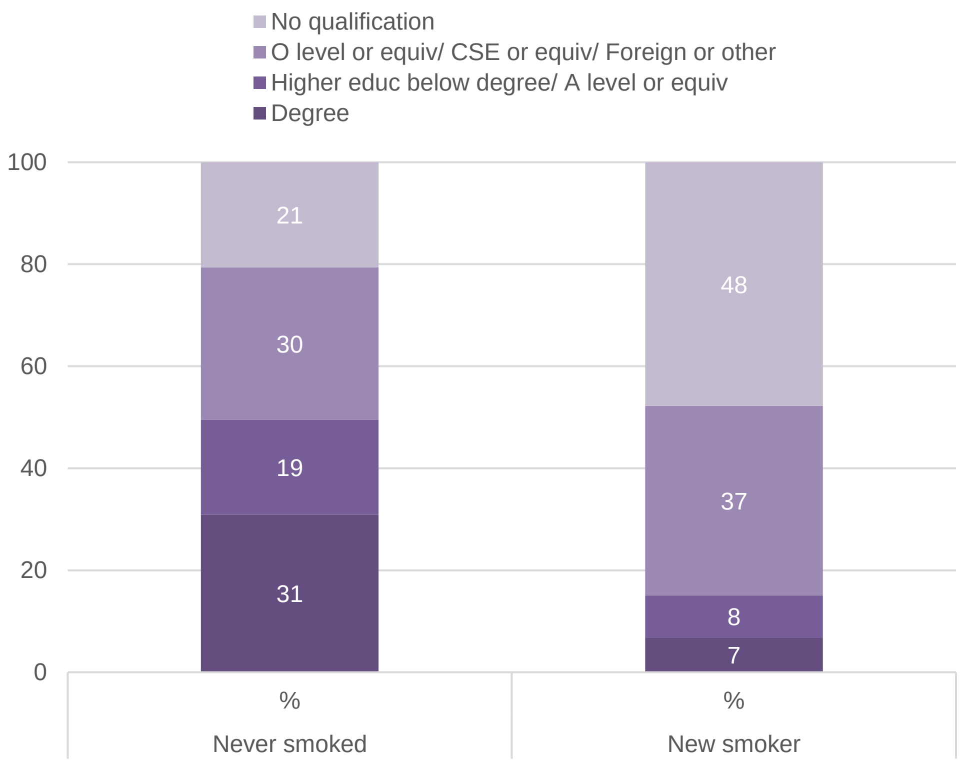
Figure 7:10 Proportion of respondents taking up smoking by socioeconomic classification



Base: All adults in work aged 16 and above

These trends were also consistent across education qualifications, where those with lower qualifications were significantly more likely to take up smoking than respondents with higher education. Almost half (48%) of new smokers had no qualifications, while 21% of those who had never smoked had no qualifications. Conversely, 7% of those who took up smoking held a degree, compared with 31% of those who had never smoked holding a degree. This is shown in Figure 7:11.

Figure 7:11 Proportion of respondents taking up smoking by highest qualification

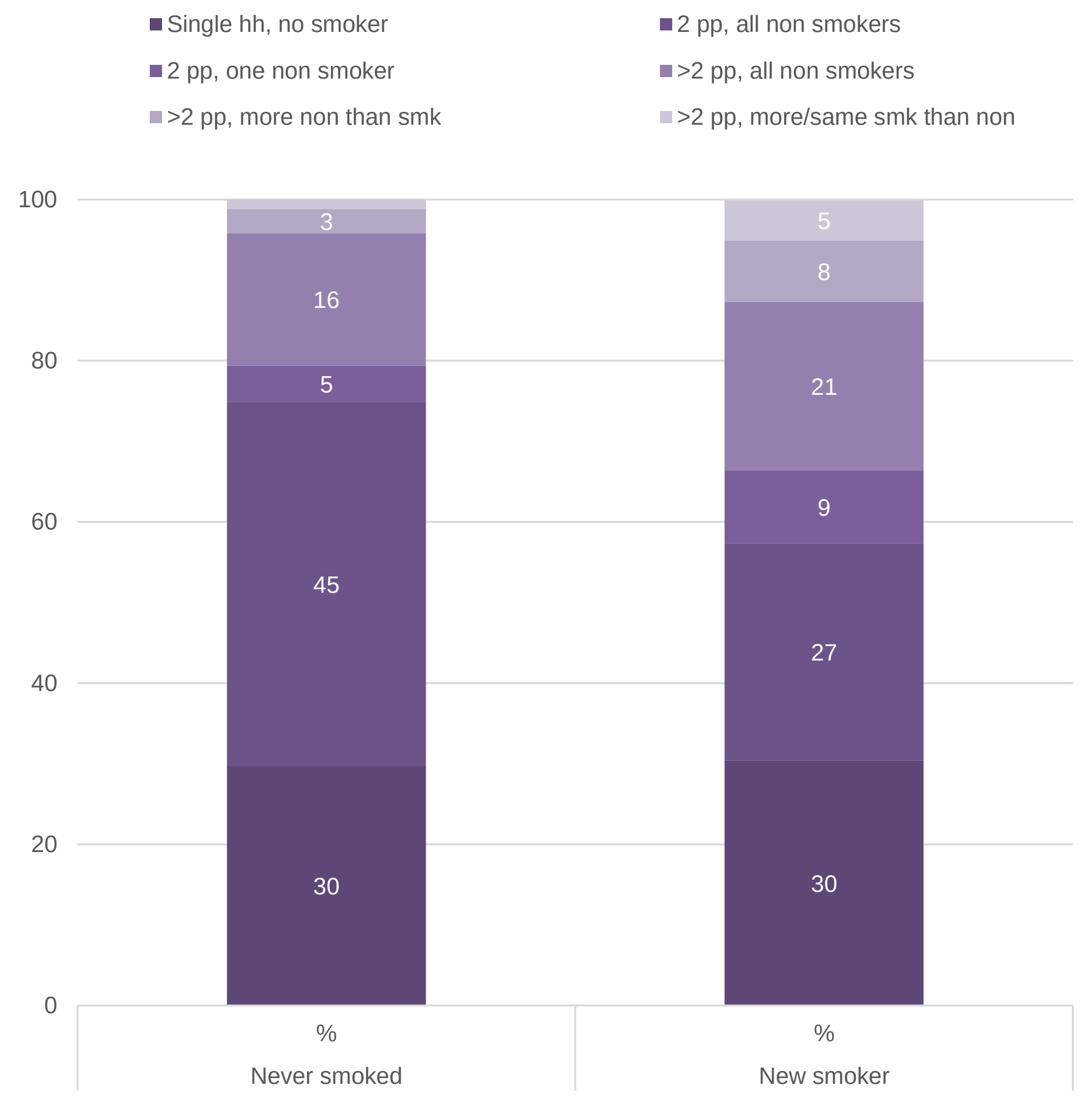


Base: All adults aged 16 and above

In terms of health outcomes, having a longstanding illness or disability at Wave 2 was associated with a lower likelihood of taking up smoking. More than one in ten (14%) of new starters had a longstanding illness or disability compared to 30% of those who had never smoked.

Household smoking behaviour was also linked to the likelihood of starting smoking. Respondents who lived in a two-person household with non-smokers were significantly less likely to start smoking. Among those who had never smoked, 45% lived in a two-person household with a non-smoker, compared with (27%) of those who took up smoking who lived in such a household. This is shown in Figure 7:12.

Figure 7:12 Proportion of respondents taking up smoking by household smoking behaviour



Base: All adults aged 16 and above

7.1.4 Multivariate analysis of new starters

Regression analysis was conducted to gain further insight into the factors related to adults taking up smoking for the first time.[xxxi] See Appendix table D:5 for the regression output. The regression model indicated socio-demographic characteristics; age, marital status, and qualifications, were most strongly related to taking up smoking at the age of 16 years or older. Household smoking behaviour was also strongly related to the likelihood of starting smoking.

[xxxi] One per cent of adults who never smoked at Wave 2 had taken up smoking by Wave 5. The low proportion impacts on the power of the model to detect significant relationships, a relationship has to be strong before the model can identify it as being significant. This results in fewer variables being placed in the model for new starters.

As expected, age was strongly related with taking up smoking; individuals aged 16–24 years at Wave 2 were far more likely to take up smoking than any other age group, with rates generally decreasing as age increases.

Marital status was also significantly related to taking up smoking for the first time. Single people were eight times more likely to take up smoking than married people. The fact that marital status is significantly related to starting smoking in the regression model shows that the relationship between marital status and starting smoking is not simply an artefact of age (single people are generally younger, and younger people are more likely to start smoking). Instead, the model demonstrates that, at any age, single status is linked to a higher likelihood of starting smoking.

Qualifications were also significantly related. Individuals without qualifications were eight times more likely to take up smoking than individuals with a degree. Similarly, individuals whose highest qualification was GCSE level or equivalent were three times more likely to take up smoking than those with a degree.

Finally, the number of household members and their smoking behaviour had an impact on new starters. Individuals living in single households at Wave 2 were the group most likely to take up smoking, individuals in large adult non-smoking households were least likely. An individual in a household containing a single adult (regardless of number of children) was twice as likely to take up smoking as the same individual living in a household containing two non-smoking adults, and over six times more likely to take up smoking than the same individual living in a household with more than two adults, none of whom smoke.

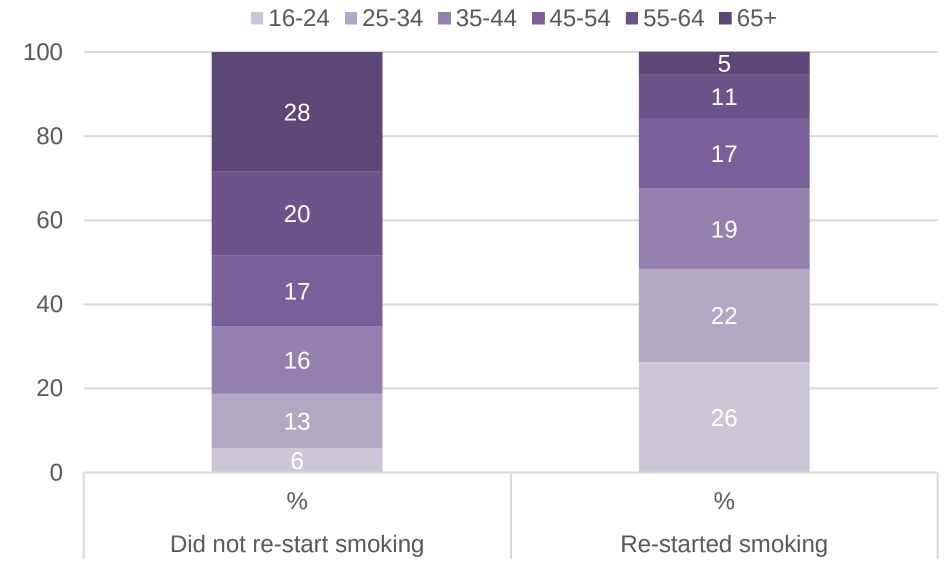
None of the health variables tested were significantly related to take up of smoking.

7.1.5 Profile of adult re-starters

This section looks at individuals who had previously smoked but were not a current smoker at Wave 2. It looks at the demographic, socioeconomic and health characteristics related to taking up smoking again at Wave 5. For brevity, this group are referred to as re-starters.

Re-starting was significantly related to age, with young people being more likely to again take up smoking. More than one-quarter (26%) of re-starters were aged 16–24 years, compared to 6% of those who remained non-smokers coming from this age group. Conversely, 5% of re-starters were aged 65 and above, relative to 28% of those who did not take up smoking again. This is shown in Figure 7:13.

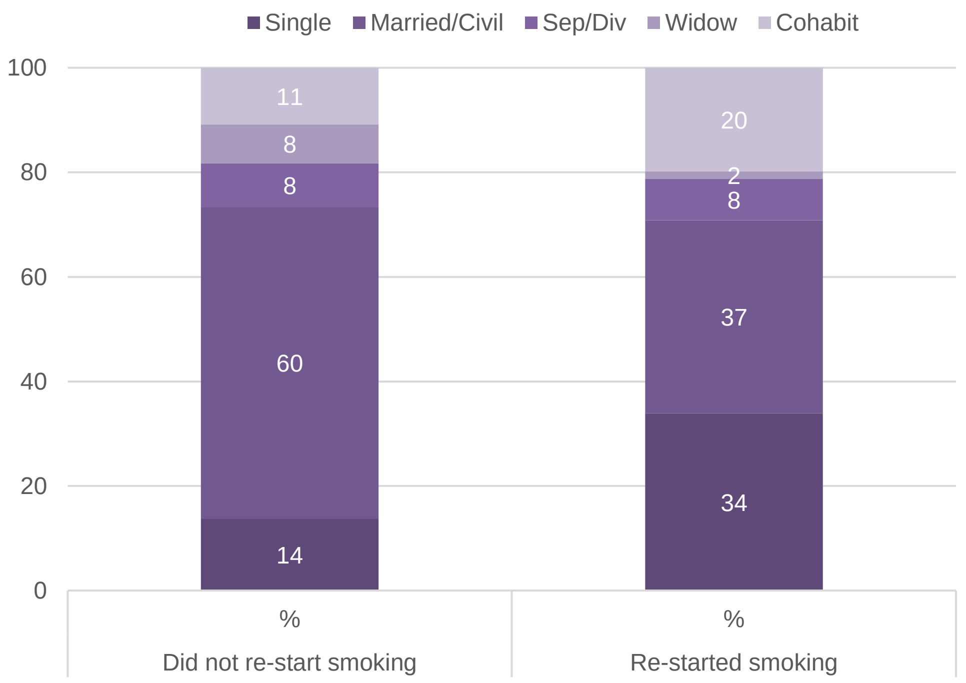
Figure 7:13 Proportion of people who re-start smoking by age



Base: All adults aged 16 and above

Respondents who were single were also significantly more likely to again take up smoking. Among re-starters, around one in three (34%) were single; by comparison, 14% of those who did not take up smoking again were single. Additionally, of people who re-started, 37% were married or in a civil partnership compared to 60% of those who did not. This is shown in Figure 7:14.

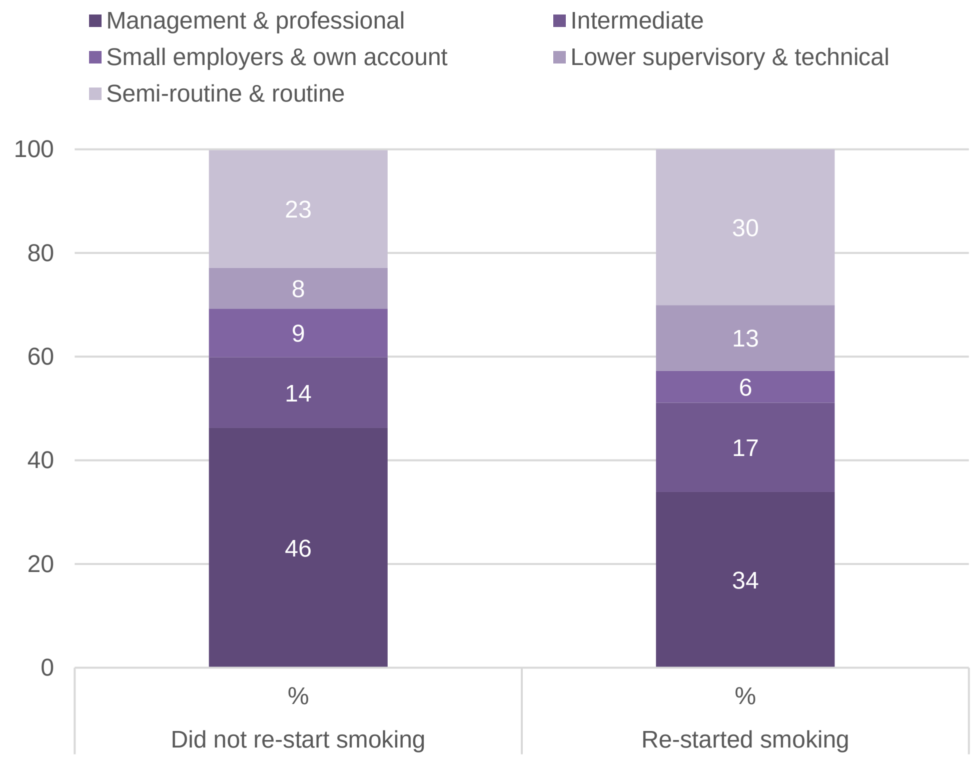
Figure 7:14 Proportion of respondents taking up smoking by marital status



Base: All adults aged 16 and above

There was no significant difference in rates of employment for those who did and did not take up smoking again. However, of those who were in work, their socioeconomic class was linked to the likelihood of again taking up smoking. Respondents in a professional or managerial occupation were significantly less likely to re-start. One-third (34%) of re-starters were in professional and managerial occupations compared to 46% of respondents who were not re-starters. This is shown in Figure 7:15.

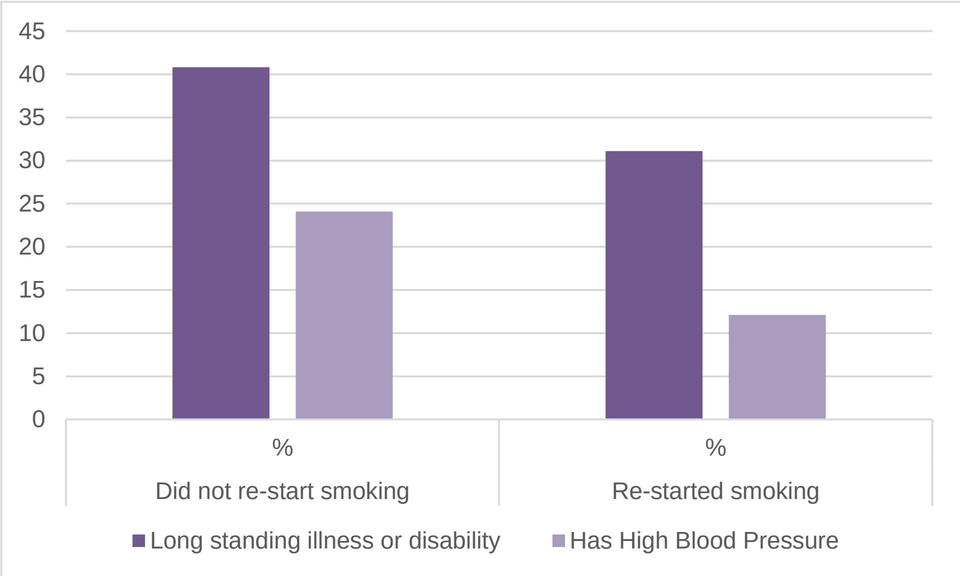
Figure 7:15 Proportion of respondents taking up smoking by socioeconomic classification



Base: All adults in work aged 16 and above

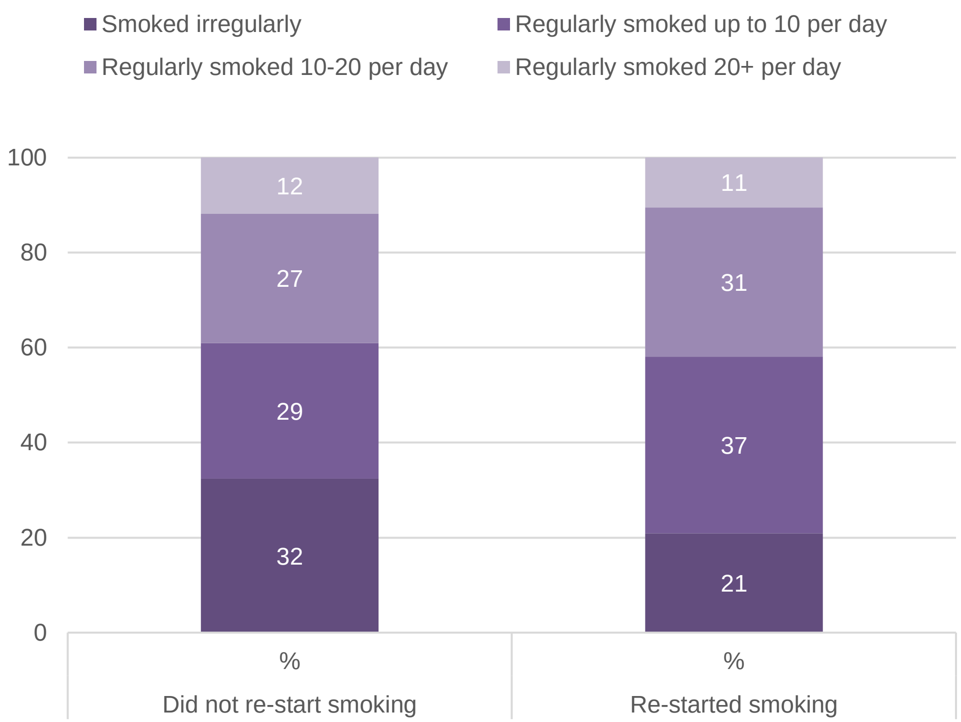
Having a pre-existing health condition was linked to a lower likelihood of re-starting smoking. Around one in three (31%) of respondents who took up smoking again had a longstanding illness or disability compared to 41% of respondents who did not take up smoking having a longstanding illness or disability. Similarly, respondents with high blood pressure at Wave 2 were significantly less likely to again take up smoking; 12% of re-starters had high blood pressure at Wave 2 relative to 24% who did not take up smoking again. These are shown in Figure 7:16.

Figure 7:16 Proportion of respondents taking up smoking by long standing illness and high blood pressure



The regularity of previous smoking behaviour was also associated with the likelihood of re-starting smoking. People who used to smoke regularly were significantly more likely to take up smoking again compared to those who did not. Around one in five (21%) of re-starters had previously smoked irregularly, compared to nearly one-third (32%) of those who did not re-start. However, being a heavy smoker did not appear to be related to an increased likelihood of re-starting; 11% of re-starters had regularly smoked more than 20 per day, compared to 12% of those who did not re-start. This is shown in Figure 7:17.

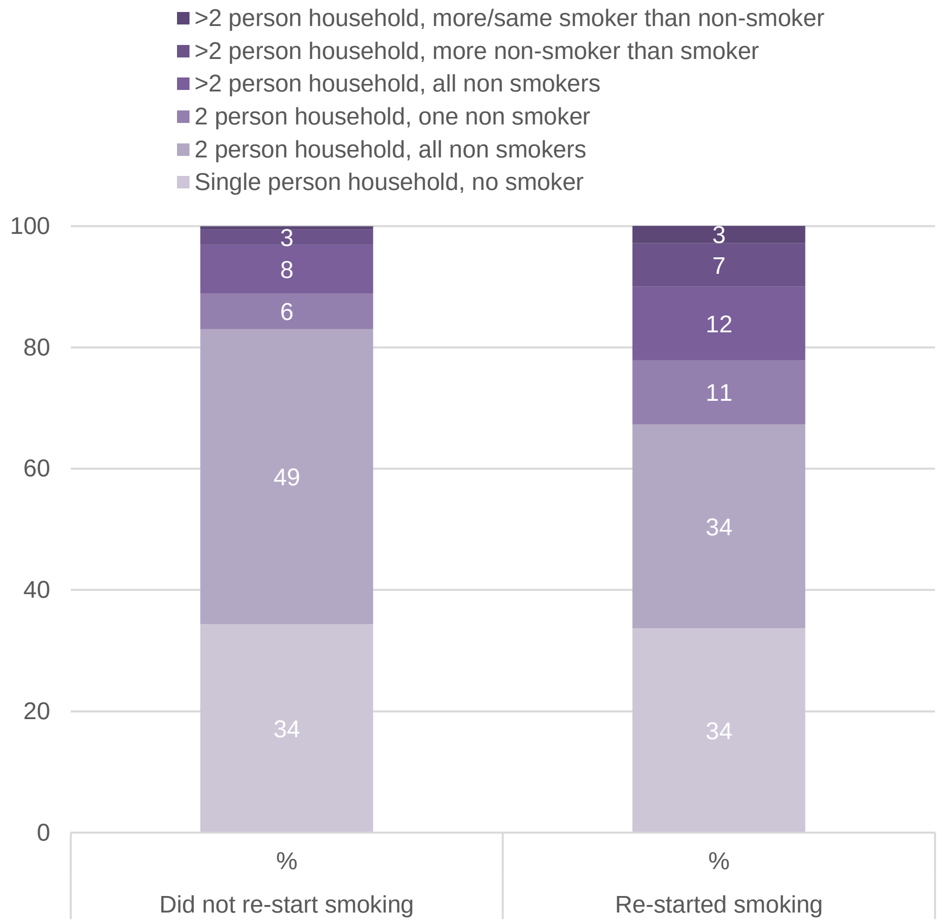
Figure 7:17 Proportion of respondents taking up smoking by previous smoking behaviour



Base: All adults aged 16 and above

Lastly, living in a household with non-smokers was linked to a lower likelihood of taking up smoking again; 21% of re-starters were living in a household where there was at least one smoker (i.e., not the respondent) at Wave 2, compared to 9% of individuals who had not taken up smoking again coming from this household type. The difference was particularly large when looking at households with two adults; around one-third (34%) of people who took up smoking again at Wave 5 had been living in a two adult non-smoking household at Wave 2, compared to nearly a half (49%) of those who remained non-smokers. This is shown in Figure 7:18.

Figure 7:18 Proportion of respondents taking up smoking by household smoking status



Base: All adults aged 16 and above

7.1.6 Multivariate analysis of re-starters

Regression analysis was again used to further explore the factors related to take up of smoking at Wave 5 by individuals who had previously smoked but were not a current smoker at Wave 2. See Appendix table D:6 for the regression output.

Previous smoking behaviour (i.e., prior to Wave 2) was found to be strongly related to the likelihood of an individual taking up smoking again. Unlike the bivariate analysis, the heaviness of smoking became significantly related to re-starting once other socio-demographic characteristics had been controlled for. The model indicates that an individual who had been a regular smoker, and a heavier smoker, was more likely to re-start. In line with the bivariate analysis, the model also suggests that the regularity of the previous habit is a bigger risk factor than the heaviness of the smoking.

The smoking behaviour of other household members also had a significant association on again taking up smoking. Living with other smokers had a big impact on the likelihood of re-starting. There is also a relationship between household size and re-starting. Individuals in larger households (with more than two adults) were more likely to re-start. Within this group, individuals in larger households where there were more smokers than non-smokers (or individuals in households with more than two adults where there was an even number of smokers and non-smokers) were most likely to take up smoking (two and a half times more likely than those in single person households). However, individuals in larger households where there were more non-smokers than smokers were still more likely to re-start than those in single households (twice as likely as those in single households). While this suggests that being around any smokers in a larger household encourages re-starting, the impact is larger if the number of smokers in the household is equal to or greater than the number of non-smokers. The lowest rates of re-starting were found among two-adult households where neither individual smoked at Wave 2.

There were a number of health factors that were related to re-starting. Individuals were twice as likely to re-start if they had an existing diagnosis of clinical depression at Wave 2 but three and a half times less likely to re-start if they had an existing diagnosis of cancer at Wave 2. Having a heart condition newly diagnosed in the period between Waves 2 and 5 was strongly associated with a lower likelihood of re-starting. General health and poor wellbeing (as measured by GHQ and SF-12) were not significantly related to re-starting, neither was an interaction of limiting long-term illness and poor mental health / clinical depression.

A number of socio-demographic characteristics were also significant. Women were significantly less likely to re-start than men.[xxxii] Individuals from non-white ethnic backgrounds were more likely to re-start than individuals from a white ethnic background; this was the case for black, Asian, and mixed-race groups. Individuals who were single were more likely to re-start than individuals who were married, although rates for separated / divorced individuals were also higher. Finally, qualifications were significantly related to re-starting; individuals without formal qualifications were more than twice as likely to re-start as individuals with a degree.

7.1.7 Summary of changes in adult smoking behaviour

The analysis shows how the household context is an important factor in quitting and take up of cigarette smoking; the presence of other smokers and non-smokers are strongly associated with changes in an individual's behaviour. This is seen in the descriptive analysis, but the association remains strong in the multivariate analysis when different individual and household characteristics are controlled for.

Individuals were more likely to smoke (in that they were less likely to quit, more likely to take up smoking, and more likely to resume smoking having previously quit) if they were not in work, worked in lower socioeconomic occupations, and had lower qualification levels.

Previous smoking behaviour was strongly linked to the individual's current behaviour. Heavy smokers were less likely to quit, individuals who had previously smoked irregularly were less likely to resume smoking.

The health of the respondent was also a factor. Existing health conditions, particularly clinical depression, and new health diagnoses were significantly related to re-starting and quitting. However, general measures of poor wellbeing, such as GHQ or SF-12 were not significantly related to quitting or re-starting once other characteristics had been controlled for. Interactions between clinical depression and physical poor health (having a limiting long-term illness) were also not significant.

[xxxii] This is possibly linked to their reasons for initially giving up, but it is not possible to confirm this using the available data. It is possible that women who gave up smoking due to pregnancy would be less likely to take up smoking again while the children were still small. The following were tested in the model: number of children, age of youngest child, and whether individual was a parent, and none were found to be significant.

7.1.8 Limitations

One of the limitations of the analysis using USoc data Waves 2 and 5, is not knowing exactly when people took up regular smoking, especially for those smoking at Wave 2 but also for those who started smoking between Wave 2 and 5. While the dataset does provide a variable which shows ‘age at which respondent smoked their first cigarette’, we are unable to conclude whether that is when they **regularly** started smoking. This makes it difficult to determine whether smoking policies introduced during that time may have influenced the change in behaviour.

7.2 Smoking behaviour of children

This section presents trends in smoking among children aged 10–15 years and aims to identify the child, family and household characteristics related to smoking among this age group. It investigates the link between parent and child smoking.

The analysis used longitudinal data from USoc. The main source of data was the youth self-completion questionnaire, which is given to all children in the household aged 10–15 years. This includes a question on smoking behaviour (‘Do you ever smoke cigarettes at all?’), which is asked in every wave of USoc[xxxiii]. Some additional information about the household, taken from the household questionnaire, and about the parents, taken from the individual main and self-completion questionnaires, was matched to this data.

7.2.1 Trends in smoking among children

The proportion of children aged 10–15 years who reported smoking at each wave of USoc is shown in Table 7:2. Despite some fluctuations between waves, with higher rates in Waves 2 and 3, and a low rate of reported smoking in Wave 7, the overall picture is generally stable, with some indication of a slight overall decline.

Table 7:2 Proportion of children aged 10–15 years who say they smoke

All children aged 10–15 years who complete a Youth Questionnaire		*USoc*
	Proportion who smoke	*Unweighted base*
Wave 1	7%	*4864*
Wave 2	10%	*4945*
Wave 3	10%	*4391*
Wave 4	7%	*4016*
Wave 5	7%	*3627*
Wave 6	7%	*3436*
Wave 7	4%	*3605*
Wave 8	6%	*3233*

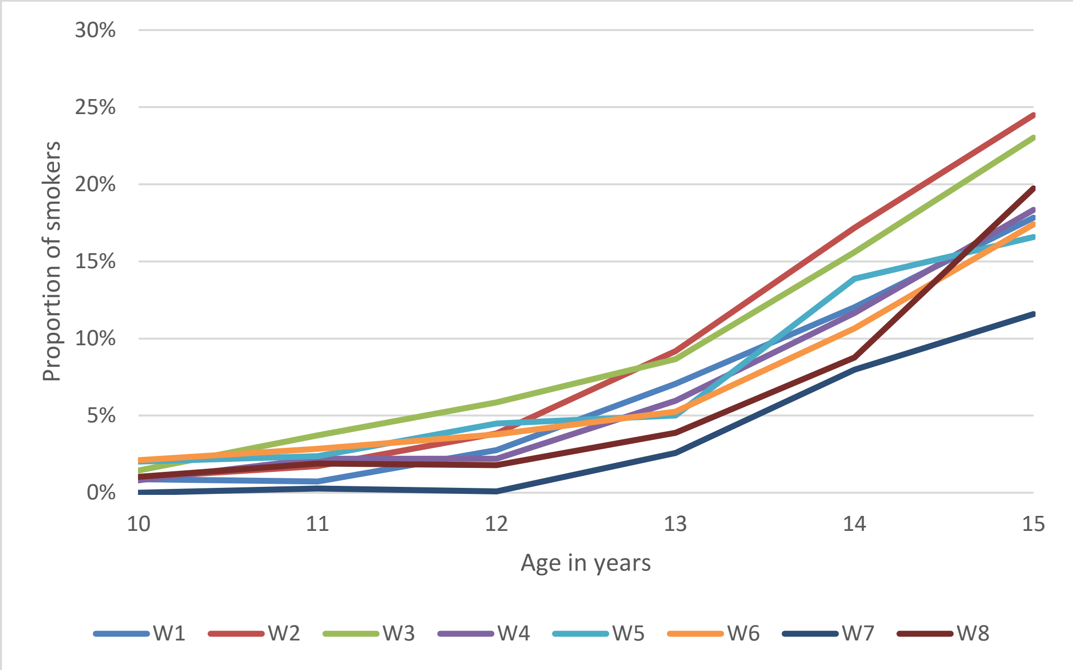
The proportion of children who reported that they currently smoked, by age and wave is shown in Figure 7:19 below. It can be seen, that at each wave smoking increases by age.

There are some differences in the rates of smoking by wave, in particular, there is a drop in reported smoking at all ages in Wave 7. The rates of smoking at Wave 8 are

[xxxiii] The variable name is **x_ypevrsmo**

similar to the rates for Wave 7 for ages 10–14, however, they then show a sharper increase at age 15.

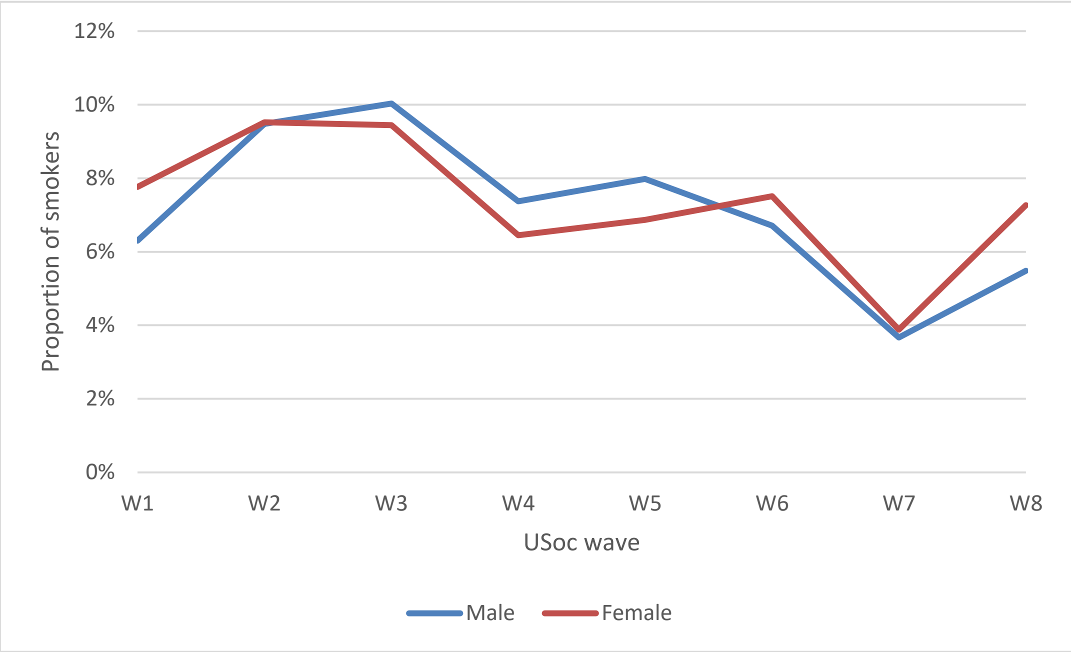
Figure 7:19 Smoking rates for children, by age and wave



The higher rates among children aged 15 at Wave 8 mean that the overall proportion of children aged 10–15 years who smoke at Wave 8 is very similar to that of earlier waves, as seen above in Table 7:2.

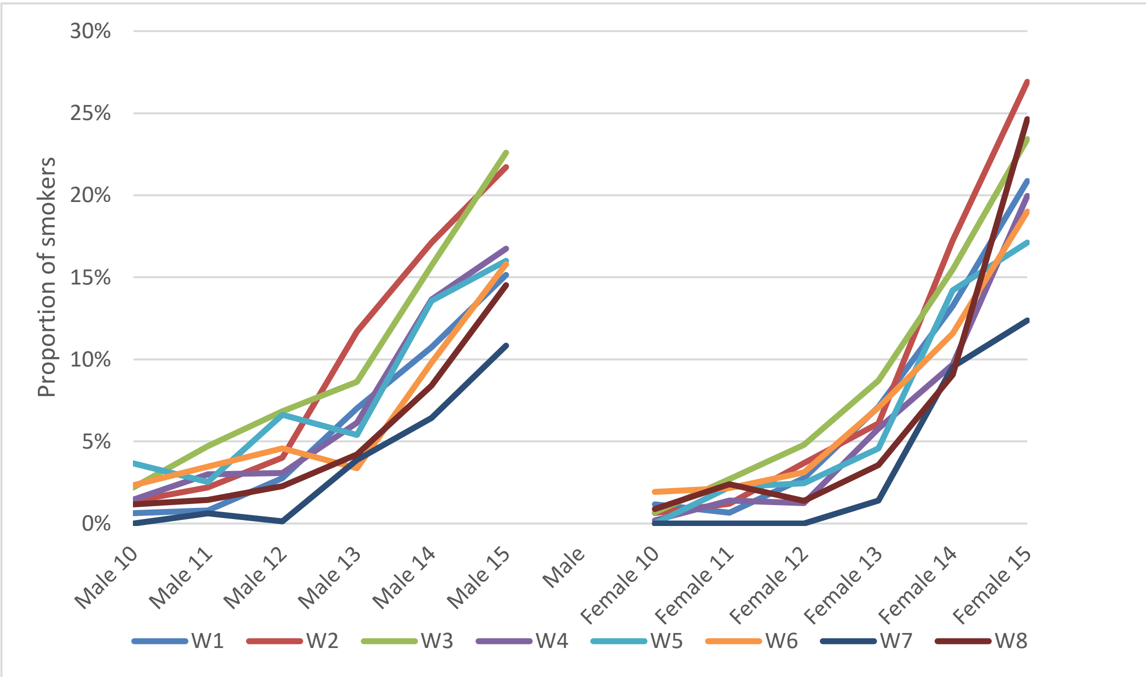
Figure 7:20 shows rates of smoking for boys aged 10–15 years and girls aged 10–15 years by wave. The difference between overall smoking rates by gender appears to be small.

Figure 7:20 Smoking rates for children aged 10–15 years, by gender and wave



However, Figure 7:21 shows there are differences in the age at which children start smoking by gender; girls have lower rates at ages 10–13 years but overtake boys to have higher rates of smoking at older ages.

Figure 7:21 Smoking rates for children, by age, gender and wave



7.2.2 Longitudinal analysis of smoking among children

The longitudinal nature of USoc meant it was possible to look at the smoking behaviour of individual children over time.

For many of the responding children, their smoking behaviour was not 'sustained'; i.e., once they had reported smoking at Wave *t*, they did not continue to report this at the following wave (Wave *t*+1). Despite the question asking whether the child had **ever** smoked, the responses shown in Table 7:3 suggest some children responded to the question as 'currently smoke', since there is a small proportion at each wave who said they had never smoked, despite having reported being a smoker at the previous wave.

Table 7:3 below shows, for paired waves, the proportion of children aged 10–15 years who did not smoke at both waves, the proportion who did not smoke at Wave *t*, but went on to smoke at wave *t*+1, the proportion of children who did the reverse, and the proportion who smoked at both waves. The final column shows the proportion of smokers who continued to smoke at wave *t*+1. This rate fluctuates, but roughly, around two-thirds of the children who said they smoked at the preceding wave continued to smoke at the following wave.

Table 7:3 Proportion of children aged 10–15 years who smoke over time

All children aged 10–15 years who complete a Youth Questionnaire — *USoc*

Paired waves	Not smoke *t* and *t*+1	Not smoke *t*, smoke *t*+1	Smoke *t*, not *t*+1	Smoke *t* and *t*+1	Total	*Unweighted base*	% of the smokers at *t* who were smoking at *t*+1
Wave 1 and Wave 2	88%	8%	2%	3%	100%	*2738*	67%
Wave 2 and Wave 3	88%	6%	2%	5%	100%	*3009*	74%
Wave 3 and Wave 4	90%	4%	2%	4%	100%	*2758*	61%
Wave 4 and Wave 5	91%	5%	1%	3%	100%	*2579*	66%
Wave 5 and Wave 6	90%	5%	2%	3%	100%	*2150*	59%
Wave 6 and Wave 7	92%	3%	3%	2%	100%	*2186*	40%
Wave 7 and Wave 8	92%	5%	1%	2%	100%	*2150*	78%

Data restructure for longitudinal analysis of children

The aim of this analysis was to look at longitudinal patterns in smoking behaviour for children between the ages of 10 and 15 years. The youth self-completion survey includes questions on whether or not the child had smoked at every wave. However, owing to the modular nature of the questionnaire, the covariates that were of specific interest to this analysis were only collected every other wave (Waves 1, 3, 5, and 7). In addition, the number of young people who smoked at each age was low, meaning sample sizes for smoking per age, per wave, were low. This meant it was not practical to analyse the data by wave.

Instead, the data were restructured and age groups combined to give three tranches of data for analysis; the first tranche contained children aged 10–11 years, the second contained children aged 12–13 years, and the third contained children aged 14–15 years. Each tranche combined children from more than one wave. Tranche 1 contained children aged 10–11 years in Wave 1 and 3, Tranche 2 included children aged 12–13 from Wave 3 and 5, and Tranche 3 incorporates those aged 14–15 from Wave 5 and 7. The data therefore contains two cohorts of children who were aged 10–11 at either

Wave 1 or 3, and who have been followed up at least every other year since. These two cohorts are shown in Table 7:4.

Table 7:4	Data restructure for longitudinal analysis of children; creation of tranches from waves of USoc			
	Wave of USoc			
	Wave 1	**Wave 3**	**Wave 5**	**Wave 7**
Child's age at wave	**10**	**12**	**14**	
	11	**13**	**15**	
		10	**12**	**14**
		11	**13**	**15**
Key: Tranche 1 of analysis data set, Tranche 2, Tranche 3				

This restructure was a trade-off between having key bits of information missing for 'even' waves (wave 2, 4, 6, etc.) and having small numbers of smokers available for analysis by year. The number of smokers per tranche in the restructured data are shown in Table 7:5.

Table 7:5	Smoking rates by tranche			
All children in the restructured data who complete a Youth Questionnaire				*USoc*
	Tranche 1	**Tranche 2**	**Tranche 3**	
Age group	10–11	12–13	14–15	*Unweighted base*
Waves covered	Wave 1 and Wave 3	Wave 3 and Wave 5	Wave 5 and Wave 7	
Boys	2.3%	7.0%	10.6%	*619*
Girls	1.5%	4.3%	13.1%	*645*
All	1.9%	5.6%	11.9%	*1264*

This data set has been used for all subsequent analysis presented in this section.

7.2.3 Factors related to smoking among children

This section presents factors related to smoking behaviour among children aged 10–15 years. The demographic, socioeconomic, household and health characteristics related to smoking were explored for boys and girls separately, given there was evidence that smoking rates differed by gender (see Figure 7:20 above). The characteristics that had a statistically significant relationship with smoking among children aged 10–15 are summarised in Table 7:6.

Table 7:6 Characteristics related to smoking among children aged 10–15 years		
Base: All children aged 10–15 years who complete a Youth Questionnaire	*USoc*	
	Girls	**Boys**
Ethnicity		
Religion		
Region		
Urban / rural		**
Tenure	**	***
Number of cars in household	*	*
Number of unemployed people in household		
Age of youngest child in household		
Household income		
Household type		
How many times in last 7 days has child eaten an evening meal with family	**	
Child always feels supported by their family	***	**
How often the child talks to their father about things that matter	***	*
How often the child talks to their mother about things that matter		
Child expresses negative feelings about their family	***	***
Child sees the importance of doing well in GCSEs or standard grades	**	***
Child feels their parents are always interested in how they do at school	***	**
How often child bullies other children (not physically)	***	***
How often child is physically bullied at school		**
Frequency of eating fast food: number of days in a normal week		
Child uses social media / website	**	***
Child has friends that drink regularly	***	***
Child drinks alcohol regularly	***	**
Child’s SDQ peer relationship problems score	*	
Child’s SDQ prosocial score		***
Child’s SDQ total difficulties score	***	***
Mum - Ever smoked cigarettes	***	***
Mum – Currently smoke cigarettes	***	***
Mum - Current job - grouped NS SEC		*
Mum - Highest qualification		
Dad - Ever smoked cigarettes	***	***
Dad - Currently smoke cigarettes	***	***
Dad - Current job - grouped NS SEC	***	
Dad - Highest qualification	***	

*** p-values <0.01, ** p-value <0.05, * p-value <0.1

The above table summarises the results from a series of random effects models that were applied to test the strength of the bivariate relationship between each characteristic and whether a child reported smoking, taking the age of the child into account. The results indicate whether a statistically significant relationship exists between each characteristic and smoking.

Additional models were used to test whether there was an interaction between each characteristic and age, to identify whether the relationship between the characteristic and smoking altered as the child aged. The results indicated that this was not the case for any of the characteristics. While the relationship between some characteristics may weaken or strengthen slightly with age, they do not alter significantly, and specifically, the direction of the relationship does not change.

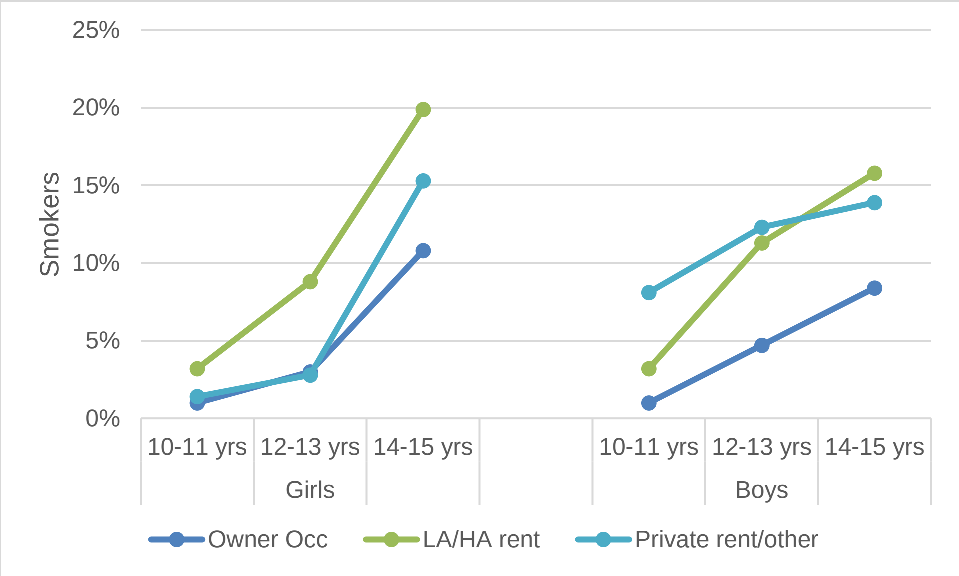
While there were a number of common themes, there were also some differences in the characteristics related to smoking among boys and girls. For example, living in an urban area was significantly associated with smoking among boys but not girls, whereas talking to their father about things that matter was significantly associated with smoking among girls but not boys. The nature of the relationship between the different characteristics and smoking are explored in more detail below.

Household and family characteristics

The following family characteristics were significantly associated ($p<0.05$) with smoking among both boys and girls aged 10–15 years: whether the child expresses negative feelings about their family; whether the child always feels supported by their family; whether the parent is always interested in how the child does at school; and whether the child recognises the importance of doing well in GCSEs or standard grades. For both boys and girls, the child was more likely to smoke if they reported negative relationships, if they felt their family was unsupportive or disinterested, or if they did not see a value in gaining qualifications (all tables can be found in Appendix D). This indicates that weak or unsupportive relationships in the home have an impact on smoking among children.

Tenure was also significantly associated with smoking. Children in owner occupied accommodation were less likely to smoke. Girls living in local authority (LA) or housing association (HA) accommodation were particularly likely to smoke. This is shown in Figure 7:22. It is likely that tenure is acting in part as a proxy for social class. Type of area was significantly related to smoking for boys, with boys living in rural areas more likely to smoke than boys living in urban areas.

Figure 7:22 Smoking rates for children, by age, gender and tenure



Parent characteristics

Parent characteristics were also important. Children aged 10–15 were more likely to smoke if either their mother or father currently smoked. Children were also more likely to smoke if either parent had smoked in the past, even if they were not a current smoker. This is shown in Figures 7:23 and 7:24. The impact of changes in the mother's smoking behaviour on the child is explored in detail in Section 7.2.4.

Figure 7:23 Smoking rates for children, by age, gender and mother's smoking

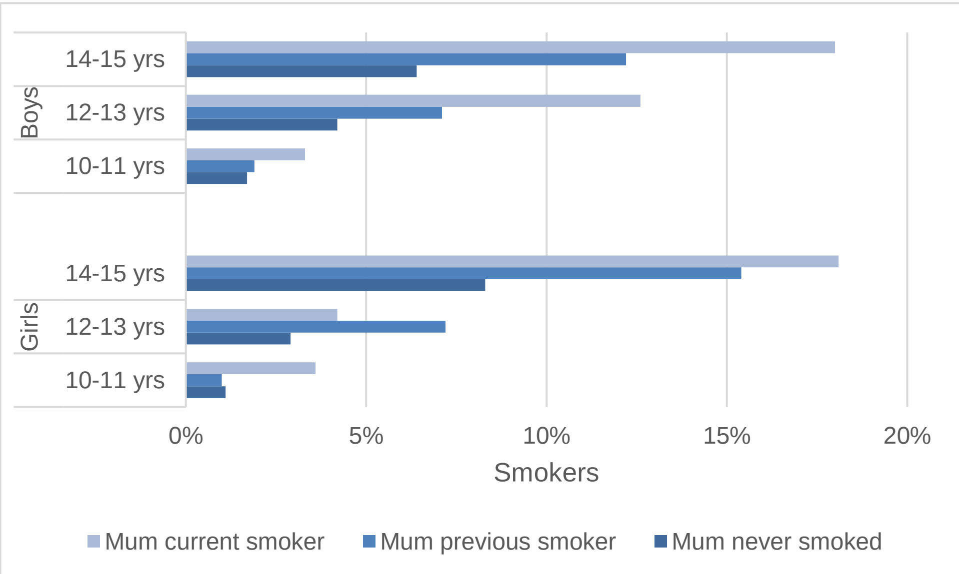
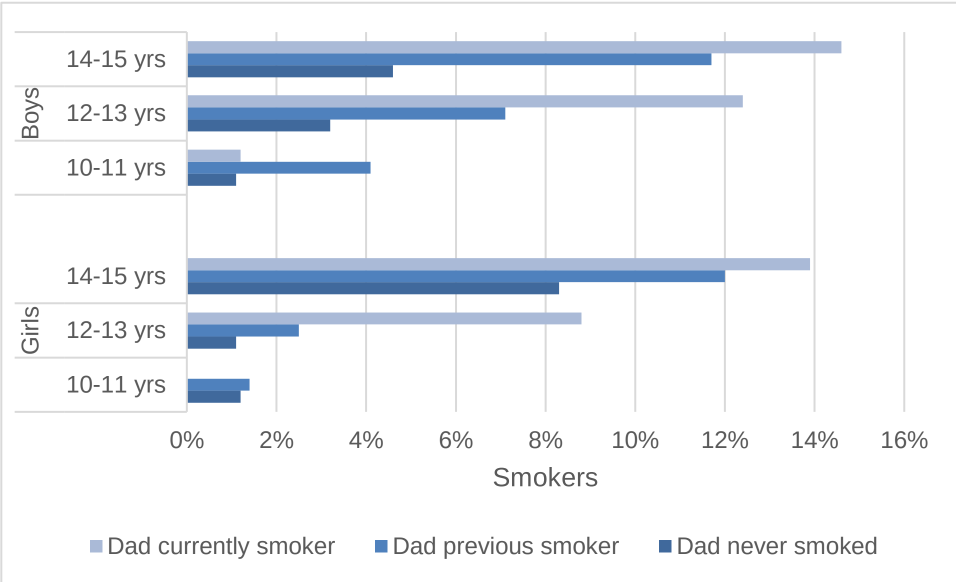
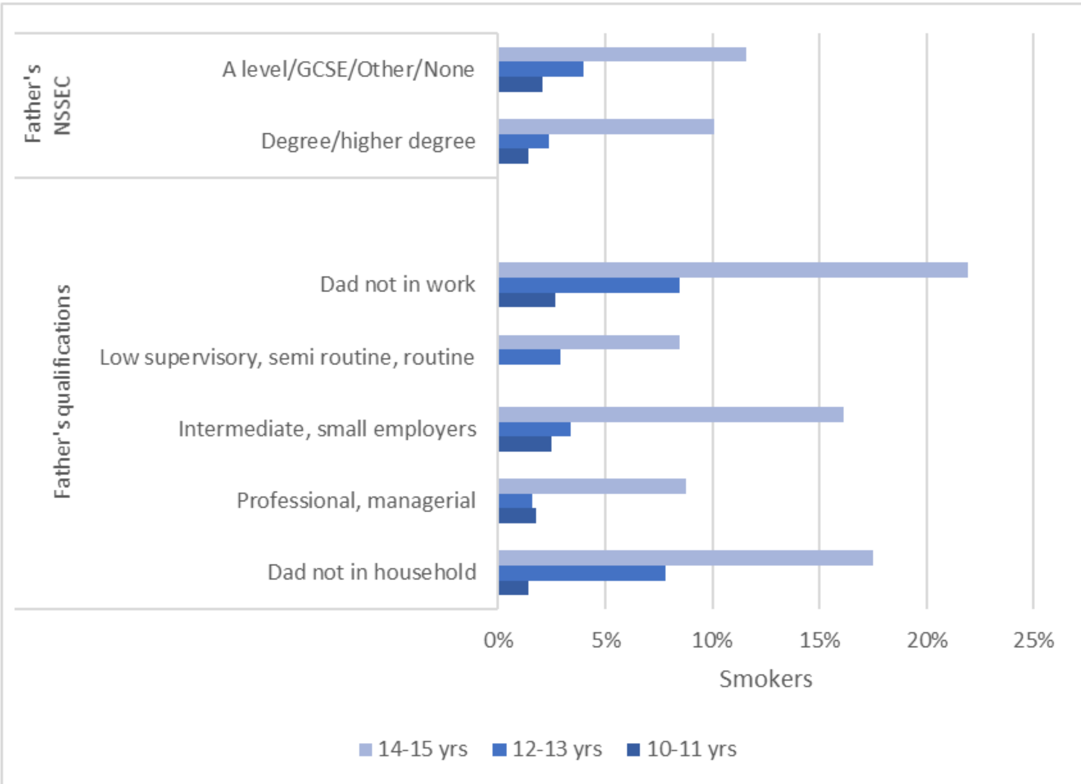


Figure 7:24 Smoking rates for children, by age, gender and father's smoking



For girls, the presence of the father in the household, his characteristics, and her relationship with him, were significantly linked to smoking. Girls were more likely to smoke if their father was not present in the household. Where the father was present, girls were more likely to smoke if they hardly ever spoke to their father about things that mattered to them (even more likely than if they had no father present in the household). Girls were also more likely to smoke if their father had no formal qualifications or if their father did not work or was in a routine or lower supervisory role. This is shown in Figure 7:25.

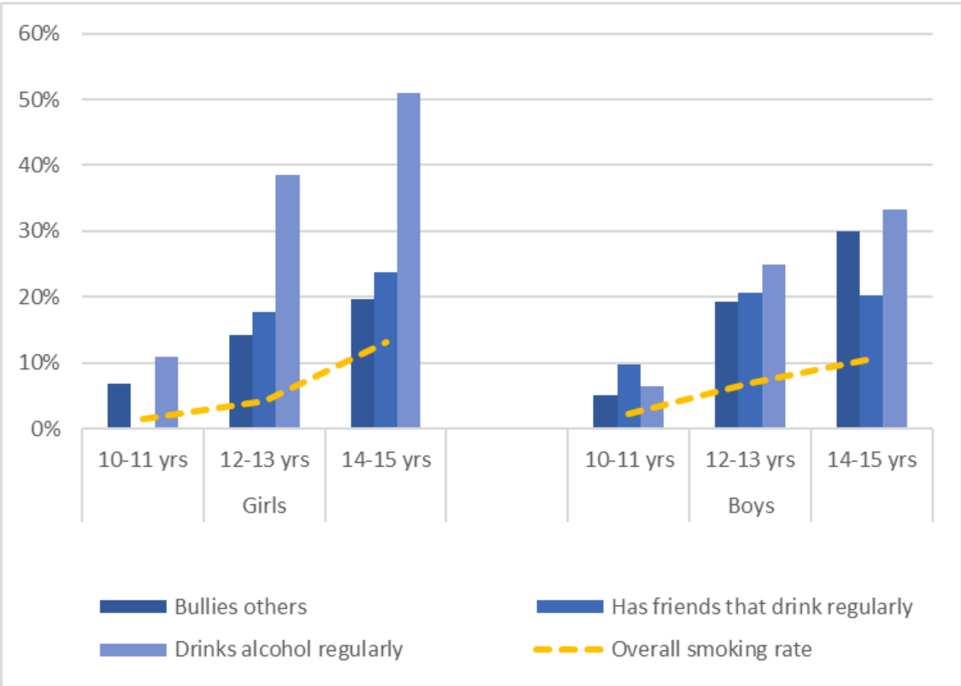
Figure 7:25 Smoking rates for girls, by age and father's characteristics



Child characteristics

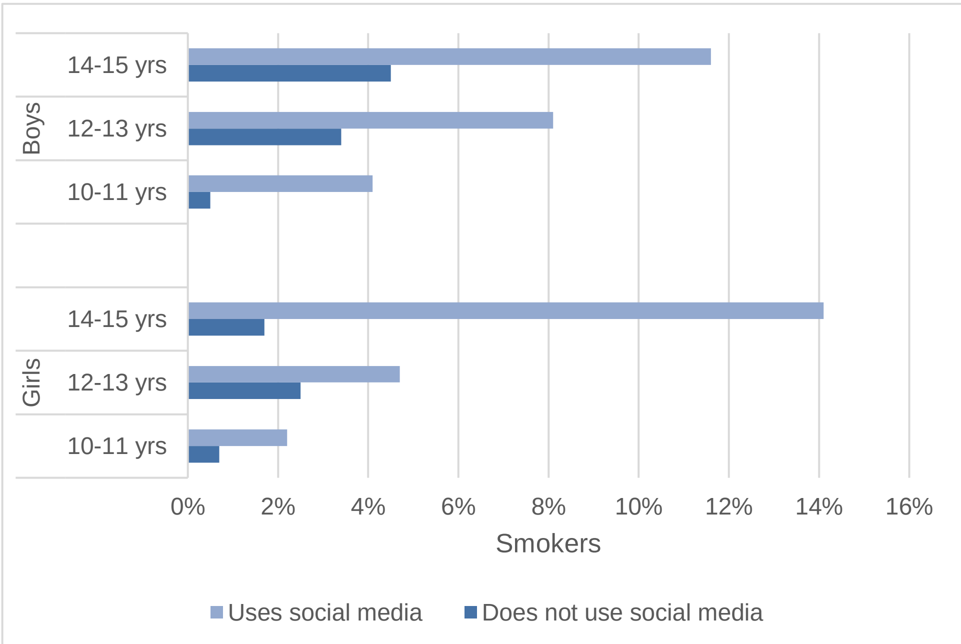
A number of other child behaviours were associated with being significantly more likely to smoke. Children who admitted they bullied other children (not physically) were more likely to smoke, as were children who said they regularly drank alcohol or had friends who regularly drank alcohol (Figure 7:26).

Figure 7:26 Smoking rates for children, by age, gender and negative behaviours



Boys who said they had been physically bullied were more likely to smoke, however, being bullied was not significantly related to smoking among girls. Children who use social media websites were more likely to report smoking. This is shown in Figure 7:27.

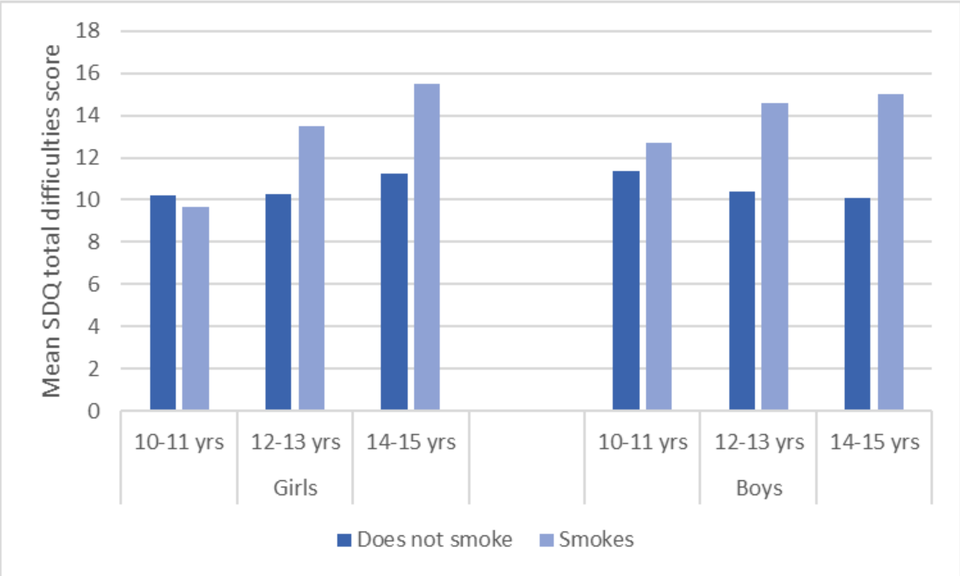
Figure 7:27 Smoking rates for children, by age, gender and social media use



Finally, for both genders, the total difficulties score from the Strengths and Difficulties Questionnaire (SDQ)[xxxiv] was related to smoking. Higher scores, which indicate a child more likely to be struggling with their behaviour and mental wellbeing, were linked to a higher likelihood of smoking.

For boys, the prosocial component of the SDQ was significantly related to smoking; boys with lower scores were more likely to smoke. Children with low scores are, for example, less likely to say they are considerate towards others, less likely to say they will help others who are hurt, and less likely to say they will be kind to younger children (see Figure 7:28).

Figure 7:28 SDQ score for children, by age, gender and smoking



7.2.4 Multivariate longitudinal analysis of smoking among children

Random effects regression models were used to investigate how different child and household factors relate to the likelihood of a child smoking cigarettes, and how these relationships change over time.

Girls and boys were modelled separately as the descriptive analysis strongly suggested different characteristics were related to smoking by gender. The models tested a range of household, family and child characteristics. However, only the characteristics significantly related to smoking were retained in the final model. The findings are described below, the model output is included in Appendix D at Appendix tables D:11 and D:12.

Factors related to smoking among girls aged 10–15 years

Age was very strongly related to smoking, with girls aged 15 years more than six times more likely to smoke than girls aged 10.

xxxiv Strengths and Difficulties Questionnaire https://www.sdqinfo.com/a0.html contains a set of questions that measure prosocial behaviour.

Family relationships were important. Girls who expressed negative feelings[xxxv] about their family were more likely to smoke. A girl's relationship with her father, and the absence of her father, were also significantly related to smoking behaviour. Girls who spoke to their father about things that matter on most days, or more than once a week, were significantly less likely to smoke than girls whose father was not present. There were no significant differences in smoking rates for those girls who hardly ever spoke to their father about things that matter, girls who spoke less than once a month, and girls whose father was not present, indicating that it is not the presence of the father in the household that is related to smoking rates, but the quality of the relationship between the girl and her father. The relationship between the girl and her mother was not significantly related to smoking.

In addition, the father's highest qualification was significantly related to smoking. Girls whose father had no formal qualifications were three times more likely to smoke than girls whose father had a degree or higher degree. The mother's education was not significantly related to smoking among girls. It is possible that the father's qualifications were acting (at least in part) as a proxy for the father's social economic status. The father's socioeconomic class was significantly related to girls smoking in the descriptive analysis (see above at Figure 7:25). However, it did not remain significant when entered into the model. Fathers' education, which is correlated with fathers' socioeconomic class, was a better predictor of girls smoking and was included in the model.

While the mother's characteristics were not significantly related to the likelihood of a girl smoking, mothers' smoking was significantly related to smoking among girls. Girls whose mothers were current smokers were more likely to smoke themselves (1.8 times more likely than daughters of mothers who did not smoke). The absence of a mother in the household was also significantly related to higher rates of smoking. However, the smoking status of fathers was not related to girls smoking. This indicates that it is the wider relationship between girls and their fathers that impacts on smoking among girls, rather than this specific behaviour of the father.

Finally, a number of other negative behaviours were significantly associated with smoking; girls were more likely to smoke if they admitted to bullying others (not physically), if they had friends who drank alcohol regularly, and if they drank alcohol regularly themselves. Girls who carried out any of these activities themselves were also more likely to smoke.

Smoking behaviour of boys aged 10–15 years

There is some overlap in the findings for boys, indicating there are some common themes. A relationship between smoking and age also exists for boys, with use generally higher among older children, although this relationship is less clear cut.[xxxvi] Admitting to bullying others and having friends who regularly drank alcohol were significantly related to smoking for boys as well as girls.

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xxxv This question is part of a section asking children to rate their feelings towards different aspects of their lives, where 1 is completely happy and 7 is not at all happy. The question relating to family was recoded to a binary variable where all responses from 3-7 were used to identify children with negative views about their family.

xxxvi The relationship between age and smoking was far stronger for girls than boys. There was a smaller difference in the smoking rates of 15-year old boys and 10-year old boys, compared to that for girls. The smoking rate of 15-year old girls was 15 times higher than that for 10-year old girls (15.4% v 1.0%), whereas the smoking rate for 15-year old boys was around 6 times higher than that for 10-year old boys (11.3% v 2.0%). The relationship between age and smoking for girls was still very much in evidence in the regression model; it remained even when controlling for other factors. In contrast, the relationship for boys was less clear-cut when modelled.

Unlike girls, the characteristics of the local area were significantly related to smoking. Boys in rural areas were twice as likely to smoke as boys in urban areas. A further difference was that use of social media was significantly related to smoking for boys, whereas it was not significant for girls. Boys who used social media websites were nearly six times more likely to smoke than boys who did not.

The prosocial behaviour of boys was significantly related to smoking, whereas it was not for girls. Boys with lower prosocial SDQ scores were more likely to report smoking. These characteristics, viewed in addition to the relationships between bullying and higher rates of smoking and between having friends who regularly drink and higher rates of smoking, suggest that smoking among boys is linked to poorer social skills.

For girls, the highest qualifications of the father were significantly associated with smoking. As we have discussed, this variable may be acting as a proxy for the socioeconomic status of the household. However, when this was included in the model for smoking among boys, there was no significant impact on smoking / non-smoking behaviours. No social class / income indicators were retained in the model.

However, the presence and behaviour of the father was related to smoking among boys, albeit in a different way to girls. The father's mental health was significantly related to smoking among boys. Boys whose fathers had very poor mental health were five times more likely to smoke than boys whose fathers had above average mental health. Boys whose fathers had poor mental health were also more likely to smoke than boys whose fathers was absent. The mental health of mothers was not significant.

Finally, boys whose fathers currently smoked were more likely to smoke than boys whose fathers did not smoke. The smoking behaviour of mothers was not significant and none of the mothers' characteristics included in the model were found to be significant for boys. This included the mother's qualifications, the mother's job status, the mother's health and mental wellbeing, presence of the mother, how often the child talked to their mother about things that matter to them, or the mother's smoking behaviour.

7.2.5 Longitudinal analysis of parent and child smoking

The analysis of smoking behaviour among adults, presented in Section 7.1, was based on detailed smoking modules carried out in USoc Wave 2 and 5. Child smoking data for the same waves, taken from the self-completion youth questionnaire, was merged to the adult data to investigate the relationship between child smoking behaviour and changes in parental smoking.

Table 7:7 shows rates of smoking among children aged 10–15 years by their mother's smoking status at Waves 2 and 5. Children whose mothers never smoked were significantly less likely to smoke than children whose mothers smoked at both Wave 2 and 5. Children whose mothers quit smoking in that period were also less likely to smoke,[xxxvii] suggesting that the mother's quitting acts as a protective factor among children.

[xxxvii] Significant at 90% confidence, p=0.059.

Table 7:7	Relationship between changes in mother's smoking habits and child smoking			
Children aged 10–15 years who complete a Youth Questionnaire linked to adult data, Wave 2 and Wave 5				*USoc*
Mother's smoking behavior Wave 2–Wave 5	Child does not smoke Waves 2–5	Child smokes* between Wave 2 and Wave 5	Total	*Unweighted base*
Smoker at Wave 2, smoker at Wave 5	62%	38%	100%	*250*
Smoker at Wave 2, not smoker at Wave 5	76%	24%	100%	*68*
Not smoker at Wave 2, smoker at Wave 5	69%	31%	100%	*42*
Not smoker at Wave 2, not smoker at Wave 5	77%	23%	100%	*1251*
Total	74%	26%	100%	

*Child smokes at any wave between Wave 2 and Wave 5

Sample sizes were too small to look at the relationship between the child smoking and changes in the father's smoking habits. However, the analysis presented in Section 7.2.3 suggests children were more likely to smoke in households where the father smokes, hence it would be likely that changes in the father's smoking behaviour will also impact the child.

7.2.6 Summary of factors relating to smoking among children

- Smoking among children increased by age.
- There were differences by gender; boys were more likely to smoke at younger ages, but girls were more likely to smoke from the age of 13 upwards.
- There were a number of common themes across genders in the factors related to smoking; poor family relationships, parental smoking, and other negative behaviours, drinking and bullying, were related to a higher likelihood of smoking among both boys and girls.
- For boys, being bullied, having a lower SDQ prosocial score, and living in a rural area were related to a higher likelihood of smoking.
- For girls, the relationship between a girl and her father had an important impact on her likelihood of smoking. Girls with good relationships with their fathers, and whose fathers were better qualified or from a higher social class, were less likely to smoke.
- The relationship between smoking behaviour of the parent and the child's smoking differed based on gender. The model suggested the mother's smoking was more important for girls, whereas the father's smoking was more important for boys.

7.2.7 Limitations

The rate of smoking is (fortunately) low for children, meaning the analysis is based on relatively small sample sizes. In consequence, it may be that some of the more nuanced impacts of different household, family and child characteristics on smoking may not be identified in the descriptive analysis or modelling. The necessity of splitting the sample by gender further reduced the sample size available for analysis.

In addition, it was necessary to combine waves of data and take data from alternating years. However, information was still available for children in every year of age. While some age groups are drawn from different waves, this is unlikely to have an impact on findings. It is unlikely that the factors relating to smoking for children aged 14 years at Wave 5 would be different to the factors for children aged 14 years at Wave 6.

7.3 Take up and use of e-cigarettes

This section investigates the use of e-cigarettes among adults and children. For adults, it explores the relationship between cigarette and e-cigarette use, whether individuals are moving from cigarettes to e-cigarettes, and if dual use is a precursor to either using e-cigarettes only, or to giving up smoking altogether. In addition, it attempts to identify whether rates of quitting are higher for smokers only, dual users, or those who use e-cigarettes only. For children, the use of e-cigarettes and smoking are explored in tandem.

7.3.1 Use of e-cigarettes among adults

Information about e-cigarettes is collected from Wave 7 onwards of USoc. However, the question changed between Waves 7 and 8, resulting in the two waves not being directly comparable. The question used at Wave 8 onwards is: ‘Do you ever use electronic cigarettes (e-cigarettes)?’

The responses to this question are given in Table 7:8 below.

Table 7:8 Electronic cigarette use among adults (16+)

USoc, Wave 8 and Wave 9, Individuals aged 16+ years

	Wave 8	**Wave 9**
I have never used e-cigarettes	85.4%	83.8%
I have only tried using e-cigarettes once or twice	6.7%	7.3%
I used e-cigarettes regularly in the past, but never use them now	2.3%	2.7%
I sometimes use e-cigarettes but less than once a month	0.9%	1.0%
I use e-cigarettes at least once a month, but less than once a week	0.6%	0.5%
I use e-cigarettes at least once a week	4.1%	4.7%
Overall proportion of current users, both regular and infrequent	5.6%	6.2%
Total	100%	100%
Unweighted base	*32298*	*29214*

The figures show a small increase in e-cigarette use between Waves 8 and 9. Regular, weekly users increased from 4.1% to 4.7%, with all current users (including both regular and infrequent users) increasing from 5.6% to 6.2%.

The Wave 7 questionnaire included the same overarching question, but respondents were only asked for a yes / no response. Of these, 7.4% of adults aged 16 and over said they used e-cigarettes. While this is significantly higher than the overall proportion of users in Waves 8 and 9 (5.6% and 6.2%, respectively), this may be due to the wording of the question with respondents interpreting this as ‘ever used’. For this reason, the remainder of this chapter is based on analysis of Waves 8 and 9 only.

Cigarette smoking

The same smoking questions are asked in all waves of USoc: ‘Do you smoke cigarettes?’ The cross-sectional responses are given in Table 7:9. The figures show that the proportion of smokers drop between Waves 8 and 9.

Table 7:9 Cigarette smoking among adults (16+)		
USoc, Wave 8 and Wave 9, Individuals aged 16+ years		
Do you smoke cigarettes?	**Wave 8**	**Wave 9**
Yes	15.9%	14.8%
No	84.1%	85.2%
Total	100%	100%
Unweighted base	*32316*	*29245*

In addition, smokers were asked the usual number of cigarettes they smoke per day. While the number of smokers had decreased, the mean number of cigarettes smoked per day was fairly stable (Table 7:10).

Table 7:10 Average number of cigarettes smoked by adult smokers (16+)		
USoc, Wave 8 and Wave 9, Individuals aged 16+ years		
Usual number of cigarettes smoked per day	**Wave 8**	**Wave 9**
Mean	12.4	12.7
Unweighted base	*4576*	*3757*

Smoking and e-cigarettes

The responses to the smoking and e-cigarette questions were used to create a derived variable that indicated whether the individual currently used both e-cigarettes and cigarettes, smoked cigarettes only, used e-cigarettes only, or used neither.[xxxviii] The distribution of users for each wave is shown in Table 7:11 below.

[xxxviii] Respondents in Wave 8 and 9 were deemed to be e-cigarette users if they said they ‘sometimes used e-cigarettes but less than once a month’, ‘used e-cigarettes at least once a month, but less than once a week’, or ‘used e-cigarettes at least once a week’. Previous e-cigarette users and individuals who have tried e-cigarettes in the past but did not currently use them, however infrequently, were not included as e-cigarette users

Table 7:11 Smoking and e-cigarette use among adults (16+)		
USoc, Wave 8 and Wave 9, Individuals aged 16+ years		
Derived Variable: Smoking behaviour	**Wave 8**	**Wave 9**
Dual user (cigarettes and e-cigarettes)	2.6%	2.5%
Cigarette only	13.3%	12.3%
E-cigarette only	3.0%	3.7%
Neither	81.1%	81.6%
Total	100%	100%
Unweighted base	*32292*	*29265*

While in Wave 8, 15.9% said they were smokers, of these, only 13.3% solely smoked cigarettes with the remainder either using e-cigarettes or being dual users. Similarly, in Wave 9 14.8% smoked cigarettes, but only 12.3% smoked cigarettes solely. The figures suggest a decrease in cigarette use and an increase in e-cigarette use. The extent of dual use appears fairly stable.

7.3.2 The relationship between cigarette and e-cigarette use among adults

Table 7:12 shows e-cigarette use and smoking status at Waves 8 and 9 for respondents who were aged 16+ and completed an interview at both waves.

Table 7:12 Cigarette and e-cigarette use over time among adults (16+)				
USoc, Wave 8 and Wave 9, Individuals aged 16+ years				
E-cigarette use	**Never used, tried, past user in Wave 9**	**Current user in Wave 9 (both regular and infrequent users)**	**Total**	***Unweighted base***
Never used, tried, past user in Wave 8	97.4%	2.6%	100%	*23004*
Current user in Wave 8 (both regular and infrequent users)	35.0%	65.0%	100%	*1121*
All Wave 8 respondents	94.1%	6.0%	100%	*24125*
Smoking	**Not a smoker at Wave 9**	**Smokes at Wave 9**	**Total**	***Unweighted base***
Not a smoker at Wave 8	97.8%	2.2%	100%	*21014*
Smokes at Wave 8	16.6%	83.4%	100%	*3140*
All Wave 8 respondents	85.8%	14.2%	100%	*24154*

The figures show that 2.6% of adults started using e-cigarettes between Wave 8 and Wave 9. Of those that used e-cigarettes in Wave 8, the clear majority (65%) were still using them at Wave 9. However, such continuing use was not as high as cigarette use, where over four-fifths (83%) of those who smoked cigarettes at Wave 8 continued to do so at Wave 9.[xxxix]

This indicates that people who used e-cigarettes were twice as likely to have stopped between Wave 8 and Wave 9 than those who smoked 'traditional' cigarettes, since 35% of Wave 8 e-cigarette users had stopped by Wave 9, whereas 16.6% of smokers stopped in the same period.

The following Table 7:13 shows combined e-cigarette and smoking status at Waves 8 and 9.

Table 7:13 Combined cigarette and e-cigarette use over time among adults (16+)

USoc, Wave 8 and Wave 9, Individuals aged 16+ years

Smoking behaviour	**Dual user at Wave 9**	**Cigarette only at Wave 9**	**E-cigarette only at Wave 9**	**Neither at Wave 9**	**Total**	***Unweighted base***
Dual user at Wave 8	**39.3%**	44.1%	11.7%	5.0%	100%	*507*
Cigarette only at Wave 8	7.9%	**75.5%**	4.9%	11.7%	100%	*2624*
E-cigarette only at Wave 8	6.1%	6.4%	**70.5%**	17.0%	100%	*614*
Neither at Wave 8	0.2%	1.6%	0.8%	**97.4%**	100%	*20368*
All Wave 8 respondents	2.3%	11.9%	3.7%	82.2%	100%	*24113*

These figures suggest dual users were the least 'stable' group with individuals in this group being more likely to move to a different state the following year. While 39% of respondents were dual users in both waves, these individuals were more likely to drop e-cigarettes than cigarettes; 44% of the Wave 8 dual users were cigarette-only the following year, compared to 12% who used e-cigarettes only by Wave 9.

The most stable group was the non-smokers with 97% remaining non-smokers by the next year. Individuals who did not smoke were slightly more likely to take up cigarettes than e-cigarettes the following year, although it is likely that a proportion of these are ex-cigarette smokers who are re-starting. However, it was not possible to separate out new starters and re-starters in these waves of data.

A lower proportion of respondents who were dual users in Wave 8 went on to quit in Wave 9. Around 5% of those using both cigarettes and e-cigarettes at Wave 8 were not smoking at all at Wave 9, compared to 12% of those who smoked only cigarettes at Wave 8 and 17% of those using e-cigarettes only at Wave 8.

If dual use acts as a precursor to quitting smoking, the expected pattern would be a move from dual use to e-cigarettes only, followed by a further move from e-cigarettes only to quitting. While the results indicate that a proportion of respondents move from

[xxxix] When looking at regular, weekly e-cigarette users only (table not included) it was seen that 68% of regular users at Wave 8 were also regular users at Wave 9, with 25% of the regular users at Wave 8 saying they were non-users at Wave 9 and a further 7% becoming less frequent users. This suggests that even among regular users the drop-out rates for e-cigarettes are higher.

dual use to e-cigarettes only, and while the figures also show higher rates of quitting among individuals using e-cigarettes only, more than two waves of data would be needed to establish whether this pattern is true.[xl]

If dual use is part of a pattern of reduction, rather than a direct precursor to quitting, then dual users would be expected to be heavier smokers (or have formerly been cigarette-only heavy smokers). This means there should be a reduction in their cigarette smoking over time (due either to an overall reduction or an increase in e-cigarette use). Table 7:14 shows the mean number of cigarettes smoked daily for dual users and those smoking cigarettes only at Wave 8.

Table 7:14 Mean usual number of cigarettes smoked per day by user group

USoc, Wave 8 and Wave 9, Individuals aged 16+ years

		Dual user at Wave 9	**Cigarette only at Wave 9**	**E-cigarette only at Wave 9**	**Neither at Wave 9**
Dual users at Wave 8	Mean number of cigarettes per day at Wave 8	13.2	13.9	10.7	6.9
	Mean number of cigarettes per day at Wave 9	12.8	14.7	0.0	0.0
	Unweighted base	*195*	*214*	*66*	*30*
Cigarettes only at Wave 8	Mean number of cigarettes per day at Wave 8	13.6	13.4	11.5	7.5
	Mean number of cigarettes per day at Wave 9	13.8	13.7	0.0	0.0
	Unweighted base	*202*	*1978*	*109*	*320*

There is some evidence that individuals who were dual users at both waves had seen a reduction in their cigarette smoking, with the mean number of cigarettes per day dropping from 13.2 to 12.8, however, this difference was not statistically significant, which is likely to be due to the small sample size (n=195).

A proportion of Wave 8 dual users became cigarette-only smokers at Wave 9. These individuals increased the mean number of cigarettes smoked per day, from 13.9 at Wave 8 to 14.7 at Wave 9, although this difference was not statistically significant (again, the small sample size may be a contributing factor).

Respondents who were dual users at Wave 8 and then moved to e-cigarettes only were lighter smokers at Wave 8 (mean of 10.7 per day), as were respondents who quit (mean 6.9 per day). The difference between these two groups was significant; dual users who went on to quit, and dual users who moved to e-cigarettes only, smoked significantly fewer cigarettes per day than the other groups. Similarly, among those who smoked cigarettes only, the lighter smokers were significantly more likely to move to using e-cigarettes only or quitting altogether.

xl It is also likely that the respondents who move from dual use to cigarette only are ‘failed’ quitters, and that more waves of data may show they bounce between dual use and cigarette only. Again, additional waves would be needed to test this.

The respondents who remained smoking cigarettes only at Wave 9 (the bulk of the respondents who smoked) increased their smoking slightly from a mean of 13.4 to a mean of 13.7 cigarettes per day. However, this increment was non-significant. There was also a small and non-significant increase in the mean number of cigarettes smoked by respondents who were cigarette-only at Wave 8 and dual users at Wave 9, from 13.6 to 13.8.

7.3.3 Characteristics of different adult smoker groups

The characteristics of different user groups were explored to identify the social-demographic characteristics related to cigarette and e-cigarette use. The analysis suggests a consistent pattern in both waves, so while the reported figures are taken from Wave 9, they reflect patterns also seen in the Wave 8 data. See Appendix table D:13 for details.

Men were more likely than women to vape, whether using e-cigarettes only or smoking both e-cigarettes and cigarettes. Men account for 49% of the overall population but made up more than half of those who vaped (56%) and more than half of the dual users (54%).

Users of e-cigarettes tended to be younger, while dual users were more likely to be older people. For instance, 20% of solely e-cigarette users were aged 16–35 years compared to 15% of dual users.

People who used e-cigarettes were more likely to be in work, and when in work, more likely to be in managerial and professional occupations than dual users or those who smoked cigarettes only. Almost three-quarters (71%) of e-cigarette users were employed compared to 57% of dual users and 55% of cigarette smokers. Almost one-quarter (24%) of e-cigarette users were in managerial and professional occupations, compared to 15% of dual users and 14% of those who smoked cigarettes only.

Respondents who vaped were significantly more likely to be married or in a civil partnership than people who were dual users or only smoked cigarettes. Almost half (46%) of e-cigarette users were married or in a civil partnership compared to 33% of cigarette smokers and 32% of dual users.

Most smokers (cigarettes, e-cigarettes and dual smokers) reported their general health as ‘good’. However, dual users and cigarette smokers were significantly more likely to rate their health as ‘fair’ or ‘poor’ than e-cigarette users; 38% of dual users said they had ‘fair’ or ‘poor’ health compared to 31% of cigarette smokers and 23% of e-cigarette users.

The dual users had the worst health of any group. People who were dual users were most likely to have a longstanding illness or disability relative to those who smoked only cigarettes or e-cigarettes. Almost one in two (48%) of dual users said they had a longstanding illness relative to 44% of cigarette smokers and 36% of e-cigarette users.

In summary, adult e-cigarette users tended to be younger, more likely to be in employment, and, where employed, more likely to be in managerial occupations. Men were more likely to vape, whether e-cigarette only or dual use. Dual users had the worst health of any group.

7.3.4 Summary of e-cigarette use among adults

- There has been an increase in e-cigarette use between Wave 8 (2016–18) and Wave 9 (2017–19), while the same time period saw a decline in cigarette smoking.
- The rate of dual users (those who both smoke cigarettes and use e-cigarettes) did not change over the same period, whereas the proportion of adults who exclusively used e-cigarettes increased and the proportion of adults who only smoked cigarettes decreased.
- Continuing use (i.e., the proportion who smoked at both time points) was higher among smokers. The rate of cessation among e-cigarette users was higher than the rate of quitting among cigarette smokers.
- E-cigarette users were also more likely to move between states, i.e., from exclusive e-cigarette use to either cigarette smoker or dual user groups, than smokers were.
- In terms of characteristics, adult e-cigarette users tended to be younger, more likely to be in employment, and, where employed, more likely to be in managerial occupations. Men were more likely to vape, whether e-cigarette only or dual e-cigarette and cigarette use. Individuals who used both e-cigarettes and cigarettes had the worst health of any group.

7.3.5 The use of e-cigarettes among children

Children aged 10–15 years were asked about smoking and e-cigarette use as part of the youth self-completion module in USoc. This data has been used to look at rates of e-cigarette use. The question used to collect information about e-cigarette use in children is the same as that used for adults. As with adults, the question response categories changed in Wave 7, leading to this analysis being focussed on Wave 8 and 9 for reasons of comparability. The distribution of responses by wave are shown in Table 7:15.

Table 7:15 Electronic cigarette use among children aged 10–15 years

USoc, Wave 8 and Wave 9, children aged 10–15 years completing the youth questionnaire

	Wave 8	**Wave 9**
I have never used e-cigarettes	90.9%	91.8%
I have only tried using e-cigarettes once or twice	6.6%	5.0%
I used e-cigarettes regularly in the past, but never use them now	1.3%	1.9%
I sometimes use e-cigarettes but less than once a month	0.3%	0.4%
I use e-cigarettes at least once a month, but less than once a week	0.3%	0.0%
I use e-cigarettes at least once a week	0.6%	0.9%
Overall proportion of current users, both regular and infrequent	1.24%	1.29%
Total	100%	100%
Unweighted base	*2171*	*1907*

The number of children who have ever used e-cigarettes, even just to try them, is shown in Table 7:16 below. Like cigarettes, rates of e-cigarette use increased with age. Unlike for cigarettes, where the overall rates for boys and girls were generally very similar (Section 7.2.1), the figures suggest boys are more likely to try e-cigarettes than girls at every age. Overall, there has been a small drop between Wave 8 and Wave 9, although an indication that rates have increased among girls aged 13–14 years.

Table 7:16 Proportion of children who have tried or used e-cigarettes, by age and gender						
USoc, Wave 8 and Wave 9, children aged 10–15 years completing the youth questionnaire						
	Boys		Girls		Total	
Age in years	**Wave 8**	**Wave 9**	**Wave 8**	**Wave 9**	**Wave 8**	**Wave 9**
10	0%	0%	0%	2%	0%	1%
11	2%	2%	0%	0%	1%	1%
12	7%	4%	4%	3%	6%	4%
13	11%	11%	5%	8%	8%	9%
14	15%	15%	10%	12%	12%	14%
15	28%	22%	22%	19%	25%	20%
All 10–15	11%	9%	7%	8%	9%	8%
Unweighted base	*1054*	*951*	*1118*	*956*	*2172*	*1907*

Table 7:17 shows the combined cigarette and regular e-cigarette usage among children aged 10–15 years (this includes all children who reported regular use, even if infrequent). It shows that the rate of e-cigarette use was lower than the rate of smoking. More children used both cigarettes and e-cigarettes than used e-cigarettes only.

Table 7:17 Combined smoking and e-cigarette use among children		
USoc, Wave 8 and Wave 9, children aged 10–15 years completing the youth questionnaire		
	Wave 8	**Wave 9**
Neither	93.1%	93.9%
Cigarettes only	5.6%	4.8%
E-cigarettes only	0.4%	0.5%
Both	0.9%	0.8%
Unweighted base	*2158*	*1894*

7.3.6 Summary of e-cigarette use among children

- Like cigarettes, rates of e-cigarette use increased with age. Boys were more likely than girls to try e-cigarettes, at every age.
- Children were less likely to use e-cigarettes than smoke cigarettes. More children used both cigarettes and e-cigarettes than used e-cigarettes only.

Work strand 2 – Comparisons to previous research findings

- In exploring those adults who quit, take up or start smoking again after previously quitting and those children who smoke, the impact of demographic and socioeconomic characteristics emerged as a key factor, with our findings both complementing and building on earlier research.

- Heavy adult smokers were found to be less likely to quit smoking, in line with prior research,[18] with those smoking fewer cigarettes (up to 10 a day) in Wave 2 more likely to have quit by Wave 5.

- As has been reported in previous research, we found a link between those quitting smoking and the family (and peer) environment.[19] Those who were married or in a civil partnership were significantly more likely to quit smoking than those who were separated or divorced. Similarly, the household context is an important factor in quitting, with respondents who lived in a two-person household with a non-smoker, more likely to quit. While this finding reflects previous literature,[20] further nuances were identified, with any protective factors of non-smokers disappearing if the household contained more than two adults and a greater number of smokers than smokers.

- Building on previous research,[21,22] socioeconomic patterns were also seen when studying those taking up smoking. For example, those who were unemployed were more likely to take up smoking, with education similarly impacting on take up; almost half of new smokers had no qualifications when compared to those that had never smoked. However, in contrast to previous research,[21] unemployment did not seem to have an impact on re-starting.

- Family relationships were also found to be key to the smoking behaviours of young people. Reflecting prior literature, children and teenagers were more likely to smoke if their parents currently smoked or had smoked in the past.[23] Although previous research has found the father's presence in the household to be important in mediating smoking,[24] we were able to develop this literature, identifying the importance of the *quality of the relationship* in reducing or stopping smoking.

8 Tobacco Control Scale: a European comparison

8.1 Introduction

8.1.1 Background

People with fewer resources are more likely to smoke.[25] This association varies in strength but remains evident in nearly all European countries.[26] The overall prevalence of tobacco smokers, however, varies enormously.[5] Different European countries also have different levels of legislative and other controls regulating the sale and use of tobacco.[27] While an association between tobacco control and smoking prevalence is known, there is also evidence that the impact of tobacco controls on people's smoking varies by socioeconomic group,[28] depending on the type of regulation.[29] It is therefore important to consider the associations between tobacco control and smoking prevalence in the context of socioeconomic inequality.

This component of the study (**work strand three**) presents analysis of a range of data sources examining the relationship between prevalence of smoking, the extent of tobacco controls, and the level of social inequality in a country. Comparisons are made between countries and over time. We hypothesised that countries with tighter regulations would have been more effective in reducing smoking prevalence than countries with more relaxed policies. These analyses seek to update existing work in this area. Technical details are provided in Appendix E, with key findings presented in this chapter on international comparisons, temporal trends, and associations with tobacco control.

8.1.2 Research questions

The research detailed in this chapter aimed to compare the UK with other European countries in terms of prevalence of smoking and two country-level factors associated with smoking behaviour.

The specific objectives were to:

- Estimate the prevalence of tobacco smokers across European countries;
- Show temporal trends in the prevalence of tobacco smoking by European country;
- Examine the association between prevalence of tobacco smoking and extent of legislative measures in each European country;
- Examine the association between prevalence of tobacco smoking and social inequality in each European country; and
- Investigate how the UK compares with other European countries in terms of prevalence of tobacco smoking trends, and its relationship with the policy implementation level and social inequality levels (where available).

8.1.3 Data sources

Data from the Eurobarometer survey[xli] and two country-level indicators were analysed:

[xli] https://www.gesis.org/en/eurobarometer-data-service/home

- **Eurobarometer survey**: Prevalence of smoking in adults aged 15 and over in EU27[xlii] member states was derived from the Eurobarometer surveys for 2006, 2012, 2014, 2017 (waves: 66.2, 77.1, 82.4, 87.1). Eurobarometer is a longstanding series of general population household surveys using consistent methods in different European countries. The surveys use a multi-stage, random probability sampling design. In the first stage, primary sampling units (PSU) are selected from each of the administrative regional units in every country. Controlling for complex survey design allows the clustering of individuals within PSUs, and for disproportionate stratification of the samples by population size in each country to be controlled for. Weights were applied to also take account of non-response and adjust the distribution of the EU27 sample to the correct distribution of the nations in the population. The time frame was selected because: it is recent, it covers a period when many control policies were implemented, and Eurobarometer and Tobacco Control Scale (TCS) data were available. Respondents' smoking status was derived using the following items:
  - In 2006, a positive response to any of: 'You smoke packed cigarettes', 'You smoke roll-up cigarettes' or 'You smoke cigars or a pipe'; and
  - In 2012, 2014, 2017, a positive response to: 'You currently smoke'.

  Eurobarometer data on respondents' age and sex was also used in the analysis.

- **Tobacco Control Scale (TCS)**: The TCS is a national indicator proposed by Joossens and Raw[10] which summarises the level of legislative tobacco control policies implemented in a country. TCS scores are available for 2005, 2010, 2013, 2016[xliii] – this informed the choice of Eurobarometer survey waves from which the prevalence-of-smoking estimates have been calculated. The total TCS score for each country was used. This is based on the national-level implementation of the six most cost-effective tobacco interventions, as determined by the World Bank in 2003.[10] These are:
  - Price increases through higher taxes on cigarettes and other tobacco products;
  - Bans / restrictions on smoking in public and workplaces;
  - Better consumer information (e.g., public information campaigns);
  - Comprehensive bans on the advertising and promotion of all tobacco products, logos and brand names;
  - Large, direct health warning labels on cigarette boxes and other tobacco products; and
  - Treatment to help dependent smokers stop, including increased access to medications.
- **Gini coefficient:** For measuring the degree of social inequality within the countries, Gini coefficients for 2007, 2010, 2013, 2016 were extracted from the Eurostat database, European Union Statistics on Income and Living Conditions (EU-SILC). The Gini coefficient is a statistical measure of economic inequality, measuring income distribution or wealth distribution in a population.

  The Gini coefficient of equivalised disposable income measures the extent to which the distribution of equivalised disposable income after social transfers deviates from a perfectly equal distribution. It is a summary measure of the cumulative share of equivalised income accounted for by the cumulative percentages of the number of

[xlii] The 27 EU member states included in the analysis are listed below at Appendix table E:1. They do not include Croatia which joined the EU as the 28th member state from 1 July 2013. The EU27 analysis does include the United Kingdom which was a member of the EU until 31 January 2020.
[xliii] https://www.tobaccocontrolscale.org

individuals. Its value ranges from 0 (complete equality) to 100 (complete inequality).[30]

8.1.4 Methods

Analyses were weighted and accounted for complex survey design, conducted in SPSS and R using *survey* package and *svyglm*() command for the general linear modelling.

In summary, the analysis consisted of the following stages:

- Descriptive analysis of change over time in prevalence of smokers, overall and within countries;
- Descriptive analysis of change over time in mean TCS score and of the correlation between mean TCS score and prevalence of smokers in the same and subsequent years (e.g., one, two, five, and seven-year time-lags), within countries;
- Descriptive analysis of change over time in mean Gini coefficient and of the correlation between mean Gini coefficient and prevalence of smokers in the same and subsequent years (one, two, four, five, and seven-year time-lags), within countries;
- Visualisation of the three-way relationship between smoking prevalence, TCS score, and Gini coefficient by country; and
- Multiple logistic regression modelling conducted on a combined individual level dataset with smoking status as the outcome. Predictor variables were year, country-level TCS score each year; country-level Gini coefficient each year; whether live in the UK, and age and sex. Interaction terms between year and each factor were included.

Further discussion of the methods and rationale for selecting the given approaches is given here.

Smoking prevalence was compared between years and nations. The difference in prevalence of smoking between 2006 and 2017 was calculated for each country, with associated confidence intervals. Non-overlapping confidence intervals were used to indicate a significant difference between groups.

For examining the association between prevalence of smoking and the two country-level characteristics (TCS score and Gini coefficient) a range of approaches were taken. First, weighted estimates of prevalence of smoking for each wave and nation using national level Eurobarometer data to visualise the relationship between smoking prevalence, TCS score and Gini coefficient. A previous study[27] found negative correlations between TCS scores in 2007 and prevalence rates of smokers in 2014. This indicated that European countries with higher levels of tobacco control have lower prevalence of smokers. The authors considered a time-lag of seven years appropriate to observe the impact of tobacco control policies on smoking prevalence. We updated those results with the most recent wave of data, but also were interested to see whether such a relationship exists for shorter periods, including for one-year time-lags. Similar analysis was done for the association between prevalence of smoking and Gini coefficient. These results should be treated with some caution given that the analysis using country-level aggregates disregards the fact that prevalence of smoking estimates come from a survey with complex sample design.

Multiple logistic regression analyses were used to examine whether residents of countries with higher TCS scores and a lower Gini coefficient are less likely to be smokers. We allowed for temporal changes in smoking prevalence and in the effect of independent predictors and controlled for potential confounders (sex and age). This type of data has a hierarchical and clustered structure – we planned to use both individual-level and country-level characteristics, while the individuals are nested within countries (more specifically, within administrative regions in each country) – by the survey design, and within waves of the survey. We considered conducting the analysis within a multi-level framework, which would recognise the existence of such data hierarchies by allowing for residual components at each level in the hierarchy.

However, we decided that accounting for the complex survey design would allow us to compute accurate estimates of standard errors which would be the main advantage of the multi-level modelling. The complex survey design procedure was then used to inform the modelling that the data is clustered within NUTS level 2 regions[xliv] (consequently – countries too) and waves, which enabled us to avoid underestimating standard errors of the effects of country-level variables. Other advantages of using multi-level modelling were not of key interest to this research (e.g., partitioning the residual variance into a between-group component (the variance of the country-level residuals) and a within-group component (the variance of the individual-level residuals), hence we decided to simplify the modelling to single level analysis.

8.1.5 Limitations

- This study draws on cross-sectional data, and conclusions about causal inference could not be drawn;
- It is likely that factors not included in the modelling explain some of the associations observed between TCS score, Gini coefficient, and smoking;
- The small number of time points limited our ability to statistically compare effects for each country or at each wave;
- Inferring the effect of country-level characteristics on individual behaviour (smoking) is problematic, especially with limited ability to control for cultural factors. Having accounted for Eurobarometer's complex survey design, we further controlled for the fact that there may be some correlation of responses / behaviours within each country. Moreover, the analysis uses that account for the differences in the countries' populations sizes at each wave, hence estimates presented are representative for the total EU27 population, and underestimation of standard errors are avoided (which would have been a problem if the analysis was run on a country-level);
- The TCS is not comprehensive of all tobacco control measures, for example it does not include the legal age for purchasing cigarettes and criminalising 'proxy purchasing', and it might capture regulations in some countries better than others. It is also only available at the country level, and therefore does not reflect differences in regulations within countries (such as between England and Scotland within the UK); and
- The combined individual-level dataset is made up of a series of cross-sectional datasets combined: for each participant, information is included for one point in time. It is not possible to directly estimate the effect of a predictor at wave 1 on an outcome at wave 4. This would be possible if an ecological approach is used (analysis using country-level aggregates from the individual-level datasets), but this was not done for reasons set out above.

[xliv] The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of the collection, development and harmonisation of European regional statistics, socioeconomic analyses of the regions and framing of EU regional policies. The classification, updated every three years, defines regions in a comparable manner, reflecting their diverse physical, demographic and administrative situations. There are 283 NUTS2 regions in the EU, with the UK being divided into 41. For more information please see: https://ec.europa.eu/eurostat/web/nuts/background

8.2 Results

8.2.1 Prevalence of tobacco smokers across European countries and over time

In 2006, 31.6% of people aged 15 and over living in EU27 were smokers. The rate declined to 27.9% in 2012 and 26.2% in 2014 and 2017 (see Table 8:1). The 2012 and 2017 estimates do not significantly differ, suggesting that the decline in overall smoking prevalence slowed down.

Table 8:1 Prevalence of smokers in EU27 in 2006, 2012, 2014 and 2017

				Eurobarometer surveys: 66.2, 77.1, 82.4, 87.1			
Smoking				Year			
				2006	**2012**	**2014**	**2017**
Currently smoking	% within year	Estimate		31.6%	27.9%	26.2%	26.2%
		Standard Error		0.7%	0.6%	0.7%	0.7%
		95% Confidence Interval	Lower	30.3%	26.7%	24.8%	24.8%
			Upper	32.9%	29.2%	27.6%	27.6%
		Unweighted Count		*7791*	*7352*	*6516*	*6514*
TOTAL		*Unweighted Count*		*27084*	*26684*	*26724*	*26796*

Figure 8:1 shows the prevalence of smokers in each member state in 2006, 2012, 2014 and 2017. In most countries, prevalence fell between 2006 and 2017. However, the trajectory and extent of change varied. In some countries there was no significant change between 2006 and 2017, and in Slovenia there was evidence of an increase (4.7 percentage points change, 95%CI [0.97, 8.49]).

Figure 8:1 Prevalence of smokers in EU27 countries, 2006, 2012, 2014 and 2017

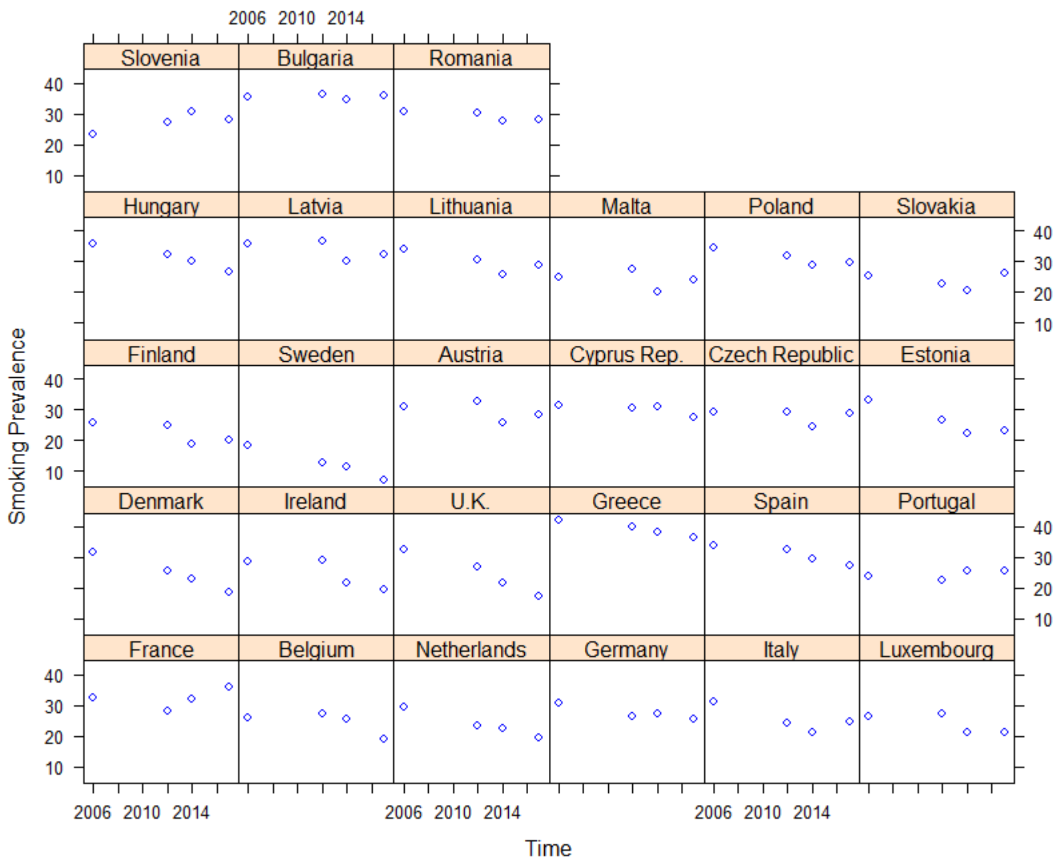


Table 8:2 presents the difference in prevalence of smoking for member states between 2006 and 2017, with associated confidence intervals. When the confidence interval includes 0, the change should not be interpreted as significant at the 0.05 level.

Table 8:2 Difference between prevalence of smokers in 2006 and 2017 by EU27 country				
			Eurobarometer surveys: 66.2, 87.1	
Country	**Difference in percentage points**	**Standard error (SE) of difference**	**95% Confidence Interval**	
			Lower	Upper
United Kingdom	-15.21	1.64	-18.42	-12.00
Denmark	-13.02	1.89	-16.72	-9.33
Sweden	-11.22	1.47	-14.10	-8.35
The Netherlands	-9.77	1.87	-13.43	-6.11
Estonia	-9.76	1.99	-13.65	-5.86
Hungary	-9.38	2.04	-13.38	-5.39
Ireland	-9.28	1.89	-12.99	-5.57
Belgium	-6.73	1.85	-10.35	-3.11
Spain	-6.55	2.03	-10.53	-2.56
Italy	-6.49	1.99	-10.38	-2.59
Finland	-5.72	1.86	-9.36	-2.08
Greece	-5.45	2.18	-9.71	-1.18
Luxembourg	-5.25	2.67	-10.49	-0.01
Lithuania	-4.81	2.07	-8.87	-0.76
Poland	-4.81	2.09	-8.90	-0.72
Germany	-4.65	1.62	-7.83	-1.47
Cyprus (Republic)	-3.73	2.87	-9.36	1.89
Latvia	-3.47	2.10	-7.58	0.64
Romania	-2.82	2.01	-6.75	1.12
Austria	-2.63	2.03	-6.62	1.35
Malta	-1.19	2.72	-6.53	4.15
Czech Republic	-0.06	1.97	-3.91	3.80
Bulgaria	0.56	2.11	-3.57	4.70
Slovakia	1.13	1.88	-2.55	4.81
Portugal	1.57	1.90	-2.15	5.30
France	3.33	2.11	-0.80	7.46
Slovenia	4.73	1.92	0.97	8.49

In the UK, the smoking rate decreased from 32.7% to 17.5%, the largest decline among the EU27 countries. Table 8:3 presents how smoking prevalence changed over time in the UK according to Eurobarometer data from 2006, 2012, 2014 and 2017.

Table 8:3	Prevalence of smokers in the UK in 2006, 2012, 2014 and 2017						
				Eurobarometer surveys: 66.2, 77.1, 82.4, 87.1			
Smoking							**Year**
				2006	**2012**	**2014**	**2017**
Currently smoking	% within year	Estimate		32.7%	26.7%	21.6%	17.5%
		Standard Error		2.3%	1.8%	1.8%	1.7%
		95% Confidence Interval	Lower	28.4%	23.2%	18.4%	14.4%
			Upper	37.4%	30.5%	25.2%	21.2%
		Unweighted Count		*417*	*349*	*265*	*234*
TOTAL		*Unweighted Count*		*1375*	*1330*	*1310*	*1337*

This steep decline in prevalence of smokers in the UK is notable when compared to the rest of the EU (Table 8:4). In 2006, the prevalence in the UK (32.7%) and the rest of the EU (31.4%) was not significantly different (adjusted F statistics=0.29, p=0.59). However, by 2017, people in the UK (17.5%) were significantly less likely to smoke than those living in other EU countries (27.4%, adjusted F=20.57, p<0.05).

Table 8:4	Prevalence of smokers in the UK and rest of EU27 in 2006 and 2017					
			Eurobarometer surveys: 66.2, 87.1.			
Smoking			**2006**		**2017**	
			non-UK	UK	non-UK	UK
Currently smoking	Estimate		31.4%	32.7%	27.4%	17.5%
	Standard Error		0.7%	2.3%	0.6%	1.8%
	95% Confidence Interval	Lower	30.1%	28.3%	26.1%	14.3%
		Upper	32.8%	37.5%	28.7%	21.3%
	Unweighted Count		*7374*	*417*	*6280*	*234*
TOTAL	*Unweighted Count*		*25709*	*1375*	*25459*	*1337*
Independence test		Adjusted F*	0.29	0.59	20.57	0.00

*The adjusted F is a variant of the second-order Rao-Scott adjusted chi-square statistic. Significance is based on the adjusted F and its degrees of freedom.

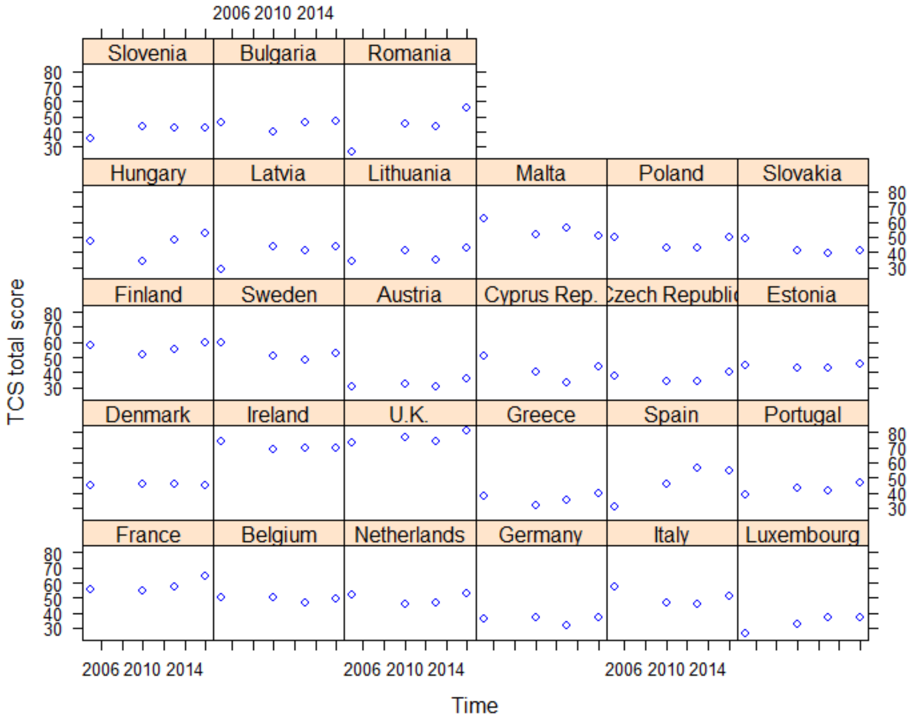
8.2.2 TCS scores: by country, year, and associations with smoking

The TCS score is an indicator of the extent to which countries implement policies designed to reduce smoking. Countries with higher scores have stricter tobacco control regulations in place. The scores for countries were averaged (see Table 8:5). Mean TCS score was highest in 2016, indicating that there has been an increase in tobacco control regulation in European countries over time. The standard deviation between scores appears greater in 2005 (13.1) than in later years (around 10 from 2010), indicating some convergence in scores over time.

Table 8:5	Mean and standard deviation (sd) of TCS score across EU27 countries by year						
						TCS	
2005		**2010**		**2013**		**2016**	
mean	sd	mean	sd	mean	sd	mean	sd
45.9	13.1	45.1	10.3	45.4	10.7	49.5	10.3

Figure 8:2 shows the mean TCS score in each country in 2005, 2010, 2013 and 2016. Countries differed significantly in both level of score and change in score over time. A few countries experienced a reduction in tobacco control efforts (for example, Malta and Slovakia), while some experienced a pronounced increase (for example, Romania and Spain).

Figure 8:2 Tobacco Control Scale: mean total score in EU27 countries, 2005, 2010, 2013 and 2016



As a first step to examining the relationship between each country's TCS score and prevalence of smokers, unadjusted correlation coefficients were calculated using country-level data. In a previous study,[27] a negative correlation was found between TCS score in 2007 and prevalence of smokers in 2014 (Spearman's rank correlation coefficients=-0.44; p=0.02[xlv]). This indicated that EU27 countries with higher tobacco control efforts subsequently tended to have a lower prevalence of smokers. A time-lag

[xlv] Feliu et al., (2019) used Spearman's rho as a measure of correlation. Pearson correlation coefficient may be a more appropriate measure for the data analysed which are raw values, not ranks. However, to enable comparisons we have also used Spearman's rank correlation rho coefficients. Moreover, we do not report p-values for the coefficients because the country-level analysis ignores the complex survey standard errors associated with the estimates of prevalence of smoking for each nation and wave of Eurobarometer.

of seven years was observed. The current study sought to a) update these results with more recent data, and b) test the relationship for shorter time-lags, including one year. Table 8:6 presents the Spearman's rank correlation coefficients for all time-lags considered. The results are consistent with those reported by Feliu and colleagues[27] for a seven-year lag. Further to the previous study, an association emerges between length of time lag and strength of association. The strength of association between TCS score and prevalence of smokers one year later was generally weak (-0.23,-0.27), while the association between TCS score and prevalence of smokers seven (-0.53) and twelve (-0.48) years later was stronger. These findings indicate that the strength of association between TCS score and smoking prevalence may increase over time for some years before plateauing.

Table 8:6 Spearman's rank correlation rho coefficients: TCS score and prevalence of smokers in EU27 countries

	Prevalence of Smokers			
TCS score	**2006**	**2012**	**2014**	**2017**
2005	-0.23	-0.44	-0.43	-0.48
2010		-0.41	-0.42	-0.53
2013			-0.27	-0.45
2016				-0.34

8.2.3 Gini coefficient: by country, year, and associations with smoking

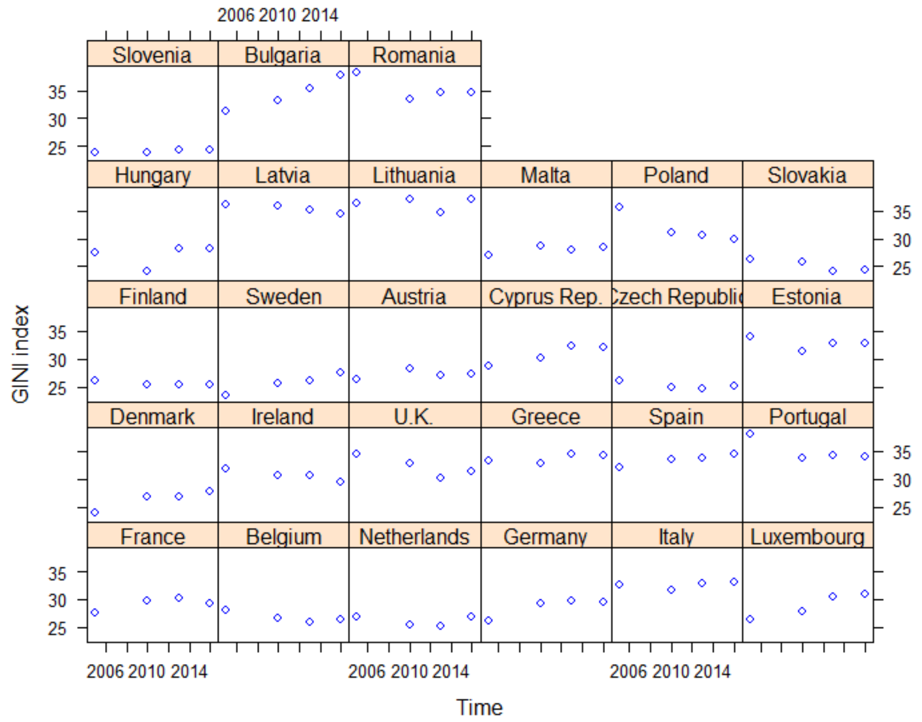
The Gini coefficient is a measure of a country's level of social inequality, where a higher score indicates more inequality. Table 8:7 shows that the mean Gini coefficient for EU27 countries combined remained quite stable across 2005, 2010, 2013 and 2016.

Table 8:7 Mean and standard deviation (sd) of Gini coefficient across EU27 countries by year

2005		**2010**		**2013**		**2016**	
mean	sd	mean	sd	mean	sd	mean	sd
29.9	4.6	29.6	3.7	29.9	3.8	30.2	3.8

Figure 8:3 visualises the Gini coefficient values by year for each member state, using the same years as those used for the TCS scores. The Gini coefficient is higher in some countries (for example, Romania, Lithuania) than others (such as Finland and Slovenia). The Gini coefficient for some countries indicates that there has been an increase in inequality over time (e.g., Bulgaria), and for others there has been a fall (Poland).

Figure 8:3 Gini coefficient in EU27 countries in 2005, 2010, 2013 and 2016



To examine the relationship between each country's Gini coefficient and subsequent prevalence of smokers, unadjusted correlation coefficients were calculated using country-level data. Spearman's rank correlation coefficients are presented in Table 8:8. The Gini coefficient at one point in time appears to more strongly predict prevalence of smokers one year later (0.56, 0.44, 0.38), than after a longer period such as seven (0.31) or twelve (0.33) years. This indicates an immediate association between level of inequality and prevalence of smokers.

Table 8:8 Spearman's rank correlation rho coefficients: Gini coefficient and prevalence of smokers in EU27

	Prevalence of Smokers			
Gini coefficient	2006	2012	2014	2017
2005	0.56	0.36	0.31	0.33
2010		0.36	0.31	0.36
2013			0.44	0.44
2016				0.38

8.2.4 Visualising associations between prevalence of smokers, social inequality and TCS score

Figure 8:4 plots prevalence of smoking (2017) by Gini coefficient (2016) for each EU country, with level of TCS score (2016) indicated by size of bubble. A moderate positive association between Gini coefficient and prevalence of smokers can be observed. This indicates that countries with a higher Gini coefficient (indicating greater inequality) tend to have a higher prevalence of smokers. France emerges as an outlier, combining a high prevalence of smokers with below-average levels of inequality. It can be observed that Sweden had an exceptionally low prevalence of smokers in 2017, together with rather low level of Gini coefficient. It is likely that snus, an oral tobacco product widely used in Sweden and Norway, is a factor in Sweden's low rate of combustible tobacco use.[31] The UK is located almost in the middle of the graph and is characterised by the second lowest rate of smoking and a mid-range Gini coefficient. The size of the points on Figure 8:4 represents the level of the TCS scores, with no clear pattern observed.

Figure 8:4 Association between prevalence of smokers (2017), mean TCS score and Gini coefficient in EU27 (2016)

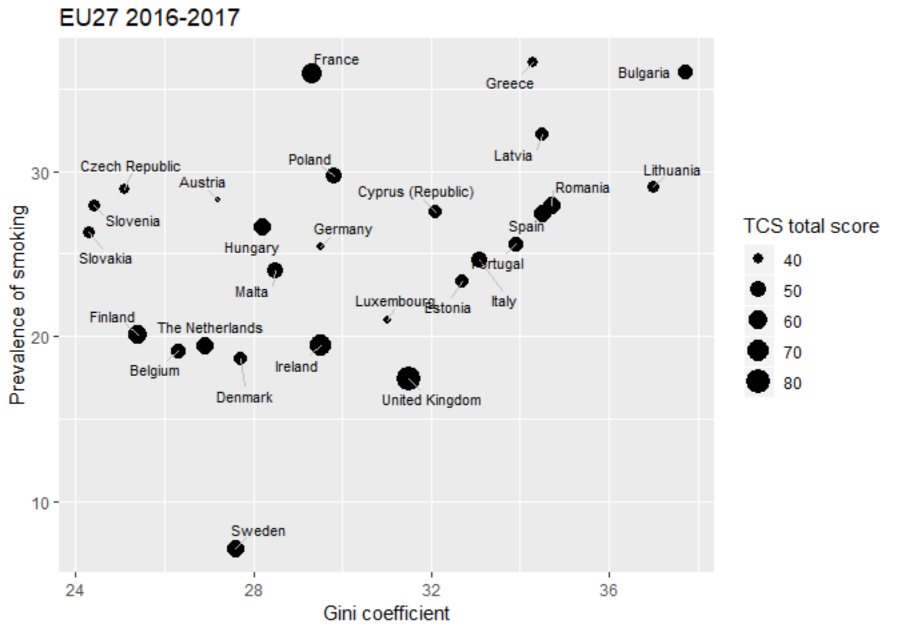
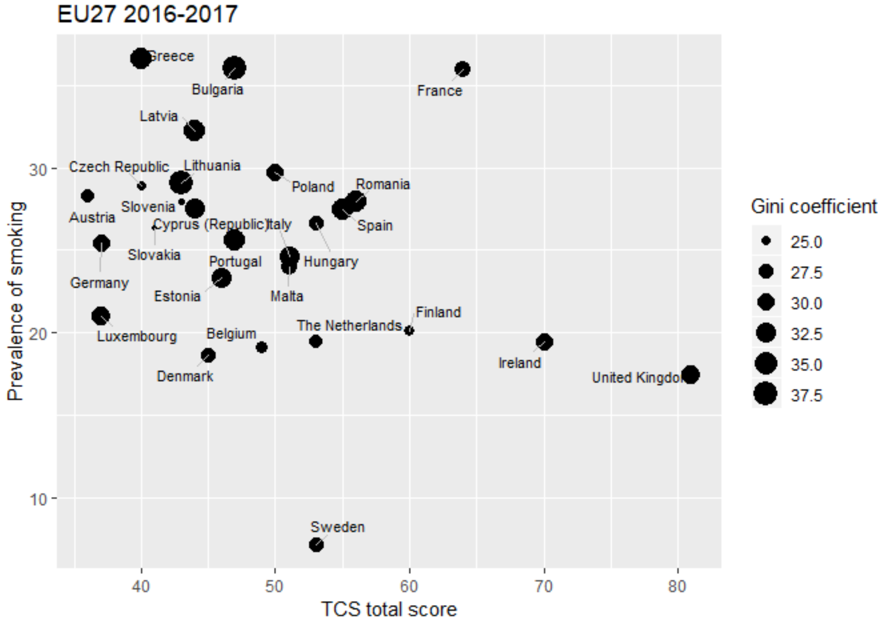


Figure 8:5 plots prevalence of smoking (2017) by mean TCS score (2016) for each EU country, this time with Gini coefficient (2016) indicated by size of bubble. A negative association between prevalence of smokers and TCS score can be observed, with most countries clustered in the top left quarter of the graph (higher smoking rate and lower TCS scores; especially Greece and Bulgaria) and a few (Ireland and the UK) with a lower smoking rate and higher TCS score. The charts make clear the extent to which the UK has higher levels of tobacco regulation in place.

Figure 8:5 Association between prevalence of smokers, Gini coefficient and mean TCS score in EU27 (2016-2017)



8.2.5 Modelling change in prevalence of smoking

Methods

A multivariate analysis on country-level data was considered. Growth curve modelling would allow for examination of changes in prevalence of smokers in each country, as well as the between-countries difference in the nature of that change.[32] However, this approach was ruled out due to small sample size (27 countries and four time points) and because such a model would not show correct standard errors as this would mean treating country-level estimates of prevalence of smokers as population values, disregarding the fact that they come from a complex survey (see Appendix table E:1). This could affect the validity of statistical tests.

Instead, multivariate modelling was performed with an individual-level dataset. Data on respondents from all four waves of Eurobarometer were combined and country-level characteristics (Gini coefficient and TCS scores at four points in time) added. Logistic regression was used to examine whether respondents from countries with lower TCS scores and a higher Gini coefficient were more likely to smoke. Interaction with year was added to the model, to investigate how the UK compares with the rest of Europe in terms of odds of smoking at each point. Age and sex were controlled for as potential confounders. A multivariate logistic regression model adjusted for complex survey design[xlvi] was run to test the association between smoking status and:

- Year (2005/06, 2010/12, 2013/14, 2016/17);[xlvii]
- TCS score of a country at a given year;

[xlvi] Individuals clustered within waves of a survey, countries, administrative regions in each country (NUTS2); stratification: nation; weight: weight for analysis of the total EUR27 countries, combined the following variables: v38 from 2006, w22 from 2012, 2014 and 2017.
[xlvii] Given the non-linear trend in smoking prevalence observed in some countries, small number of data points (4) and unequal time differences between the Eurobarometer waves, we decided to represent the time as a categorical variable.

- Gini coefficient of a country at a given year;
- Whether UK or other EU27 country;
- Sex of respondent;
- Age (grouped) of respondent; and
- Interaction of year with each factor.

For each factor, p-values associated with the Wald test were computed, indicating whether the factor is significantly associated with smoking behaviour. For a categorical variable (e.g., age group) the p-value associated with the Wald test indicates whether the overall effect of a factor is significant, while for a continuous variable (e.g., Gini coefficient), the decision about the null hypothesis is made based on p-values associated with a t-test. If the factor is significant, we can then look at the p-values for each of the categories within each factor; if the p-value for a category indicates significance then the category is considered to be significantly different from the reference category.

Odds ratios (OR) are used to compare the relative odds of smoking for a subgroup (e.g., women) compared to a reference group (e.g., men). If the value is greater than 1, the odds of the outcome occurring in that subgroup are higher. Because the model includes interactions, the ORs of the main effects should be interpreted as ORs when the other variables are held constant (equals 0 for continuous variables and reference category for the categorical factors). The ORs of an interaction term demonstrates the ratio by which the OR changes compared with the reference category.

Results

Appendix table E:2 presents the results (with TCS score and Gini coefficient as continuous variables). After controlling for all factors, the following significantly predicted being a smoker:

- Gender;
- Age group;
- Year;
- Interaction of year and whether UK;
- Interaction of year and TCS Total Score; and
- Interaction of year and age group.

Consistent with previous research, being female or aged 55 or over was associated with not smoking.

Year was significant, which indicates that the declining trend in smoking cannot be fully explained by the other factors in the model, such as a country's TCS score and Gini coefficient.

The significant interaction between year and whether UK is consistent with the results of the descriptive analysis. There was no difference in odds of smoking between UK and the rest of Europe at Wave 1 (2005/06). However, at Wave 4 (2016/17) the odds of smoking in the UK were lower than for the rest of Europe (OR=0.16, P(>X2)= <0.01).

This approach did not detect a significant effect of TCS score or Gini coefficient on prevalence of smokers when other factors are adjusted for. At Wave 1, a one-point increase in TCS score did not change the odds of smoking (OR=1.00, 95%CI: 0.99-1.00); likewise, at Wave 1 a one-point increase in the Gini coefficient (OR=1.01, 95%CI: 1.00-1.03) was not significantly associated with an increase in the prevalence of smokers after other factors were controlled for. This lack of significant effect was observed for the Gini coefficient at all waves (p-value for the Wald test of an interaction with wave=0.26). Although the interaction of TCS score and wave was found significant, only a marginal effect can be observed for the last wave. At Wave 4, a one-point increase in TCS score was associated with only a slight increase in the odds of being a smoker (95%CI: 1.00-1.02). Therefore, after adjustment for all factors, countries' social inequality levels and tobacco control policies did not appear to fully explain the differences in smoking prevalence in Europe.

To check whether the lack of a significant effect was due to the use of continuous variables, the model was rerun using categorised TCS score and Gini coefficient. The variables were computed based on weighted tertiles of the scores for all waves together, resulting in three categories for each variable:

- TCS score grouped: <44, 44-53, >53; and
- Gini coefficient grouped: <29.50, 29.50-32.70, >32.70.

Appendix table E:3 presents the results from the new model, which also found a lack of direct association between TCS score and Gini coefficient with smoking rates when these were measured around the same time, and when other factors were adjusted for. Again, these significantly interacted with year. The revised model provided some evidence of effects at wave 2 (2010/12), for example when living in a country in the highest Gini coefficient tertile was linked with increased odds of smoking of 1.44 (P(>X2)=<0.01). Similar effects were not evident for other waves.

The effects for both TCS score and Gini coefficient have been observed for Wave 2 (2010/12) only. This wave is the only one used in the analysis with a two-years lag between country level indicators (2010) and smoking prevalence estimates (2012). The lack of significant association at the other points in time may be due to the shorter time-lag, which would be consistent with the correlation analysis of TCS findings.

8.3 TCS – Conclusions

Analyses of data from 27 countries, drawing on the Eurobarometer Survey linked to each country's Tobacco Control Scale scores and Gini coefficients for 2006 to 2016 highlighted a range of findings:

8.3.1 Trends over time

- Since 2006, the proportion of people in European countries smoking cigarettes has fallen. The decline was initially steep but has slowed. This pattern is true for most, but not all, countries (e.g., France and Slovenia);
- Overall, there has been a slight increase in the extent of tobacco control regulation in Europe. This has varied from country to country: most experienced little change or some increase, but a few saw regulations relaxed (e.g., Malta and Slovakia) and
- The level of social inequality in Europe, as measured by the Gini coefficient, has generally remained quite stable, although again some countries have experienced an increase in inequality and others a reduction.

8.3.2 Associations over time

- Simple analyses indicate that countries with more tobacco control and less social inequality tend to have a lower prevalence of smokers;

- While the association between regulation and smoking behaviour appears to take some years to have an effect, the link between social inequality and smoking appears to be more immediate;
- These associations were significant when other factors were not controlled for, but they were generally not strong (that is the correlation coefficients were generally less than 0.5); and
- The extent of tobacco control and social inequality in countries do not seem to explain the overall decline in prevalence of smokers in Europe.

8.3.3 Implications for research and policy

- When evaluating the success of tobacco regulation and other measures it should be recognised that these may take five to seven years to have a measurable effect on behaviour at the population level;
- The Tobacco Control Scale is produced by expert review, and how valid and comprehensive it is may need revisiting; and
- While legislation and regulation are important, it is likely that many other factors drive levels of smoking and change in levels of smoking over time, including interpersonal and cultural factors.

Work strand 3 – Comparisons to previous research findings

- The prevalence of tobacco smokers in Europe (EU27) has declined between 2006 (31.6%) and 2017 (26.2%), although the downward trend has progressively slowed down to the extent that the estimated prevalence in 2012 (27.9%) does not significantly differ from the 2017 estimate. In the same period, the UK saw the largest reduction of smoking rate (from 32.7% in 2006 to 17.5% in 2017) among the EU27 countries. Other countries, such as France, Slovenia, Portugal, Slovakia and Bulgaria, recorded no changes or even a slight increase in smoking rates.
- Following the example of Feliu and colleagues,[27] we examined the relationship between the TCS in each country and the prevalence of smokers. The correlation between TCS scores and prevalence of smokers observed at different time points showed that there is a negative correlation between these two variables. In addition, it was also observed that the association between TCS scores and prevalence of smokers becomes stronger over the years. Such findings are consistent with results from previous studies,[27] which also found a negative correlation between TCS scores and prevalence of smokers after a time-lag of seven years.
- We also examined the relationship between the Gini coefficient of social inequality and the prevalence of smokers. In this context, we found a positive correlation between higher scores of the Gini coefficient (corresponding to countries with more social inequality) and the prevalence of smokers. Such correlation was stronger one year later than after a longer period, which suggests that the association between the two is immediate.
- The association between prevalence of smokers and both Gini coefficient and TCS scores was either weaker or absent when controlling for other factors such as age, sex and year. The effects of the Gini coefficient and TCS scores are slightly stronger when there is a longer time-lag between the country level indicators and the smoking prevalence estimates. In other studies on EU27 countries[28] it was found that the association between TCS scores and smoking intensity and cessation was stronger for higher socioeconomic groups, while it was weaker or absent for lower groups. Such factors should be taken into account in future studies, together with other variables (including cultural and socioeconomic ones), to mitigate the effects of potential confounders.

9 E-cigarette Rapid Evidence Assessment

9.1 Background

E-cigarette use has increased substantially throughout the UK in recent years, reaching an estimated 3.6 million adult users in 2019.[33] As the use of e-cigarettes has grown, so has an emerging public health debate over the implications of their use. Some research contends that e-cigarettes provide a useful tool to help cigarette smokers quit smoking tobacco,[34] while others find that e-cigarettes act as a gateway mechanism to smoking, especially where they contain nicotine, and particularly among younger people. In turn, this may increase the likelihood of further substance use.[35] To date, research on both perspectives is inconclusive.[36–38]

National surveys of smoking habits have been slow to adapt to this change in technology and accompanying increases in use, only capturing these data in the last couple of years. For example, while the survey USoc included a binary (yes / no) question on e-cigarettes in Wave 7 (2015–2017), this area of enquiry was only extended in Wave 8 (2016–2018). This has necessarily reduced the type and extent of evidence available to explore and understand this emerging area. However, it could be argued that, as opportunities to market tobacco have declined (e.g., ending of sale of tobacco products through vending machines, ending of open displays of tobacco in all shops or premises, introduction of standardised packaging of tobacco products), the marketing of e-cigarettes entered in its place. If e-cigarettes do act as a gateway for young people to take up smoking, or encourage ex-smokers to relapse, then they are of significant policy concern.

This work package seeks to address the gaps in the evidence through a Rapid Evidence Assessment (REA) of current literature on e-cigarette consumption in the UK. It includes descriptive profiling of the demographic and socioeconomic characteristics of e-cigarette users, what the evidence on e-cigarette consumption can tell us about the effects of tobacco control legislation, and any significant gaps in the emerging evidence. The REA also includes an assessment of the methodology, sample, sample characteristics and response rate (if applicable) of the included papers, to make sure the findings are based on robust evidence.

This REA forms **work strand four** of the larger project seeking to understand whether the recent tobacco regulations implemented (both through the EU as well as UK specific legislation) have had an impact on the level of consumption of cigarettes and on attitudes towards smoking. By understanding how e-cigarettes are used by individuals, and the national policies and health campaigns which directly or indirectly affect use, this review aims to provide a broader understanding of tobacco use within the UK, and to allow for greater insights into this important area of public health research.

9.2 Research questions

Two core research questions were adopted, with five additional sub-questions.

1. Who are the consumers of e-cigarettes?
    a. What are the demographic and socioeconomic characteristics of the consumers of e-cigarettes?

b. Which national policies and / or health campaigns have been the key drivers of changes (if any) to the consumption patterns for e-cigarettes?

2. How does e-cigarette consumption compare to the consumption of tobacco?
    a. What are the differences in rates of consumption (i.e., frequency of use, amount of nicotine inhaled or absorbed) between consumers of e-cigarettes and consumers of tobacco cigarettes?
    b. What are the differences in rates of consumption by duration of use of e-cigarettes?
    c. What are the differences in rates of consumption by type of consumer: former tobacco smoker; never-tobacco smoker; dual user?

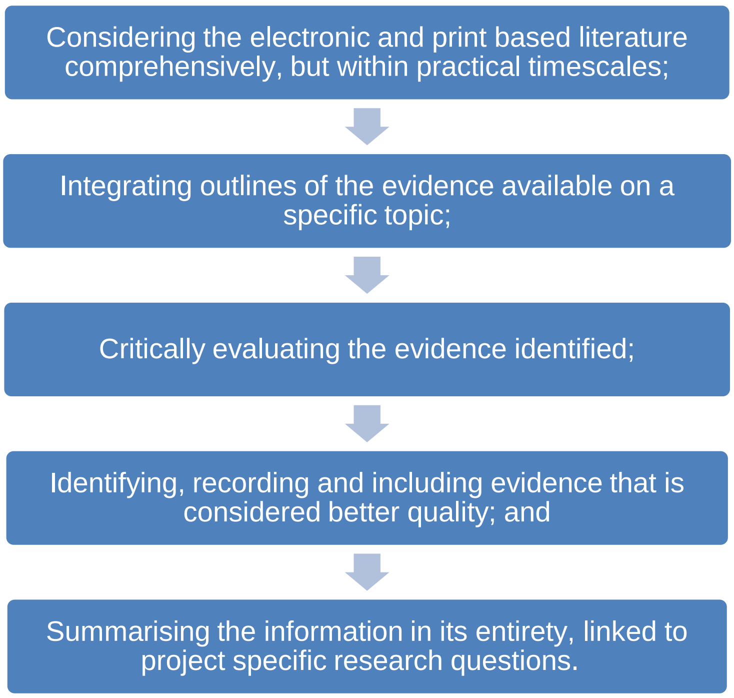
9.3 Methods

9.3.1 REA process

The overall objective of this study was to conduct a rigorous and relevant evidence review in two key areas relating to e-cigarettes: firstly, a review of the demographics and characteristics of consumers of e-cigarettes, and secondly, a review of the consumption patterns of e-cigarettes by type of user and duration of e-cigarette use.

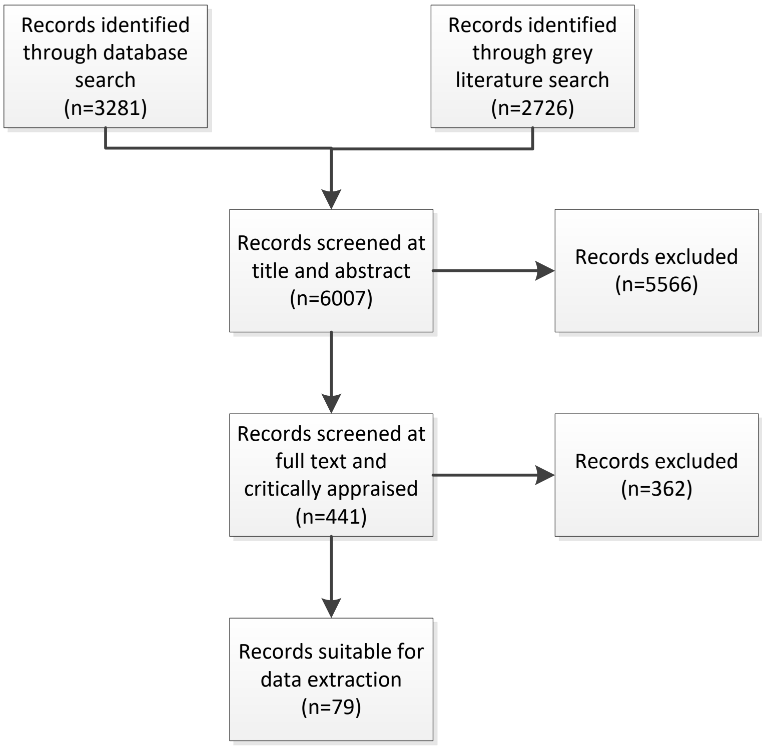
A REA provides a robust and transferable collation, review, and synthesis of relevant material in an efficient way. By following consistent criteria at each screening stage, assessing the suitability of literature for inclusion in the final report, a REA provides a systematically selected overview of the literature, applying a limited number of databases and adhering to a time-limited period. This is a tool specifically designed to inform policy research across central and local government. The process for conducting a REA is summarised at Figure 9:1[39]:

Figure 9:1 The process of conducting a REA



This section summarises the criteria and processes for determining the inclusion of studies, data extraction, and the synthesis of findings. Published and grey literature (research publications not issued by academic or commercial publishers) since 2008 were considered for inclusion. A summary of each stage is presented in Figure 9:2 below.

Figure 9:2 Process for REA



9.3.2 Screening and study prioritisation

Database searches

A systematic search of relevant databases and evidence repositories for published and grey literature was undertaken. Search strings were developed for application in academic databases (Appendix F). Searches were completed in five databases: Embase; Medline; Epistemonikos; Scopus; and the Cochrane Library. These five databases were selected to ensure the inclusion of a range of disciplines in the area of tobacco use. For example, while the majority of the literature was within the overarching health disciplines (e.g., epidemiology, public health, health promotion, and clinical treatment), appropriate literature was discussed in e.g., behavioural sciences, sociology, and economics. All these areas are well-represented in Medline, Embase, Epistemonikos and Cochrane Library, with the Cochrane Library specifically chosen for evidence relating to trials, systematic reviews and meta-analyses. To capture those mainstream social science journals which may have been excluded, searches were carried out within Scopus. This large multidisciplinary database indexes over 22,000 peer-reviewed journals and ensures inclusion of those papers potentially missed by the health databases.

A total of 3,281 papers were identified across these databases and included in title and abstract screening (see Figure 9:2, above).

Grey literature searches

A grey literature search was completed, applying a set of search terms (see Appendix G). The following websites were included:

- Action on Smoking and Health;
- Centers for Disease Control;
- European Health Observatory;
- Gov.uk;
- Grey Matters;
- ITC Project;
- NHS Digital;
- NICE;
- Office for National Statistics;
- Open-Grey;
- Smokefree Action Coalition;
- Smoking Toolkit.
- Society for Research on Nicotine and Tobacco;
- UK E-cigarette Research Forum; and
- WHO Regional Office for Europe.

A total of 2,726 papers were identified in these databases and included in title and abstract screening (see Figure 9.2, above).

Title and abstract screening

To be included in the study, academic literature, grey literature and other reports had to meet a number of inclusion criteria used at title and abstract screening (presented in Appendix H). Studies were reviewed by a single screener using Abstrackr software. Abstrackr enables the organisation of search results and uses machine learning to semi-automate citation screening by prioritising more relevant results. Papers were marked for inclusion, exclusion or for further review. Following screening in Abstrackr, a meeting was held with the full screening team to discuss and evaluate any papers which were marked for further review. In total, 3,281 studies were screened in Abstrackr and a further 2,726 were found online as part of the grey literature search.

Studies were evaluated in two stages. Firstly, studies were required to meet all of the following criteria:

- Published in the UK, the European Union,[xlviii] Australia, Canada, the United States of America, Norway and Switzerland;
- Included e-cigarettes, Electronic Nicotine Delivery Systems (ENDS), vape devices (vapes) or Juul as keywords; and
- Included at least one of the following methodologies: systematic reviews; quasi-experimental studies (including cohort studies and pragmatic trials); case studies; observational studies; representative population surveys; and qualitative research.

Secondly, studies had to meet at least one of the following criteria:

[xlviii] The screening took place in 2019 prior to the UK's departure from the European Union.

- Identified the consumers of e-cigarettes with reference to a defined set of demographic characteristics;
- Discussed health campaigns in relation to consumption of e-cigarettes;
- Discussed international or national policy in relation to consumption of e-cigarettes;
- Discussed the rates of consumption of e-cigarettes;
- Discussed the rates of consumption of e-cigarettes by the duration of use of e-cigarettes; or
- Discussed the rates of consumption by the following three groups of e-cigarette user: never-tobacco-smoker; dual user (tobacco smoker and e-cigarette user); former tobacco smoker.

Following title and abstract screening, all titles and abstracts were reviewed a second time by the project team to ensure consistency across all screening. Following this process, 441 relevant papers were included at full-text screening.

Full-text screening: a two-stage process

Stage 1: Substantive screening
Following a briefing on the use of the full-text screening criteria and a piloting of the full-text screening tool, reviewers used an Excel spreadsheet to score each of the 441 papers across 16 categories (Appendix I). The maximum score available for papers to achieve was 18, while the maximum score achieved was 12. All scores were reviewed by a second reviewer. All papers which scored 9 or above were included for weight of evidence screening. In total, 120 papers were included at weight of evidence screening.

Stage 2: Weight of evidence screening
Weight of evidence analysis is based on the approach first developed by the EPPI-Centre (Evidence for Policy and Practice Information and Coordinating Centre),[40] which has been applied in the analysis of both quantitative- and qualitative-based research. Weight of evidence analysis explores each individual source in terms of quality and relevance to the overarching research aims and objectives, while providing a score. Each study in this review was scored using a weight of evidence tool (Appendix J), based on:

- Relevance;
- Quality of design and methodology; and
- Whether the research paper meets its stated aims and objectives.

The maximum score available for papers was 12 and the maximum score achieved was 12. All scores were reviewed by a second reviewer. All papers which scored 8 or above were included for data extraction. In total, 79 papers were included.

9.3.3 Data extraction and synthesis

Data extraction was conducted using a data extraction template, (piloted and adjusted prior to use by the full team), to promote replicability and reliability at the review stage. The template contained themes drawn from the overarching research questions for this REA (Appendix K). Additional columns were included in the tool that enabled the summarising of data that may also be relevant to wider themes covered across this report. Each theme formed a component of a research question, against which data could be lifted from the evidence and summarised. After all relevant data had been extracted from the included studies, the results for each study were narratively synthesised against the research questions. A full list of papers included in this REA can be found in Appendix L.

9.4 Findings

9.4.1 Overview of included studies

Of the 79 papers taken forward for data extraction, the majority included data from the US only or the UK only. There was a total of eight papers which compared data from multiple countries (see Table 9:1). Of the papers, most were cross-sectional surveys or longitudinal surveys but there was also some evidence from qualitative studies, randomised control trials and mixed methods studies. The papers included were all published between 2015 and 2019. Most papers included were published in 2018 or 2019.

Table 9:1 Overview of included studies

Country of origin for data included	Number of papers
US	49
UK	10
Australia and New Zealand	3
Canada	4
Other EU countries	5
Comparison between EU countries	2
Comparison between Australia and the UK	2
Comparison between Australia, Canada, England and the US	4
Methodology	
Cross-sectional surveys	54
Longitudinal surveys	19
Randomised controlled trials	3
Qualitative studies	2
Mixed methods	1
Year published	
2019	22
2018	29
2017	16
2016	5
2015	7
Total papers	79

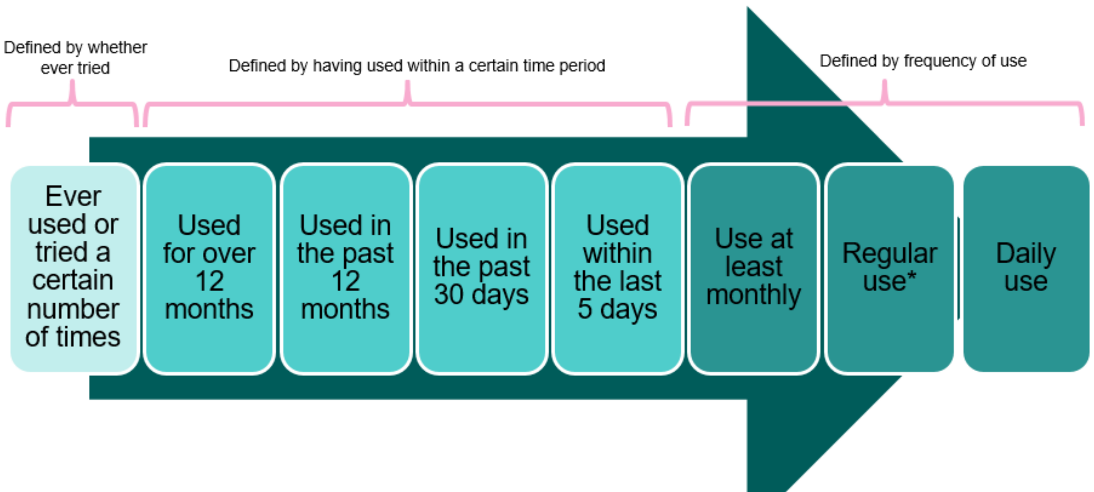
Within the body of evidence reviewed, some categories are better represented than others. In part, this is reflective of the evidence available, with some topics covered better by the literature. Of included papers, the majority examined patterns of product use (n=68) but fewer examined the impact of policies and health campaigns on patterns of product use (n=11). The included papers also examined a range of products. Most papers either had a sole focus on e-cigarette use (n=32) or examined both e-cigarette and cigarette use (n=30). Smaller numbers of papers looked at Electronic Nicotine Delivery Systems or ENDS use (n=4), Dual ENDS and cigarette use (n=3), JUUL use (n=2), vape device use (n=3), or the use of multiple other tobacco products including e-cigarettes (n=5).

9.4.2 Who are the consumers of e-cigarettes?

What are the demographic and socioeconomic characteristics of the consumers of e-cigarettes?

Studies defined e-cigarette consumers or users differently. Broadly, these definitions fell into three groups as shown in Figure 9:3: individuals who have ever used e-cigarettes, individuals who have used these within a defined time period, and individuals who use e-cigarettes with some degree of frequency. The use of different measures builds different pictures of the consumers of e-cigarettes. Therefore, to the extent that this information is available, the different measures applied will be referred to in the sections below.

Figure 9:3 Defining consumers or users of e-cigarettes



* Encompassing daily, occasional, weekly or "some days" use (daily is used only when this is not separated from other measures i.e. "daily or occasionally")

Age

A large number of studies reported on the prevalence of use of e-cigarettes by different age groups. Table 9:2 below summarises the findings between teenagers / adolescents and adults by ever use, use within a certain time period, and frequency of use.

Table 9:2	Defining consumers or users of e-cigarettes: by age	
	Teenagers / adolescents	**Adults**
Ever use	Older teenagers were more likely than younger teenagers to have ever used e-cigarettes. However, one study found that teenagers who initiated use of tobacco products through e-cigarettes tended to be younger than those who started by using other products.	The balance of the evidence suggested that younger adults were more likely to have ever used e-cigarettes than older adults. However, there was some discrepancy as to whether the youngest adult groups (including those in their teenager years and twenties) or slightly older age groups (those in their twenties and thirties) were the most likely to have ever tried e-cigarettes. Potential determinants of these patterns included advertising, flavouring and attitudes.
Use within a certain time period	Among teenagers, there was evidence suggesting that both older and younger groups were the most likely to have used e-cigarettes recently.	Younger adults - and those in their late teens - were more likely to be recent users than older adults. Despite tending to be the most likely to try e-cigarettes and to be recent users, younger e-cigarette users were not the most likely to maintain their use over a long period of time. Some studies found that likelihood of continued use increased with age, while others found this was most likely in middle (rather than the oldest) adult age brackets.
Frequency of use	One study found that daily e-cigarette users were more likely to be older, while non-daily users were more likely to be younger.	While there is some inconsistency in the direction of the evidence available, in the main, adults in the youngest or middle age brackets were more likely to smoke regularly, when this includes self-reported ‘daily’ and ‘occasional’ smokers. There was conflicting evidence as to whether older or younger adults were more likely to be daily users.
The relationship between age and different nicotine products	In studies looking at vaping and ENDS use among populations of tobacco cigarette smokers; young adult smokers were found to be more likely to vape or use ENDS and older adult smokers were more likely to be sole tobacco cigarette smokers	

Consumers defined by ever use
The balance of the evidence suggested that younger adults were more likely to have ever used e-cigarettes than older adults.[41–46] In each of these studies, young adults (with age ranges between 15–24 and 18–29) were the most likely to have ever tried e-cigarettes, with the likelihood decreasing as age increased. Similarly, Ruokolainen et al.[47] found that, in a study of those aged 15 and above, those aged 15–24 were the most likely to have tried e-cigarettes a couple of times, with the likelihood declining as age increased. In a study population of young people aged between 15–24 years, those who had ever tried e-cigarettes were more likely to be younger.[48,49] However, other studies have found that slightly older adults (25–39 year olds) were the most likely to have ever used e-cigarettes, more so than both younger and older age brackets.[50,51]

Factors highlighted to explain why younger adults tend to be more likely to try e-cigarettes include advertising, the appeal of flavourings, and attitudes towards acceptability of cigarette use. It has been argued that younger adults may be more receptive to e-cigarette advertising. For example, Agaku et al.[52] found that, while there was no difference in terms of exposure to e-cigarette advertising, receptivity is higher among those aged 18–24 than those in older age brackets. However, receptivity was lower for the 25–44 age bracket than for older adults. Younger adults may also be more receptive to the flavoured products, as younger adult groups were more likely than older adults to indicate flavouring as a reason for their e-cigarette use and to use flavoured products.[53,54] Acceptability may also play a role. Lee et al.[55] found that those under 40 were more accepting of e-cigarette use than those who were over 60, however this finding only applied to the UK. Conversely, in a qualitative study of young people in Scotland, 16–24 year olds felt that e-cigarettes were intended for older people to quit smoking, or for younger adolescents under 16 years.[56]

Older teenagers were more likely than younger teenagers to have ever used e-cigarettes. Among teenagers*,* Miech et al.[57] found that the likelihood of ever having used a nicotine vaporiser increased between school grades 8 and 12 (approximate ages between 14 and 18). These findings are echoed by Best et al.,[58] whose study population was comprised of 10–18 year olds, and who found that the older teenagers were more likely to have tried e-cigarettes or to intend to try this product in the next six months. Auf et al.[59] also found that teenagers (12–19 year olds) who initiated their use of tobacco products through e-cigarettes tended to be younger than those who started by using other products. However, the difference was not more than one year in age for use of any product and data relied on children remembering dates of initiation.

Consumers defined by the time period of use

Recent users
Younger adults and those in their late teens, were more likely to be recent users of e-cigarettes than older adults, however there was mixed evidence among teenagers. Younger adults between 18–29 were most likely to have used e-cigarettes in the past 12 months, with over 65s the least likely to report having used e-cigarettes in this time period.[41,60] Younger adults aged 18–39 were also more likely to have used e-cigarettes in the last five days compared to older age groups.[61] Both Vallone et al.[49] and Mehra et al.[48] studied younger age groups, (aged between 15–34 and 15–24 respectively), finding that 15–17 year olds were more likely to have used e-cigarettes recently than the older age groups. However, among teenagers, there was evidence suggesting that both older and younger groups were the most likely to have used e-cigarettes recently, with the measure tending to be self-reported use within the last 30 days.[59,62–65]

Long-term users
Despite tending to be the most likely to try e-cigarettes and to be recent users, younger e-cigarette users were not the most likely to maintain their use over a long period of time. Over a study period of three years, younger adults were less likely to maintain e-cigarette use compared to older adults.[50] Coleman et al.[66] also found that in a study of adults aged 18 and above, the youngest adult age group of daily e-cigarette users (18–24 years) were more likely to decrease their e-cigarette use than older groups, with the oldest group being 65+. This finding aligns with the study of Levy et al.[42] which found that the "*current-ever*" ratio, (i.e., the percentage of ever e-cigarette users who had used e-cigarettes in the last 30 days), increased with age. This means older adults were more likely to have continued using e-cigarettes. Similar findings were reported by Laverty et al.,[46] although the study authors applied different age ranges (15 and above with the oldest age range being 55 and over).

In contrast, some studies found that continued use was most likely in middle (rather than the oldest) age brackets. In a study of adults over the age of 16, Jackson et al.[67] found that those aged 35–54 were more likely to have used e-cigarettes for over 12 months than younger and older adults, with the oldest age bracket being defined as 65+. Atuegwu et al.[68] also found that across a three-year study period, "*longitudinal e-cigarette users*", (i.e., those who self-reported "*every day*" or "*some day*" use in all three years) were most common in the group aged between 25–34 in the first survey year, followed by the younger (18–24) and then older age groups up to 55+.

Younger people may be more likely to try different products and change their habits. Poly-tobacco use among current e-cigarette users was more likely among those aged 25–29 compared to those aged 18–24, however figures were higher for both younger groups than older age groups.[69] Johnson et al.[70] also found that high school students showed a greater range of patterns of tobacco consumption than young adults aged 18–24.

Consumers determined by the frequency or intensity of use

While there is some inconsistency in the direction of the evidence available, in the main, previous research highlights that adults in the youngest or middle age ranges were more likely to smoke regularly when this includes self-reported ‘daily’ and ‘occasional’ smokers. Younger adults were found to be more likely to be regular e-cigarette users when compared to older adults, when regular use was considered to be at least monthly.[71] Studies also found that the percentage of current e-cigarette users was highest in the youngest adult age groups (aged 18–24 years) and decreased with age when defining current use as daily or occasional.[44,72] However, other authors found the highest numbers of e-cigarette users to be in the middle age ranges when using similar measures (25–34 in Weaver et al.[51]; 35 to 54 years old in Patel et al.[53]; 24–44 years in Owens et al.[54]). In some studies, there was no clear pattern.[45,73]

There was conflicting evidence on daily use. Studies found that the likelihood of being a daily e-cigarette user increased with age between groups aged 18–24 and 65+,[74] and daily users tended to be older when compared to non-daily users (using age ranges between 18–24 and 65+).[60,75] However other studies found a higher prevalence of daily e-cigarette use in 25–34 year olds than younger (15–24) and older (up to 45–69) age groups,[47] or that younger adults were more likely to use e-cigarettes daily than older adults.[71,72,76] Chan et al.[77] also found that among smokers, vaping frequency was higher for younger ages. Among teenagers, Merianos et al.[78] found that daily e-cigarette users were more likely to be in grades 6 to 8 (aged approximately 11–13) than grades 9 to 12 (aged approximately 14–18), while non-daily users were more likely to be in grades 6 to 8.

Age and different nicotine products

In studies exploring vaping and ENDS use among populations of tobacco cigarette smokers, younger adult smokers were found to be more likely to vape or use ENDS and older adult smokers were more likely to be sole tobacco cigarette smokers. For example, two studies[79,80] found that among tobacco cigarette smokers, those who vaped, (regardless of frequency), were most likely to be 18–24 and 25–39 respectively, while tobacco cigarette smokers who did not vape were more likely to be 55 or over. This suggests that younger people may be more likely to use e-cigarettes to quit smoking. Benmarhnia et al.[81] found that "*quit attempters*" aged under 34 years were more likely to use ENDS with nicotine replacement therapy, such as patches or chewing gum, compared to older quit attempters who were more likely to use other pharmaceutical products. However, Jaber at al.[61] found that 15.1% of 18–39 year old e-cigarette users had never smoked tobacco cigarettes, in comparison to 0% of respondents aged 40 or older. This suggests that younger adult groups may also initiate nicotine consumption via e-cigarettes, and therefore, not solely use this device as a smoking cessation tool.

Conversely, other studies did not find age to be significant when comparing those who only smoked tobacco cigarettes with dual users[82] and comparing those who only used e-cigarettes with those who only smoked tobacco cigarettes.[83]

Gender identity and sexual orientation

Gender
The balance of evidence indicated that men were more likely to use e-cigarettes than women. However, this was contradicted by a more limited number of studies which showed either that women were more likely to use e-cigarettes than men or that there was no statistically significant difference.

Studies finding that men were more likely to use e-cigarettes than women used a variety of measures, (ever use, daily use, use in the past 30 days, past 12 months and longitudinal use across three years) and included adults and teenagers, and sole and dual users.[41,44,46,48,54,57,59–64,68,71,72,74,76,78,79,84–90]

A smaller tranche of studies found that women were more likely to be current or ever users[42,50,53,63] and to use e-cigarettes more frequently.[77] Studies also found that, among people with cardiovascular disease and cancer survivors, women were more likely to use e-cigarettes than men.[91,92]

Lastly, some studies found that gender was not significantly associated with e-cigarette use or frequency of use.[51,60,65,73,80,83,93]

Sexual orientation
Sexual and gender minorities were more likely to be e-cigarette users than heterosexual and cisgender individuals. Hoffman et al.[45] looked at the relationship between lesbian, gay, bisexual and transgender identity and e-cigarette use in the USA. Their sample was large (n=205,271), but not nationally representative. When controlling for factors such as health, age, ethnicity and socioeconomic status, it was found that based on self-reported "*ever*", "*daily*" or "*some-day*" use:

- Gay men were around 1.5 times more likely than heterosexual men to have ever used e-cigarettes;
- Bisexual men were around 1.2 times more likely to have ever used e-cigarettes and around one and a half times (1.5) more likely to use e-cigarettes daily or some days, compared to heterosexual men;
- Gay and lesbian women were around 2.2 times more likely to have ever used e-cigarettes than heterosexual women; and
- Bisexual females were over one and a half times (1.6) more likely to have ever used e-cigarettes than straight females.

Higher numbers of transgender adults also reported e-cigarette use compared to cisgender adults, however this was not found to be statistically significant.[45]

This study aligns with the findings of Weaver et al.,[80] who found that heterosexual participants were less likely to ever have used ENDS, and Mirbolouk et al.,[72] who found higher e-cigarette use among lesbian, gay, bisexual and transgender adults, when comparing those who used daily or occasionally.

Race and ethnicity

Studies considered a number of different racial and ethnic groups. However, as many of the studies were based in the US, they applied the United States classifications, which necessarily differ from those applied by the Office for National Statistics (ONS). The results described below focus on groups which are analogous to the ONS five ethnic groups. Those studies that were focused **solely** on Hispanic or Indigenous populations are excluded, as the experiences of both groups are not fully transferable to the UK context.

In the US and Canada, studies found that daily and regular use of e-cigarettes was more prevalent in White (non-Hispanic) participants than in racial and ethnic minority groups,[41,42,49,94] including in populations of teenagers.[62] Liu et al.[83] also found that e-cigarette users in their study were more likely to be White when compared to tobacco cigarette smokers. This was despite White people being found to be less receptive to e-cigarette advertising than other ethnic groups.[52] However, when comparing different levels of use, Sharapova et al.[75] found contrasting results: Asian e-cigarette users were the group most likely to use e-cigarettes daily; Black users most likely to use e-cigarettes some days; and Hispanic users the most likely to use e-cigarettes rarely.

A number of studies found that Black participants were least likely to report e-cigarette use,[45,49,61,65,85,87] and this finding remained true when controlling for age, sex and education.[70] It was also found that Black ever-smokers exhibited reduced likelihoods of exclusive vaping or e-cigarette use which suggests this group is less likely to switch to e-cigarettes exclusively.[43,90] However, a significant association was not always found between race and ethnicity and differences in prevalence.[51,73,95]

In the UK and Australia, findings were also mixed. Yong et al.[50] found that non-White ethnicities were more likely than those of a White ethnicity to have ever used an e-cigarette across the UK and Australia, while Best et al.[58] found that in Scotland, being of a non-White ethnicity increased the likelihood that a school aged child would have tried an e-cigarette, albeit that findings were not statistically significant. Conversely, Jackson et al.[67] found that long-term e-cigarette consumers were more likely to come from a White ethnic background in England and Conner et al.[96] found ethnicity not to be significant.

Health

Physical health

E-cigarette users tended to report more physical health conditions than non-users. Jackson et al.[67] found that long-term e-cigarette consumers were more likely to report having a disability than the wider population. Mirbolouk et al.[72] and Weaver et al.[80] found that e-cigarette and ENDS use was higher among those who self-reported chronic health conditions compared with those who did not. These conditions included cardiovascular disease, cancer, asthma, chronic obstructive pulmonary disease (COPD) and chronic bronchitis. Deshpande et al.[88] also found that e-cigarette use among asthmatics has been increasing over time and Stokes et al.[91] reported that 11% of participants with cardiovascular disease had ever used e-cigarettes. However, neither study compared such changes to (any) increased use among the general population, so findings are indicative of these groups only.

A number of studies also found an association between e-cigarette or ENDS use and poorer self-reported general health scores.[51,71] However, the data did not show whether poor health preceded and / or followed the take up of e-cigarettes. Those with pre-existing conditions may be more likely to take up e-cigarettes. However, use of these products (possibly alongside or instead of tobacco cigarettes) could also have negative impacts on health. For example, Bowler et al.[93] found that e-cigarette use in adults with, or at risk of, COPD was also associated with worse pulmonary-related health outcomes. In contrast, two papers suggested a lesser impact on health of e-cigarette use. Shahab et al.[97] found that over one-fifth (22.2%) of former smokers who were e-cigarette users had a recent illness compared to 37.8% of tobacco cigarette-only users and 19.4% of dual users. Similarly, Atuegwu et al.[68] found that the mean body mass index (BMI) for non-users of e-cigarettes and longitudinal users of e-cigarettes was similar.

Evidence comparing health between different types of smokers was mixed. When compared to tobacco cigarette smokers, higher percentages of e-cigarette users perceived their health as either being either excellent or poor, with more tobacco cigarette consumers perceiving their health as good.[82] However, other studies found no difference in actual or perceived health status between e-cigarette users and other smoking groups.[80,98,99]

Mental health
Studies found an association between mental health and e-cigarette use. A core limitation of these studies was that few considered if the condition preceded the e-cigarette use, limiting the conclusions that can be drawn on the direction of association. Spears et al.[100] found that study participants who reported having ever being diagnosed with a mental health condition and / or suffering from serious psychological distress in the past month had a higher prevalence of ENDS use compared to those who had not. There was also a positive relationship between the number of mental health conditions reported and use of ENDS.[101] Similarly, Chan et al.[71] and Park et al.[43] found that e-cigarette consumers and dual users were more likely to suffer from higher levels of psychological distress than non-users. Weaver et al.[80] also found that a higher percentage of ENDS users had ever received psychiatric or psychological therapy compared to non-ENDS users.

Some studies looked at specific mental health conditions and found that:

- All mental health conditions except schizophrenia were significantly associated with higher likelihood of lifetime and current ENDS use[100];
- Prevalence and intensity of e-cigarette use and vaping was higher in those with depression[41,45,72,77]; and
- ENDS use was significantly related to borderline and antisocial personality disorders as well as panic disorder.[41]

However, Friedman and Horn[90] found that while mental health was associated with tobacco cigarette and dual use, it was not associated with sole e-cigarette use.

Associations were also made between e-cigarette use and behaviours which may lead to increased risk of poor mental health. Studies found relationships between e-cigarette or ENDS use and high levels of alcohol and drug use.[41,45,60,61] Female adolescents who perceived themselves as overweight were also more likely than those who perceived themselves as normal weight to be current electronic vapor product users. However, the same relationship was not found for male adolescents or for dual users or tobacco cigarette smokers.[85] In addition, after adjusting for socio-demographic variable and smoking status, it was also found that e-cigarette users were more likely to report that they had experienced childhood psychological abuse, physical abuse or sexual abuse.[102]

Socioeconomic status

Education
Traditionally, a negative relationship has been found between smoking and education, with those with the highest education attainment being the least likely to smoke. However, findings in this REA have been contradictory, with studies finding evidence to both support and oppose the theory that there is a negative relationship between e-cigarette use and highest educational attainment.

For example, a number of studies found that those with lower levels of education, (in particular, those without a university education), were more likely to be e-cigarette or ENDS users.[51,61,91,92] This may be because exposure and receptivity to e-cigarette advertising was highest among those with less than a high school education and lowest among those with at least a college degree.[52] Among e-cigarette users, it was also found that daily or almost daily use was also most common for those with a "*basic*" or unknown education compared to those with an "*intermediate*" education or a "*high education*" (terms not defined).[47] However, Friedman and Horn[90] found that, although there was a small negative relationship between education and exclusive e-cigarette use, this was statistically insignificant in contrast to stronger negative relationships between education and both dual use and tobacco cigarettes. The relationship was strongest for tobacco cigarettes.

Other studies have found that those with higher levels of education were more likely to have tried e-cigarettes or vaping and to vape more frequently than those without a higher level of education.[46,77] For example, those with university level education and above are more likely to use e-cigarettes or ENDS than those with only a high school education.[41,67,86] Lopez et al.[94] also found that non-pregnant women between 15–44 who had at least a bachelor's degree were more likely to use e-cigarettes than those without a bachelor's degree. However, Yong et al.[50] and Levy et al.,[42] found that ever use of an e-cigarette was most likely to be seen in those who had achieved some level of education, but not the highest levels (i.e., high school degree or other "*medium*" level of education). Finally, two studies found education level not to be significant in relation to e-cigarette use.[76,95]

There was also conflicting evidence on whether the type of school impacted on the likelihood of e-cigarette use. In Canada, it was found that a higher prevalence of students in schools in both a high and a low socioeconomic area compared to a middle socioeconomic area were likely to have ever consumed e-cigarettes.[62] However, in Germany no association was found between whether a child went to a Gymnasium, a selective academic school, and their use of e-cigarettes.[103]

Evidence on whether e-cigarette users were more likely to be highly educated than tobacco smokers was also mixed. Liu et al.[83] found that most of the e-cigarette only users in their study had received some sort of post-secondary education (57.1%) while most of the tobacco cigarette smokers had not received this (59.3%) with similar findings reported by Park et al.[43] Conversely, Nayak et al.[82] found that a higher proportion of tobacco cigarette smokers had received both a high school and a university education, when compared to dual users.

However, studies suggested that tobacco smokers who switched to e-cigarettes were more likely to be more educated.[90,98] For example, among "*ever-smokers*" only (those respondents who had smoked at least 100 tobacco cigarettes in their lifetime), higher education was positively associated with exclusive e-cigarette use suggesting that "*more educated smokers are more likely to switch to exclusive e-cigarette use than less educated smokers*".[90 (p1363)]

Income level or economic position

As with education, traditionally a negative relationship has been found between tobacco cigarette smoking and income.[90] In alignment with this, some studies found a negative relationship between e-cigarette use and income, with income found to be lower among groups of e-cigarette and ENDS users when compared to the wider study population, i.e., all those who did not use e-cigarettes, which could include smokers of other tobacco products.[41,51,60,61] However, a number of studies[73,76,90] found that, although there was a small negative relationship between income and exclusive e-cigarette use, this was statistically insignificant, in comparison to stronger negative relationships between income and both dual use and tobacco cigarettes. As with education, the negative relationship was strongest for tobacco smokers.

Studies exploring young people's adherence to particular brands found positive relationships between e-cigarette user and income or affluence. Vallone et al.[49] found that greater financial comfort was significantly correlated to the use of one particular brand, JUUL. Studies looking at children and young people also found positive relationships between household socioeconomic status and e-cigarette use. Young children scoring higher on the family affluence scale were more likely to have tried e-cigarettes[58] and 12th grade students (aged 17–18) who had at least one parent who had achieved a university degree were more likely to have last vaped using nicotine compared to those whose parents did not have a university degree.[57] However, other studies found that maternal education and family affluence were not significant.[96,104]

There was mixed evidence on whether income was correlated with intensity of use. Chan et al.[71] found that current e-cigarette consumption was not associated significantly with socioeconomic area, but daily users were more likely to be from the least advantaged area. This aligns with the study of Levy et al.,[42] who found that regular e-cigarette use was higher at lower incomes, with Kyriakos et al.[105] finding daily or weekly e-cigarette use was higher for participants who did not report difficulties paying bills compared to those who did have difficulty. In contrast, income was not found to be significant by Roberts et al.[60] when comparing non-daily and daily users.

Studies comparing tobacco cigarette smokers and e-cigarette users found that e-cigarette users were likely to be more affluent. Liu et al.[83] found that almost one-third of tobacco cigarette smokers were below the poverty level in comparison to less than one-sixth of e-cigarette only users. Such findings were supported by two further papers[77,79] which found that smokers who did not vape were more likely to have a low income compared to daily and non-daily vapers. While this may be due to differences in price, Robertson et al.[106] found that some participants in New Zealand reported that they started consuming ENDS to help reduce the financial burden associated with smoking cigarettes after smoke-free policies were adopted, which raised cigarette costs.

Qualitative fieldwork from one study provides a wider context to these findings. In qualitative interviews with young people from disadvantaged backgrounds, Lucherini et al.[56 (p85)] found that *"many described the everyday stress of their lives, usually due to their precarious working and living circumstances"*, and valued tobacco cigarettes as stress relievers. However, e-cigarettes were not perceived as being able to relieve stress in the same way that a tobacco cigarette could. Many participants therefore did not use e-cigarettes when they were stressed. A further factor which emerged in the same study was cultural norms, with the authors finding that while tobacco smoking was accepted and normalised within this group, vaping was not. It was argued that this was partially due to perceptions of vapers as being less in control of their habits.[56]

Employment and occupation

There was mixed evidence on whether employed or unemployed people were more likely to use e-cigarettes. Hoffmann et al.[45] found that those who were unemployed were more likely to use e-cigarettes than those who were employed, students, retired or homemakers. Ruokolainen et al.[47] also found that daily or almost daily use was most common among unemployed participants. However, Chan et al.[71] found that e-cigarette current and daily consumers were more likely to be employed, or looking for work, compared to not looking for work. While Weaver et al.[80] found that the most common employment status of e-cigarette users was working as a paid employee, they also found that a further population group, not-working disabled, were likely to be ENDS smokers. Different types of occupations were linked with e-cigarette use. Jackson et al.[89] found that long-term consumption of e-cigarettes was more likely in "*higher social grade*" roles (i.e., managerial and professional occupations).

Studies did not distinguish between those who had been unemployed for shorter and longer periods, therefore no consideration could be given to impacts of long-term unemployment.

Location
Evidence on the geographical location of e-cigarette users was mixed. In the USA, studies found that the likelihood of being an e-cigarette user was higher in metropolitan or urban areas.[42,54] However, Chou et al.[41] found that lifetime ENDS use was slightly higher in rural populations. When studying a population of teenagers, Noland et al.[65] found that among current tobacco cigarette smokers, those attending urban schools were 86% more likely than rural students to also be current e-cigarette users, however among non-smokers, urban and rural students were equally likely to use e-cigarettes.

In Canada, smokers reporting current and non-current e-cigarette use were more likely to be from urban living areas than rural.[63] However, when studying teenagers, Montreuil et al.[62] found that e-cigarette use was more common in rural areas. No significant relationship was found between urban or rural location and e-cigarette use in Finland.[47]

Family and friends

Smoking habits of family and friends
In young people, having a family member or friend who used e-cigarettes or tobacco cigarettes was found to be associated with e-cigarette use, tobacco cigarette use, and dual use.[84,96,103,107,108] This may be because, the more family and friends one has who use regularly, the more likely one is to see e-cigarette use as socially acceptable.[55] However, while it could be assumed that parents, (although not siblings or friends), smoked prior to the young person taking up smoking, this cannot be confirmed from the data available. This finding was also only significant in Australia, not in the UK.[55] Among adults, having family and friends who do not smoke may encourage people to take up e-cigarettes as a cessation aid. Former smokers who were e-cigarette only users had the lowest proportion of family members or friends who smoked compared to cigarette-only users and dual users.[97] However, this study population was small (n=181) and not representative.

Household factors
There was an association between household smoking and e-cigarette use in young people and adults. Among teenagers and young adults, household e-cigarette use was found to be associated with lifetime, current and ever use of cigarettes.[49,59,65,87] In particular, Noland et al.[65 (p1241)] found that *"participants who lived with an e-cigarette user were 276% more likely to have used the product in the last 30 days"*. Household use of conventional tobacco products was also found to be associated with e-cigarette use.[48,59] Among adults, Agaku et al.[52] found that those reporting another smoker in the house were more likely to report e-cigarette use, and that exposure to e-cigarette advertising was significantly higher among those who lived with a smoker in the house compared to those who did not. Longitudinal adult e-cigarette users were also more likely than never users to have a history of second-hand exposure to tobacco smoke, again suggesting they are more likely to have spent time around people who smoke.[68]

Findings were mixed as to the association between smoking patterns and the presence of children in the home. For example, one study found that current e-cigarette users were more likely to not have any children in their household than to have children.[53] Dual users were more likely than those who only used tobacco cigarettes to report having children under 18 in their household.[82] This may mean that smokers with children are more likely to use e-cigarettes as a safer alternative to tobacco cigarettes, or as a cessation aid. However, Jackson et al.[67] found that long-term e-cigarette use was less prevalent among cigarette smokers with children in the household. It was not clear from this study if this was because those with children had quit smoking altogether or returned to smoking tobacco cigarettes. However, other studies found no relationships between presence of children in the household and ENDS use[51] or different smoker type.[80,98] The impact of children on smoking behavior may depend on wider factors. For example, Patel et al.[53 (p16)] found that *"consideration of others"* was more likely to be a reason for e-cigarette use among those with a university education than those without.

Marital status
Associations were found between marital status and e-cigarette use. Studies found that e-cigarette use was more closely associated with those who had never been married, or who are divorced, widowed or separated, than with married people.[41,42,61,71] Park et al.[43] found this relationship to be consistent across different smoker types. In contrast, other studies found no significant relationship between e-cigarette use and marital status.[47,73,76,80,95]

9.4.3 Which national policies and / or health campaigns have been the key drivers of changes (if any) to the consumption patterns for e-cigarettes?

As outlined in the previous section of this report, there are a number of demographic and socioeconomic characteristics that are associated with the use of e-cigarettes. However, further factors may have a role in shaping their consumption and how their use is perceived. These depend on national policies (including taxation and pricing), health campaigns and advertising regulation, which interact with each other and with a number of other factors at different scales (for example, individual characteristics and sociocultural environments). Regulatory approaches differ from country to country and their main differences can be understood in terms of how restrictive their policies are on tobacco and e-cigarettes. A number of policies also have a cross-national foundation, such as European Union directives, and their effects seem to vary from country to country as a result of the interaction with national regulations and contexts. A further aspect linked to the differences between regulatory environments is the effects that different tax regimes and price policies have on the use of e-cigarettes, particularly with regard to smoking reduction and cessation, as well as vaping initiation.

Regulatory approaches, together with health campaigns and advertisements, also seem to have a role in shaping the perception of vaping and the use of e-cigarettes in public spaces. The magnitude of their role, or any long-term results are not, as yet, clear. As we have highlighted, various other factors are at play in this context and they are intertwined with how policies and campaigns impact on individual (or population) behaviours.

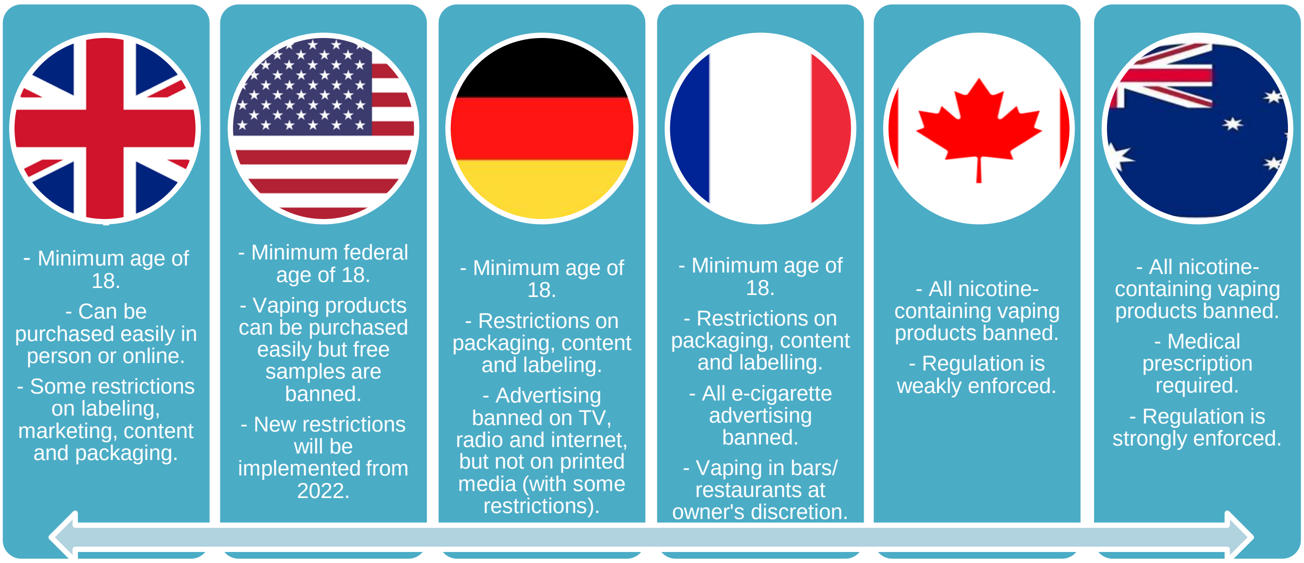
National regulatory approaches

The regulatory landscape regarding the use and commercialisation of e-cigarettes is diverse, and it spreads on a continuum that goes from more to less restrictive approaches (Figure 9:4). Restrictive approaches may include the ban on the sale of e-cigarettes and vaping liquids, or other restrictions such as allowing the sale of vaping products only under the condition of being prescribed by doctors as smoking-cessation treatment. Other restrictions may include plain packaging of vaping products or advertising bans. Less restrictive approaches would instead allow the use of branded packaging and the sale of vaping products in dedicated (i.e., vape shops) and generic (e.g., supermarkets) outlets. Less restrictive actions may also include the possibility for manufacturers and retailers to advertise vaping products with fewer limitations. The main differences and similarities between national regulatory approaches can be summarised as follows[xlix]:

- The 2014 European Union Tobacco Products Directive (EU TPD) is mainly aimed at reducing health risks linked to the use of tobacco and nicotine-containing vaping products by improving the packaging and labelling of these products (e.g., plain packaging, warning messages), and defining new rules for cross-border sales and marketisation of new products[105,109];
- Australia and Canada ban the sale of nicotine-containing vaping products, and are thought to have the most restrictive regulations among countries[79,110]; and
- In the USA, the approach began changing in 2016 since the regulation of all tobacco products became the responsibility of the US Food and Drug Administration (FDA).[52,74,111] The USA presents a somewhat heterogeneous picture owing to the relative autonomy of each single state with regard to taxation and health initiatives.[42]

Figure 9:4. presents the regulatory status for each country or union, with the spectrum indicating less restrictive to more restrictive policies from left to right.

Figure 9:4 Continuum describing the restrictiveness of regulatory approaches on vaping products, based on minimum age of purchase of e-cigarettes and availability



National regulatory approaches – Left: less restrictive; Right: more restrictive

The approach pursued by the European Union with the EU TPD, published in 2014 and implemented by member states between 2016 and 2017, focuses on the reduction of risks for users and non-users who may be at risk if they come into contact with vaping products, e.g., children,[105] and on providing the member states with the necessary guidelines for national policies on tobacco products (European Parliament, 2014).[109] European Directives require EU members to achieve specific objectives or goals within certain timeframes. However, each state can decide how they achieve these goals, by devising and implementing their own laws and policies. The specific characteristics of this directive are due to its cross-national nature: the EU TPD mainly specifies the norms to be followed when new tobacco products are launched in the EU, and cross-EU-border rules for the sale of tobacco products. There are also a number of required features for all vaping products containing nicotine, for example, child-proof containers,

[xlix] Further details of legislation referred to in this section can be found in Appendix A.

warning labels, informational leaflets, maximum concentration of nicotine allowed in vaping liquids (20mg/ml), and new technical specifications to avoid spilling and leaking.[109] The European Commission has also suggested that future research should focus on the assessment and reduction of risk caused by customised use of vaping products, such as mixing of vaping liquids and modifications to the voltage of vaping devices,[105] which may cause unexpected toxicity or other health hazards.

National regulatory frameworks, as discussed, can be classified based on the restrictiveness of their policies. At one end of this continuum are those policies implemented in e.g., Australia,[110] where regulations forbid the sale of vaping liquid containing nicotine unless this is prescribed by a doctor for the purpose of smoking cessation.[71] Australian regulatory authorities only allow the sale of devices and vaping liquids without nicotine, with the exception of one state where the sale of all devices and vaping liquids are also banned.[55]

A similar approach to e-cigarette regulation is observed in Canada[79,110] where the sale of e-cigarettes, both liquids and devices containing nicotine, is banned. However, contrary to Australia, the implementation of the ban in Canada has been weak,[79] and in 2019, Canadian regulators were discussing new laws that would allow the retail sale of nicotine-containing vape products.

As highlighted by O'Connor et al.,[111] in countries such as Australia the restrictions are circumvented by purchasing nicotine-containing vape liquid online. The role played by the internet in helping vaping users avoid national restrictions had been highlighted in a paper six years previously,[112] [l] which found that people in Canada and Australia were aware of and using nicotine-containing vaping products, despite national vaping bans. The authors observed that those respondents who completed their survey online were also more likely to be aware of vaping products than the respondents who completed it over the phone: suggesting that there may have been an association between experience in the use of the Internet and awareness of vaping products.[112] Furthermore, in Canada, the weaker implementation of vaping regulations means that manufacturers of vaping devices have been able to launch products, with enforcement of vaping regulations targeted primarily at dual manufacturers of tobacco and vaping products.[111]

The USA has adopted a less restrictive regulatory approach that allows vaping products to be sold and advertised without specific constraints.[110] However, from 2016 all tobacco products, including e-cigarettes, have been placed under the regulatory authority of the US FDA. According to Coleman et al.[74] this change of regulatory authority will require a more detailed knowledge of the effects of e-cigarettes on health in the near future if further decisions on product regulation are to be undertaken. Some greater restrictive practices are being introduced in the US with, for example, the FDA imposing a ban in 2016 around the sale of vaping products to minors and the distribution of free samples.[111] O'Connor et al.[111] also highlighted that the regulatory authority is planning to enforce further regulations on e-cigarettes from 2022, such as a ban on flavoured e-cigarettes. Lastly, each single state within the Union has some room for manoeuvre with regard to taxation of tobacco products and tobacco control initiatives.[42] This adds a further layer of complexity to the American landscape that should be considered when discussing its regulatory approach to e-cigarettes.

Finally, several authors placed the UK at the least restrictive end of the continuum.[50,55,110] Yong et al.[50] reported that in the UK, the sale of nicotine-containing vape products is allowed with few restrictions in terms of content, marketing and

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[l] This paper is cited here because it provides valuable insights that fill a gap in the evidence of how internet access influences e-cigarette use. It was not among the 79 papers formally included using the REA protocol, owing to a lower Weight of Evidence Score, but has been included here as an additional relevant paper.

labelling. These restrictions in place are a consequence of the EU TPD introduced in 2014,[50] which came into effect from May 2016.[55] In addition to a less restrictive approach to regulation, England was also the first country in the world to encourage the use of licensed e-cigarettes for harm reduction in the treatment of tobacco dependence.[50]

Effects of regulation on e-cigarette use and perception

Social acceptability

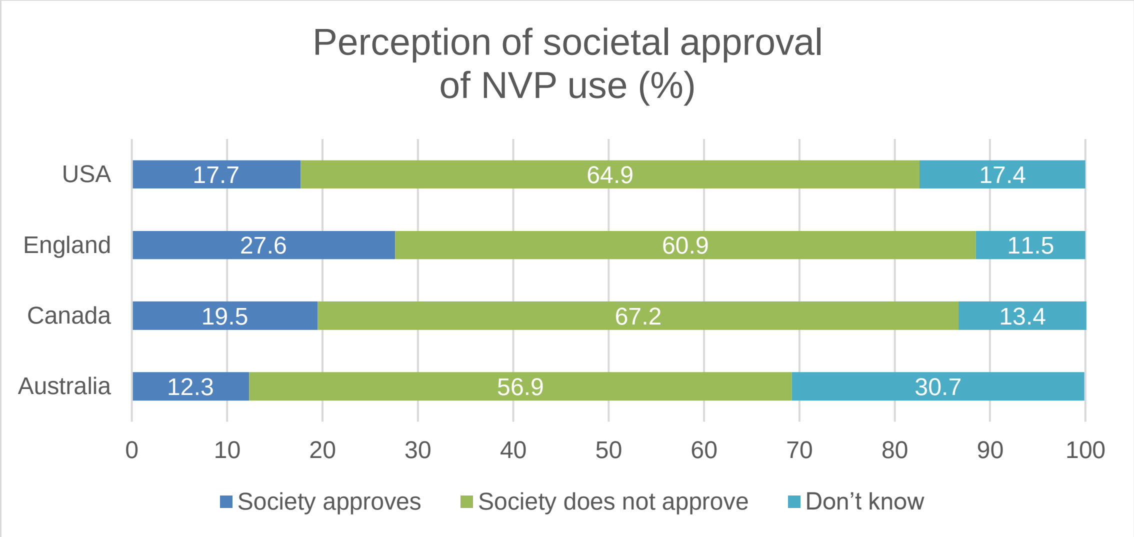
One key area of research in this study is identifying whether national policies have an impact on e-cigarette use by decreasing the social acceptability of using e-cigarettes in public. Using the continuum described above as a framework (focusing on whether policies are more or less restrictive), the main finding is that the perception of social acceptability of e-cigarettes is to some extent linked to the national regulatory environments.[111] For example:

- More restrictive regulatory approaches may reduce the odds of seeing vaping as socially acceptable[55];
- However, other confounding factors may intervene and affect the outcome of new and existing regulations. For example, Aleyan et al.[110] identified low levels of social acceptability of vaping in the USA, despite the less restrictive regulatory approach adopted in that country. The authors' assumption was that in this specific case, the American media had negatively influenced the public's view on e-cigarettes[110]; and
- More restrictive regulations may also be associated with a less frequent exposure to vaping owing to a reduced number of opportunities to use e-cigarettes.[110]

O'Connor et al.[111] argued that it is possible that the restrictiveness of national policies has an impact on the way e-cigarettes are used and perceived. Analysis performed by Lee et al.[55] on the results of the Australian and UK responses to the International Tobacco Control Four Country project (ITC4, 2014 Wave) showed different perceptions of social acceptability of vaping in the two countries. In the UK, over half of respondents (56.4%) perceived vaping in public as acceptable in comparison to just over one-quarter (27.9%) of respondents. The authors argued that less permissive regulatory environments are linked to lower social acceptability of vaping when compared with more permissive ones.

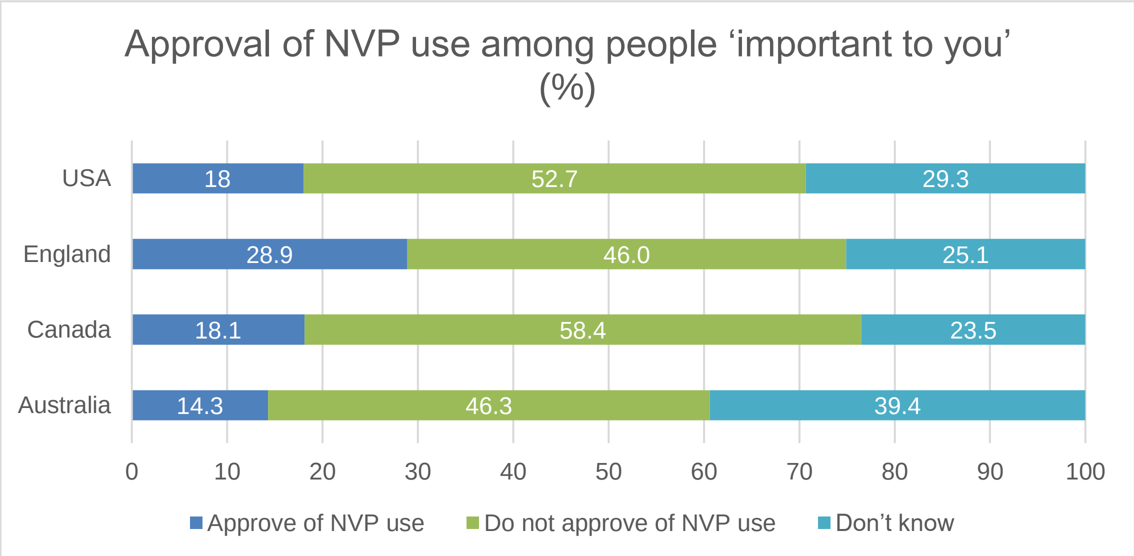
This conclusion is partially called into question by the results of the analysis of the 2016 wave of the ITC4 carried out by Aleyan et al.[110] On this occasion they analysed data from all four countries (Australia, Canada, England and USA). While they confirmed the difference between the social acceptability of vaping perceived in England and in Australia, (in England 27.6% of respondents thought that society approved of vaping and 28.9% perceived that people who were important to them approved; in Australia the two percentages were respectively 12.3% and 14.3%), they also found that the perception of social acceptability in the USA, a country with a regulation framework comparable to the UK, was similar to that observed in Canada and Australia (see Figures 9:5 and 9:6), two countries with more restrictive legislations on vaping. The authors found that the percentage of respondents in the US who perceived that society approved of vaping was 17.7%. A comparable proportion (18.0%), also perceived that people important to them approved of their use of nicotine-containing vaping products. In Canada these percentages were respectively 19.5% and 18.1%.[110]

Figure 9:5 Distribution of the respondents' answers regarding their perception of the societal approval of vaping



* Data from Aleyan et al. (2019).[110]

Figure 9:6 Distribution of the respondents' answers regarding their perception of the approval of vaping by people they consider important, such as friends and relatives



* Data from Aleyan et al. (2019).[110]

This variance was explained by the authors as dependent on the role played by the media and health organisations in informing people's world views; the negative depiction of vaping common in the US media was considered the most likely explanation of the US respondents' perception of vaping when compared to the UK respondents.[110] This negative approach adopted by the US media was not observed in the UK, where nicotine-containing e-cigarettes were also included by public health authorities among the allowed methods of harm-reduction or of cessation for smokers.[50,110]

A further finding by Aleyan et al.[110] regarded the more frequent exposure to public use of vaping products especially observed in England, but also in the USA and Canada, when compared to Australia. The authors suggested as a likely explanation that more restrictive norms are associated with less opportunities to vape in public, which would explain the less frequent exposure to vaping in public spaces observed in Australia.[110]

Public spaces

The social acceptability of vaping may also be linked to the differences in use in public spaces observed in countries with different regulatory approaches. The main findings can be summarised as follows:

- In Australia, a country with a restrictive regulatory approach, the percentage of respondents who felt comfortable smoking in public spaces was lower than in the UK where the regulatory approach is less restrictive.[55] This difference may be due to both regulatory environments and social expectations[55];
- In the UK, almost half of the e-cigarette users who took part in the research of Sherratt et al.[113] would also use vaping devices in places where they would not normally smoke cigarettes; and
- In the USA, the ban of cigarettes on worksites seems to be associated with a less frequent use of e-cigarettes; while the ban of e-cigarettes on worksites does not seem to affect the prevalence of regular users.[42]

Lee et al.,[55] in analysing the data from the Australian and UK portions of the ITC4, observed different attitudes towards vaping in public and in smoke-free public spaces in the UK and Australia. In the UK, 57.7% of vapers felt comfortable with vaping in public compared with 47.5% in Australia. The difference between these two countries was even more pronounced when comparing the attitude towards vaping in smoke-free spaces: in the UK 33.9% felt comfortable in this situation, compared to only 13.2% of respondents in Australia. Lee et al.[55] suggest that this may be linked to the social acceptability of vaping, which they assumed was caused by a more restrictive regulatory environment in Australia, but also linked to the vapers' fear of contravening prohibitions and social expectations already associated with tobacco smoking.

Further research in the UK with a small sample (n=319) of current and recent ex-smokers between 18 and 60 years of age[113] found that 46.4% of respondents used e-cigarettes in locations where they would not normally have used tobacco cigarettes (for example, shops, pubs, at work, on public transport, and so on). The authors suggested that this may be the consequence of the perception of e-cigarettes vapour as less harmful than tobacco smoke, as well as the legal status of e-cigarettes in the UK.

In the USA, Levy et al.[42] found that respondents in states with stricter worksite cigarette bans had a lower regular use of e-cigarettes. In states which also banned e-cigarettes on worksites, the prevalence of regular users was similar to other states without any worksite e-cigarette ban. However, the prevalence of ever users was generally lower than in other states without a worksite e-cigarette ban.[42]

Smoking and vaping reduction and cessation

This research also examined the role played by national regulatory approaches regarding the reduction and cessation of smoking. The main findings can be summarised as follows:

- New policies and health campaigns can potentially reduce the prevalence of smokers and e-cigarette users, as well as raise awareness of the health risks of smoking and vaping[114];
- However, a reduction of the number of e-cigarette users may also be linked to an increment in the prevalence of smokers.[86] This aligns with the use of nicotine-containing vaping products as a smoking reduction tool, as hypothesised by Heckman et al.[79]; and

- More restrictive regulatory approaches seem to have an effect on the low prevalence of e-cigarette users in Australia, but not on the increasing trend of use;[50] suggesting the existence of alternative supply channels.[50,111]

El-Khoury et al.[114] observed in their analysis of the DePICT survey (Description des Perceptions, Images, et Comportements liés au Tabagisme) that stricter control regulations had a positive impact on smoking and vaping reduction. The authors assessed the effectiveness of new policies, such as plain packaging, graphic warnings, smoking cessation campaigns and other tobacco control policies, on the French population. This study, as well as the new policies and campaigns, were focused on both cigarettes and e-cigarette users. The authors found that the new policies coincided with a reduction in the number of smokers and e-cigarette users. In particular, e-cigarette use reduced from 3.9% of the population in 2016 to 3.0% in 2017. The reduction in the prevalence of e-cigarette users was interpreted as positive given that the use of e-cigarettes may be linked to an increased relapsing risk for former smokers.

Australian laws on e-cigarettes are seemingly having an impact on the prevalence of vaping, given the low percentage of e-cigarette users found by Chan et al.[71] when analysing the data from the 2016 wave of the National Drug Strategy Household Survey (NDSHS). The authors estimated that only 1.2% of adult Australians were e-cigarette users, and just 0.5% were daily users.[71]

However, when exploring the behaviours of Australian tobacco smokers, there is an indication that the prevalence of use is higher. For example, one study[50] that compared Wave 8 (2010) and Wave 9 (2013) of the International Tobacco Control Survey identified an increase in vaping prevalence among former and current tobacco smokers. Among former and current smokers, the prevalence of ever users of e-cigarettes increased from 2.2% to 19.7%, and the prevalence of current users from 0.6% to 6.6%. Although referring to slightly different groups of respondents, Chan et al.[71] reflected these findings, identifying that among respondents who had smoked during the year before the survey (2016 Wave of the NDSHS), 25.7% had tried vaping at least once, 2.7% were non-daily vapers and 1.6% were daily vapers.

Within the same period, the increase appears higher in the UK. Among former and current smokers, the prevalence of ever users of e-cigarettes increased from 9.6% to 39.9%, and the prevalence of current users from 4.5% to 18.8%.[50] In analysing these data Yong et al.[50] described the influence of the normative environments as the most plausible cause of the differences between Australia and the UK. However, these differences in prevalence were not observed in relation to the trends of increased awareness and use of e-cigarettes. That is, the differences in regulation may have determined a different prevalence between the two countries but they did not hinder the increasing use of e-cigarettes in Australia. The authors' assumption was that the demand for nicotine-containing vaping products was supplied by a growing black market,[50] which would be in accordance with what O'Connor et al.[111] suggested about the use of online channels in Australia for the purchase of vaping products containing nicotine.

Taxation and pricing

Only a limited number of studies were identified as assessing the effects of pricing and taxation on the use of e-cigarettes. Their findings can be summarised as follows:

- The regular use of e-cigarettes in the USA is higher in states with low cigarette taxes and low levels of tobacco control spending[42];
- Directly taxing e-cigarettes does not seem to reduce the regular use of these devices[42];

- In one four-country study, the use of e-cigarettes by non-daily tobacco smokers seemed to have an influence on the decision to stop using tobacco when its price increases[79]; and
- In the same study, non-daily tobacco smokers who were daily vapers were found to be more frequently former smokers and more motivated to quit smoking. Heckman et al.[79] assumed that these respondents were former daily smokers who were using e-cigarettes as a way to reduce, and possibly quit, smoking.

Levy et al.[42] analysed the results of the May 2014 Tobacco Use Supplement-Current Population Survey (TUS-CPS) against the data on taxes and tobacco control spending in each state obtained via the CDC STATE System, an application created by the Centers for Disease Control and Prevention (CDC) to show state-level data on tobacco. The authors observed a higher prevalence of regular users of e-cigarettes in states with low cigarette taxes and with low tobacco control spending, while taxes on e-cigarettes did not seem to affect their regular use.[42] Moreover, the authors found that the use of e-cigarettes in states where the tobacco control spending is high is associated, although weakly, with lower levels of e-cigarette use in current smokers.[42] Levy et al.[42] hypothesised that this phenomenon may be due to the respondents feeling discouraged from switching or having already transitioned to e-cigarettes some time ago.

With regard to pricing, Heckman et al.[79] conducted a price experiment with smokers in four countries (Australia, Canada, England and the United States). This experiment asked tobacco smokers whether they would purchase cigarettes at different prices and assessed whether this was associated with the use of e-cigarettes. They found that e-cigarette use only had an influence on decisions made by the group of non-daily smokers, while they saw only a small difference in the group of daily smokers.[79] These results were reflected by Robertson et al.[106] which implied that imposing higher prices on tobacco products, as well as increasing the number of smoke-free areas, would push more smokers to stop using tobacco, increasing the number of e-cigarette users.[106]

Heckman et al.[79] also identified that respondents who were non-daily smokers but frequent vapers, were more likely to accept higher costs of cigarettes during the pricing exercise. While the authors suggested that this may indicate an increased risk of becoming daily smokers, an alternative explanation put forward was that vaping is the first step for a number of smokers to transition to non-daily smoking. This latter interpretation seemed to be aligned with a further finding of their study. That is, non-daily smokers who were also daily vapers showed a higher motivation in quitting smoking, and were more frequently former daily smokers.[79] The authors' conclusions were that vaping was used by these respondents as a smoking replacement tool, and that the availability of nicotine-containing vaping products was linked to their chances to avoid relapsing to pre-vaping smoking levels.

Effects of advertisement and health campaigns on e-cigarette use and perception

Public health campaigns

As discussed above, El-Khoury et al.[114] assessed the effects of new tobacco control policies, implemented in France after 2016, on the use of nicotine containing products, including e-cigarettes. These policies also included some health campaigns aimed at encouraging smokers to quit smoking, such as 'Stoptober', which invited smokers to quit smoking for the whole month of October. This was a national campaign carried out with the collaboration of pharmacies throughout the whole country, resulting in more than one million visits to a dedicated website.[114] The authors did not measure the effects of each component of the new policies, but they found that their general effect was a reduction in the prevalence of smokers and vaping users.[114]

Other findings with regard to public health campaigns can be summarised as follows:

- Health campaigns on smoking reduction and cessation should consider risk and benefit perceptions of the general public, as well as positive and negative effects[115];
- The main affects (feelings, emotions and moods caused by specific stimuli) associated with tobacco smoking in non-smokers and former smokers were strongly negative; while negative affects were less commonly associated with e-cigarettes[115]; and
- Information which is pro e-cigarette, including medical informative material on smoking cessation, may further promote vaping initiation in individuals who already show vaping intention.[116]

Popova et al.[115] suggested that to maximise their effectiveness, new campaigns have to focus on affects, together with risk and benefit perceptions. Affects are defined by the authors as those feelings, positive or negative, associated with e.g., objects and situations. Their conclusions, (based on the analysis of data from the Tobacco Products and Risk Perceptions Survey 2015, TPRPS), found that cigarettes were commonly associated with strong negative feelings (such as disgust) in non-smokers and former smokers, while this kind of response was less frequently associated with e-cigarettes.

A further finding of this study was that the negative affect often associated with e-cigarettes was that they are “*unnatural*”. However, this response was reported by only some respondents, while a more common response with regard to e-cigarettes was the category “*other*” (including a wide range of specific responses such as people, objects, places and times). According to Popova et al.[115] this finding was aligned with previous studies and identified that at the time of the survey the respondents’ perceptions of and attitudes towards e-cigarettes were not yet formed. The authors also added that the use of e-cigarettes was growing, despite the increased perception of risk linked to e-cigarettes. They explained this apparent discrepancy by highlighting the less negative feelings associated with e-cigarettes, when compared to tobacco cigarettes. Building on these findings, the authors suggest in their conclusion that if future public health campaigns are to be more effective, they must consider the intertwined effects of affect, risk perception and use.

Yang et al.[116] reached similar conclusions when they analysed the results of a longitudinal survey conducted between June 2014 and December 2016 which involved participants aged 13–25 years old. The authors found that both vaping intention and seeking information about e-cigarettes were predictors of e-cigarette use after six months. The intention to use vaping products was mediated by health information seeking behaviour (HISB), which, they stated, is becoming increasingly important considering the growing interest of individuals in being involved in the decision-making process about their own health. The authors added that, according to the respondents, the majority of health information available on e-cigarettes is presented in a positive or mixed light. Following these findings, the authors concluded that information that is pro e-cigarette use may encourage vaping initiation.[116]

Advertising

Yang et al.’s study[116] explored any kind of health information on e-cigarettes that was available to their respondents. However, other authors[52,58] have concentrated solely on the impact of adverts on behaviours. Their findings can be summarised as follows:

- Best et al.[58] found that the exposure of young people to e-cigarette advertising in shops could be associated with the use or the intention to use e-cigarettes. This association was comparable to the association between smoking tobacco cigarettes and tobacco advertising, although weaker than the association between having previously smoked tobacco products and vaping initiation; and

- A further study[52] found that high receptivity to e-cigarette advertising was associated with higher odds of vaping initiation in non-smokers and former smokers. Given these results, the authors suggested that specific regulations around e-cigarette advertising should be implemented to protect vulnerable individuals.[52]

The consequences of e-cigarette advertising, including health campaigns that promote the use of e-cigarettes as a smoking cessation aid, were discussed by Best et al.[58] following the analysis of data collected in 2015 for a Scottish cross-sectional survey on the effects of tobacco legislation. The authors measured the effects of e-cigarette advertising in points of sale (POS) on young people, with a particular focus on their intention to start using vaping products. The authors found that being exposed to e-cigarette advertising in POS and recalling the advertisement were associated with the use or intention to use e-cigarettes in young people, although this association explained less variance than having smoked tobacco cigarettes in the past. According to the authors, the effect of being exposed to e-cigarette advertising in POS was comparable to the effect of being exposed to tobacco advertising. In this regard, they suggested that e-cigarette advertising should be regulated in a similar fashion to tobacco advertising.

Agaku et al.[52] also found a relationship between receptivity to e-cigarette advertising and vaping initiation. The authors used data from a longitudinal survey conducted in two waves in 2014. The sample was nationally representative, and all participants were either non-smokers or former smokers. This study measured the respondents' receptivity to e-cigarette advertisements by exposing the respondents to advertisement examples and then by assessing their impressions with a multi-item scale. Once the second wave was completed, the authors found that a higher receptivity to e-cigarette advertising during the first wave was associated with increased chances of vaping initiation in wave two. These findings similarly highlight the necessity of specific regulations for e-cigarette advertising to reduce the risk of vaping initiation in non-smokers, especially those who are part of vulnerable populations, including underage people and young adults.

9.4.4 How does e-cigarette consumption compare to the consumption of tobacco cigarettes?

What are the differences in consumption between consumers of e-cigarettes and consumers of tobacco cigarettes?

This section of the REA presents the evidence regarding differences in consumption between consumers of e-cigarettes and consumers of tobacco cigarettes. This includes differences in nicotine consumption, time-to-first use of tobacco cigarettes or e-cigarettes in the morning, frequency and length of smoking sessions, and spending.

Nicotine consumption by current tobacco smokers and dual tobacco and e-cigarette users

Bowler et al.[93] used data from a longitudinal study of older adults with COPD to compare nicotine consumption between current tobacco cigarette users and dual tobacco cigarette and e-cigarette users. Tobacco-specific urinary metabolites (anabasine) and urinary nicotine metabolites present with both tobacco and e-cigarette use were tested. Tobacco-specific urinary metabolites were similar among current, former and never e-cigarette users, which indicates similar levels of tobacco cigarette consumption, while current e-cigarette users were found to consume more total nicotine than former and never e-cigarette users.

A nationally representative sample of tobacco smokers in six European countries (Germany, Greece, Hungry, Poland, Romania and Spain) reported by Liu et al.[83] found that 19.6% of adult smokers reported ever use of e-cigarettes, with 1.5% of the total sample reporting daily or weekly use of e-cigarettes. Among respondents using e-cigarettes at least monthly, varying nicotine strengths were reported, with 36.6% using 1-8 mg/ml, 43.1% using 9-20 mg/ml and 2.2% using 21 mg/ml or higher. Almost one-fifth (18.3%) did not know the nicotine strength of their current / last e-cigarette. This may account for the higher nicotine consumption by e-cigarette users identified by Bowler et al.[93]

Among a small sample of dual tobacco cigarette and e-cigarette users interviewed by Robertson et al.,[106] 16 respondents reported daily ENDS consumption. Of these, five respondents reported using e-cigarettes with a nicotine level of 18mg or higher; 10 reported 6-12mg; three reported 0-3mg; and two did not know.

According to Kotz et al.,[86] the median daily consumption rate of disposable e-cigarettes was 0.5 cartridges a day. Only half of users of replaceable, pre-filled cartridges or tanks could estimate the amount they used (median 3.0ml). 72.1% used e-cigarettes with nicotine, and the average nicotine concentration was 6.5mg/ml.[86 (p238)]

Time to first cigarette by current smokers
Liu et al.[83] used data from the Population Assessment of Tobacco and Health (PATH) study (Wave 1) to assess levels of nicotine dependence among daily users of e-cigarettes and tobacco cigarettes, using time-to-first-use as a measure of dependence. The time-to-first-use is longer for e-cigarette users (29.16 minutes) than for cigarette smokers (20.03 minutes), indicating lower levels of nicotine dependence among e-cigarette users.

Frequency and length of smoking sessions
A qualitative study by Lucherini et al.[56] found that e-cigarette use was more frequent than cigarette use, and smoking sessions were longer because e-cigarettes do not have the same ‘finish’ as cigarettes. While cigarettes have an ‘end’ point when they can no longer be smoked, e-cigarettes can be used for a longer period of time with no noticeable change to use. The ability to use e-cigarettes inside impacted frequency of use as participants said they were more likely to frequently pick up their e-cigarette during the day.[56 (p84)]

Spending
Jackson et al.[89] found that spending on tobacco cigarettes and e-cigarettes differed across users. Using data from a cross-sectional survey of current and ex-smokers in England, Jackson et al.[89] found that those who were e-cigarette only users spend less money per week than those who smoked only tobacco cigarettes. E-cigarette only users spent on average £8.03 per week, compared to cigarette only users who spent on average £23.09 a week. Respondents who were dual users of e-cigarettes and tobacco cigarette spent on average £7.28 per week on e-cigarettes and £24.54 on cigarettes (£31.82 total), spending less than e-cigarette only users on e-cigarettes but spending more than tobacco-only users on tobacco cigarettes. Women were also found to spend less money per week on e-cigarettes compared to men.

Mode of use
Lucherini et al.[56] used solo and group interviews with young people (aged 16–24) to look at the frequency of e-cigarette ‘pick-up’. Young people reported that the nature of e-cigarettes led them to be used for longer and picked up more frequently, due to the absence of a “*finish*” point, in comparison to a combustible tobacco cigarette. Each

session of use was therefore reported as longer in comparison to smoking tobacco cigarettes.

Ease of use in smoke-free locations
Location was identified as one reason for respondents to increase their consumption of e-cigarettes in comparison to tobacco cigarettes. In Lucherini et al.,[56] young people reported that the ability to smoke inside meant that they were more likely to pick an e-cigarette throughout the day, in comparison to tobacco cigarettes. Qualitative interviews by Robertson et al.[106] found that dual tobacco cigarette and e-cigarette users who smoked daily reported that they switched between tobacco cigarettes and e-cigarettes to ration their tobacco cigarettes and to "*manage*" smoke-free areas where tobacco smoking was prohibited.

Perception of harm
Persoskie et al.[117] found that perceptions of harm in e-cigarette use led to change in e-cigarette consumption. For example, in Wave 2 of the PATH study, dual users who viewed e-cigarettes as less harmful than cigarettes, used e-cigarettes *"on 5.8 more of the past 30-days than did other dual users, and they puffed on the e-cigarette 6.3 more times on the most recent day they used it"*.[117 (p5)] Using data from Waves 2 and 3 of the PATH study, the authors also found that dual users who changed from not viewing e-cigarettes as less harmful at Wave 2 to viewing them as less harmful at Wave 3, also changed their behaviour at Wave 3, by decreasing the number of days in which tobacco cigarettes were consumed and increasing both the number of days on which e-cigarettes were used and the puffs per day. This indicates that how dual users perceive the harmfulness of e-cigarette use influences their behaviours.

What are the differences in rates of consumption by duration of use of e-cigarettes?

There were no papers that reported the differences in the consumption of e-cigarettes by the duration of use of e-cigarettes. One study[77] found that those with a higher vaping frequency at initiation were more likely to still be vaping at follow up, whether they had been smoking weekly (OR 9.80),[li] monthly (OR 4.32) or less than monthly. This suggests that there may be a relationship between frequency of use and continuation of use, which requires further research to fully discuss.

What are the differences in rates of e-cigarette consumption by type of consumer: former tobacco smoker; never-tobacco smoker; dual user?

This section of the report focuses on the intersection of tobacco cigarette and e-cigarette use, examining the prevalence of e-cigarette use (ever use and current-use) among current tobacco smokers, former tobacco smokers, and never tobacco smokers.

Table 9:3 presents the prevalence of e-cigarette use among current tobacco cigarette smokers.

- Ever use of e-cigarettes by current tobacco smokers was relatively common, reported by between one-fifth and one-half of current smokers. For example, 25.7% of adult past-year smokers in Australia, 22.9% of 15–24 year old smokers in Canada, 37.9% of current smokers in the EU and between 37.7% and 54.3% of adult smokers in the US, reported ever use of an e-cigarette.[42,46,48,71,101]

[li] OR = odds ratio.

- Daily use of e-cigarettes and current use of tobacco cigarettes was less commonly reported, and the prevalence was low overall. For example, in Australia, 1.6% of past-year smokers reported daily use of e-cigarettes, comparable to 0.8% in Finland, which increased to 3.1% of current smokers in the USA.[47,71,72]
- When focusing on current use as opposed to daily use, the picture was more varied. This is likely due to the variance of measurements of current use.
- A number of studies used past-30-day measures to indicate current use of either tobacco cigarettes or e-cigarettes.[42,48,49,51,62–64,70,82,94,98]
- However, other studies used frequency measures to indicate current use, for example, asking respondents to select daily, weekly or monthly use, and combining these into a current or regular use measure.[44,46,61,72,73,90,94]
- Finally, other studies used self-reporting status, for example, asking respondents whether they are a ‘current user’ of either tobacco cigarettes or e-cigarettes.[47,67,89,114]
- The variance in these definitions makes it challenging to assess trends in the take up of e-cigarettes by current tobacco smokers. The following tables (Table 9:3, Table 9:4, and Table 9:5, below) present total figures by country, and by measurement applied to allow for ease of comparison within and across countries.

Table 9:3 Consumption rates of e-cigarettes among current cigarette smokers

Study information[lii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of tobacco cigarette use in study (if required)**	**Definition of e-cigarette use in study (if required)**	**Findings**
Chan, G. et al.	2019a	National Drug Strategy Household Survey, 2016.	Cross-sectional survey. Nationally representative data. Respondents aged 18 and over, n=22,354.	Australia	Past-year smoker defined as ever use of over 100 tobacco cigarettes and smoking in past 12 months.	Occasional use is defined as “at least weekly (but not daily)” or “At least monthly (but not weekly” and “Less than monthly”. "Tried but no current use" is defined as "used to use them but no longer use" and "only tried them once or twice”.	Among past-year cigarette smokers, 25.7% reported trying but not currently using e-cigarettes. 2.7% reported occasional e-cigarette use. 1.6% reported daily e-cigarette use.
Mehra et al.	2019	Canadian Tobacco, Alcohol and Drugs Survey, 2017.	Cross-sectional survey. Nationally representative data. Young adults aged 15–24, n=10,322.	Canada	Current smokers not defined.	E-cigarette use defined as use within the past 30-days.	22.8% of current tobacco smokers reported use of e-cigarettes in the past 30-days.
Azagba and Wolfson	2018	Canadian Student Tobacco, Alcohol and Drug Survey, 2014–15.	Cross-sectional survey. Nationally representative data. Respondents in grades 6–12 (approx. ages 11–18), n=42,094.	Canada	Current tobacco cigarette use defined as use within the past 30-days.	Current e-cigarette use defined as use within the past 30-days.	43% of current smokers in grades 9-12 used e-cigarettes in the past 30-days.
Montreuil et al.	2017	Canadian Student Tobacco, Alcohol and Drugs Survey, 2014–2015.	Cross-sectional survey. Nationally representative data. Respondents in grades 6–12 (approx. ages 11–18), n=42,094.	Canada	Current smokers not defined.	Ever e-cigarette use defined as answering 'yes' to question about ever use of e-cigarettes. Current e-cigarette use defined as use within the past 30-days.	75.7% of current smokers were ever users of e-cigarettes. 46.6% of current smokers were past 30-day e-cigarette users.
Jackson et al.	2019a	Smoking Toolkit Study, 2014 and 2016.	Longitudinal survey. Nationally representative data. Adults aged 16 and over, n=40,933.	England	Current tobacco cigarette use defined by self-report as "current smoker".	Long-term use of e-cigarettes defined as current use initiated more than 52 weeks prior to baseline.	3.8% of current tobacco smokers at baseline were long-term users of e-cigarettes.

[lii] For full citation details of papers in this table, see Appendix L.

Table 9:3 Consumption rates of e-cigarettes among current cigarette smokers							
Study information[lii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of tobacco cigarette use in study (if required)**	**Definition of e-cigarette use in study (if required)**	**Findings**
Laverty et al.	2018	Eurobarometer, 2014 and 2017.	Longitudinal study. Nationally representative data. Respondents aged 15 or over, n=27,801 (2014) and n=27,901 (2017).	EU	Current tobacco cigarette use defined as responding yes to "You currently smoke".	Ever e-cigarette use defined as current use, previous use, or previous try of e-cigarettes (including 1-2 uses). Current regular use defined as "every day" or "every week" use of “electronic cigarettes or similar electronic devices (e.g., e-shisha, e-pipe)”.	37.9% of current smokers reported ever use of e-cigarettes, of whom 27.0% reported regular use of e-cigarettes.
Ruokolainen et al.	2017	Primary data collection	Cross-sectional survey. Nationally representative, ages 15–39 years, n= 3,461.	Finland	Daily smokers not defined.	‘Trying e-cigarettes a couple of times’ defined as 'has tried a couple of times' 'Daily or almost daily use' e-cigarette use defined as a “daily or almost daily use' response to question 'Do you use electronic cigarettes or similar vaporizers?'. 'Has quit' e-cigarette use defined as answering “I have used before, but now I have quit” in response to the question 'Do you use electronic cigarettes or similar vaporizers?'.	30.4% of daily smokers had tried e-cigarettes a couple of times. 0.8% of daily smokers had daily or almost daily use of e-cigarettes. 3.4% of daily smokers had quit e-cigarettes.
El-Khoury et al.	2019	DePICT (Description des Perceptions, Images, et Comportements liés au Tabagisme), 2016 and 2017.	Longitudinal survey (data used cross-sectionally). Nationally representative data. Respondents aged 18–64 years, n=8,470.	France	Current tobacco cigarette defined as one or more tobacco cigarettes per day. Occasional cigarette use reported but not defined.	Current e-cigarette use defined as responding yes to "Do you currently use an e-cigarette?" Ever use defined as responding yes to "Have you ever used an e-cigarette?".	7.6% of current tobacco smokers reported current e-cigarette use in 2016; this was 5.4% in 2017. 9.1% of occasional tobacco smokers reported current e-cigarette use in 2016; this was 5.0% in 2017.

Table 9:3 Consumption rates of e-cigarettes among current cigarette smokers							
Study information[lii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of tobacco cigarette use in study (if required)**	**Definition of e-cigarette use in study (if required)**	**Findings**
Kotz et al.	2018	The German Study on Tobacco Use (Deutsche Befragung zum Rauchverhalten, DEBRA), 2016–2017	Cross-sectional survey (six waves included). Nationally representative data. Young people and adults aged 14 and over, n=12,273.	Germany	Current smokers not defined.	Current e-cigarette used not defined.	5.1% of current smokers reported current use of e-cigarettes.
Friedman and Horn	2019	National Health Interview Surveys, 2014–2016	Cross-sectional survey. Nationally representative data. 25–54 year olds, n=50,306.	USA	Current tobacco cigarette use defined as ever use of 100 cigarettes and reporting "some days" or "daily" use.	Current e-cigarette use defined as "some days" or "daily" use.	2.7% of total sample are concurrent e-cigarette users and tobacco cigarette users. 13.7% of current smokers in sample are e-cigarette users.
Jaber et al.	2018	National Health and Nutrition Examination Survey, 2013–2014.	Cross-sectional survey. Nationally representative data. Adults over 18, n=5,423.	USA	Current tobacco cigarette use defined as ever use of 100 cigarettes and smoking within past five days.	Current e-cigarette use defined as use within the past five days.	8.2% of current smokers were current e-cigarette users.
Johnson et al.	2018	National Youth Tobacco Survey (NYTS), 2011–2015. Truth Initiative Young Adult Cohort Study (TIYACS), 2011–2015.	NYTS: Cross-sectional survey. Nationally representative data. Adolescents in grades 6-12 (approx. 9-18), n=16,925. TIYACS: Longitudinal survey. Nationally representative data. Adults aged 18–24, sample n=1,170, observation n=1,618.	USA	Current tobacco cigarette use defined as past 30-day use.	Current e-cigarette use defined as past 30-day use.	3.9% of total sample reported dual use of tobacco cigarettes and e-cigarettes in TIYACS, 2011-2015. 5.9% of total sample reported dual use of tobacco cigarettes and e-cigarettes in TIYACS, 2014. 8.9% of total sample reported dual use of tobacco cigarettes and e-cigarettes in TIYACS, 2015.

Table 9:3 Consumption rates of e-cigarettes among current cigarette smokers

Study information[lii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of tobacco cigarette use in study (if required)**	**Definition of e-cigarette use in study (if required)**	**Findings**
Lopez et al.	2018	Population Assessment of Tobacco and Health (PATH) Survey, 2013–2014	Longitudinal survey. Nationally representative data. Non-pregnant women, aged 15–44, n=12,848.	USA	Current tobacco cigarette use for adults over 18 defined as "some days" or "every day" use. Current tobacco cigarette use for adolescents defined as smoking one cigarette in previous 30-days.	Current e-cigarette use for adults over 18 defined as "some days" or "every day" use. Current e-cigarette use for adolescents defined as using e-cigarettes at least once in the previous 30-days.	22.5% of current smokers were current e-cigarette users.
Merianos et al.	2018	National Youth Tobacco Survey, 2013–2015.	Cross-sectional survey. Nationally representative data. Adolescents in grades 6–12 (approx. aged 9–18), n=31,022.	USA	Current tobacco cigarette use defined as use within the past 30-days.	Current use of e-cigarettes defined as use within the past 30-days.	In 2013, 19.3% of current tobacco smokers reported current e-cigarette use; in 2014, 53.7%; in 2015, 51.5%.
Mirbolouk et al.	2018	Behavioral Risk Factor Surveillance System, 2016.	Cross-sectional survey. Nationally representative data. Adults over 18, n=466,842.	USA	Current tobacco cigarette use defined as ever use of 100 cigarettes and reporting smoking "every day" or "some days".	Current e-cigarette use defined as "some days" or "every day" use.	11.4% of current smokers reported current use of e-cigarettes. 3.1% of current smokers reported daily use of e-cigarettes.
Vallone et al.	2019	Primary data collection	Cross-sectional survey. Nationally representative data, ages 15–34, n=13,357.	USA	Current combustible tobacco use defined as use of one or more of the following products in the past 30-days: cigarettes, large cigars, little cigars, cigarillos, hookah and pipe (with tobacco).	Ever JUUL use defined as those who answered 'yes' to 'Have you ever smoked a JUUL vape?'. Current JUUL use defined as use of JUUL within the past 30-days. Current ENDS use defined as use of one or more of the following products in the past 30-days: e-cigarette, e-cigar, e-hookah, vape pipe, vape pen and hookah pen.	13% of current smokers had ever use of JUUL. 10% of current smokers had current use of JUUL. 33% of current smokers had current use of ENDS.

Table 9:3 Consumption rates of e-cigarettes among current cigarette smokers

Study information[lii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of tobacco cigarette use in study (if required)**	**Definition of e-cigarette use in study (if required)**	**Findings**
Levy et al.	2017	Tobacco Use Supplement-Current Population Survey, 2014.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=160,825.	USA	Current tobacco cigarette use defined as ever use of 100 or more cigarettes and current smoking "some days" or "every day".	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as having used e-cigarettes at least one day in the last 30-days. Regular use defined as having used 20 or more days in last month.	37.7% of current smokers reported ever use of an e-cigarette. 10.6% of current smokers reported current use of an e-cigarette. 3.6% of current smokers reported regular use of an e-cigarette.
Zhu et al.	2017	Tobacco Use Supplements - Current Population Survey, 2001–02, 2003, 2006–07, 2010–11, 2014–15.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=161,054.	USA	Current tobacco cigarette use defined as ever use of 100 or more cigarettes and current smoking "some days" or "every day".	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as using e-cigarettes "every day" or "some days".	38.2% of current smokers reported ever use of e-cigarettes. 11.5% of current smokers reported current use of e-cigarettes.
Nayak et al.	2016	Tobacco Products and Risk Perceptions Survey (TPRPS), 2014	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=1,262.	USA	Current tobacco cigarette use defined as ever use of 100 or more cigarettes and current smoking "some days" or "every day".	Use of ENDS within past 30-days. ENDS defined as synonymous with e-cigarettes.	19% of current tobacco cigarette users reported use of ENDS within past 30-days.
Pechacek et al.	2016	Tobacco Products and Risk Perceptions Survey (TPRPS), 2014	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=5,717.	USA	Current tobacco cigarette use defined as ever use of 100 or more cigarettes and current smoking "some days" or "every day".	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as using e-cigarettes within the past 30-days.	51.1% of current cigarette smokers reported ever use of e-cigarettes. 20.7% of current cigarette smokers reported use of e-cigarettes in the past 30-days.
Rutten et al.	2015	Primary data collection	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=2,663.	USA	Current smokers defined as using tobacco cigarettes 'some days' or 'every day'.	Current e-cigarette use defined as 'every day' or 'some days'.	3.7% of current smokers reported current use of e-cigarettes (every day). 20.4% of current smokers reported current use of e-cigarettes (some days).

Table 9:3 Consumption rates of e-cigarettes among current cigarette smokers							
Study information[lii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of tobacco cigarette use in study (if required)**	**Definition of e-cigarette use in study (if required)**	**Findings**
Spears et al.	2017	Tobacco Products and Risk Perceptions Survey, 2015.	Cross-sectional survey, nationally representative data. Adults aged 18 and over, n= 6,051.	USA	Current smokers defined as people with ever use of 100 or more cigarettes and who responded, 'every day' or 'some days' to the question 'Do you currently smoke cigarettes every day, some days, or not at all?'.	Ever ENDS use defined as those who had used ENDS even once or twice.	54.3% of current smokers reported ever ENDS use.
Weaver et al.	2016	Tobacco Products and Risk Perceptions Survey, 2014.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n= 5,717.	USA	Current smokers defined as people with ever use of 100 or more cigarettes and who responded, 'every day' or 'some days' to the question 'Do you currently smoke cigarettes every day, some days, or not at all?'.	Ever e-cigarette use defined as ever trying e-cigarettes, even just one time. Current use is defined as use of e-cigarettes at least once during the past 30-days.	51.1% of current smokers reported ever use of e-cigarettes. 20.7% of current smokers had used e-cigarettes in the past 30-days.
Yong et al.	2015	International Tobacco Control survey, 2010 and 2013.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n= 4,326.	UK and Australia	Current smokers not defined.	Ever e-cigarette use not defined. Current e-cigarette use defined as people who responded ‘daily’, ‘less than daily but at least once a week’, ‘less than weekly but at least once a month’, or ‘less than monthly’ to the question ‘how often, if at all, do you use an electronic cigarette?’.	In Australia in 2010, 2.5% of current smokers reported ever use of e-cigarettes and in 2013, 23.7% reported ever use of e-cigarettes. In Australia in 2010, 0.8% of current smokers reported current use of e-cigarettes and in 2013, 8.9% reported current use of e-cigarettes. In the UK in 2010, 10.9% of current smokers reported ever use of e-cigarettes and in 2013, 43.3% reported ever use of e-cigarettes. In the UK in 2010, 4.9% of current smokers reported current use of e-cigarettes and in 2013, 20.7% reported current use of e-cigarettes.

Table 9:4 presents the prevalence of e-cigarette use among former tobacco cigarette smokers.

- Current use of e-cigarettes by former smokers varied by country. For example, in Australia, 2.5% of former smokers reported current use of e-cigarettes in the past-30 days,[50] compared to 5.5% of former smokers in France[114] and 1.6% of former smokers in Germany.[86] Ever use was high among adolescents in Canada, with 77.6% of former smokers in grades 6-12 (approximately 11–18 years old) reporting ever use of e-cigarettes.
- However, as with measures of current smoking status, former smoking status (and current e-cigarette use) was not consistently defined across the surveys, making it challenging to present direct comparisons.
- One notable difference across countries was the role of age in e-cigarette use among former smokers. For example, in a survey of 25–54 year olds in the USA, 7.3% of former smokers reported e-cigarette use ‘some days’ or ‘daily’,[90] while in a survey of former smokers over 18, just 2.7% reported using e-cigarettes within the past five days.[61] This may suggest that frequent use of an e-cigarette in smoking cessation was more predominant among those aged 25 years and over in the USA. In contrast, in Canada, 20.7% of young former smokers (aged approximately 11–18 years old) reported current use of an e-cigarette, which dropped to 10.7% among respondents aged 15–24 years old.[48,62] Further research is required to identify the factors leading to this change, including the exploration of those different measures included in these surveys, and different socioeconomic contexts.
- In addition to differences by age of sample population, there were also differences by time since quitting smoking. In Levy et al.,[42] 16.3% of former smokers who quit less than one year ago reported current use and 12.7% reported regular use of e-cigarettes. For those who quit smoking more than three years ago, this declined to 0.5% for current use, and 0.3% regular use.
- However, this may reflect the changing availability of e-cigarettes instead of the growing availability of e-cigarettes for more recent quitters: 3.1% of former smokers who quit more than 3 years ago had ever tried an e-cigarette, compared to 43.4% of those quitting in the past year.[42] Further research is required to assess whether these changes are related to availability of products or the decreased use of cessation tools over time.

Table 9:4 Consumption rates of e-cigarettes among former cigarette smokers							
Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Mehra et al.	2019	Canadian Tobacco, Alcohol and Drugs Survey, 2017.	Cross-sectional survey. Nationally representative data. Young adults aged 15–24, n=10,322.	Canada	Former smokers not defined.	E-cigarette use defined as use within the past 30-days.	10.7% of former tobacco smokers reported use of e-cigarettes in the past 30-days.
Montreuil et al.	2017	Canadian Student Tobacco, Alcohol and Drugs Survey, 2014–2015.	Cross-sectional survey. Nationally representative data. Respondents in grades 6–12 (approx. ages 11–18), n=42,094.	Canada	Former smokers not defined.	Ever e-cigarette use defined as answering 'yes' to (yes / no) question about ever use of e-cigarettes. Current use is defined as past 30-day use of e-cigarettes.	77.6% of sample who were former smokers were ever users of e-cigarettes. 20.4% of former smokers were past 30-day e-cigarette users.
Jackson et al.	2019a	Smoking Toolkit Study, 2014 and 2016.	Longitudinal survey. Nationally representative data. Adults aged 16 and over, n=40,934.	England	Recent ex-smoker defined as quitting within past year or sooner. Long-term ex-smoker defined as quitting one year ago or longer.	Long-term use of e-cigarettes defined as current use initiated more than 52 weeks prior to baseline.	3.8% of recent ex-smokers were long-term users of e-cigarettes. 3.2% of long-term ex-smokers were long-term users of e-cigarettes.
Laverty et al.	2018	Eurobarometer, 2014 and 2017.	Longitudinal study. Nationally representative data. Respondents aged 15 or over, n=27,801 (2014) and n=27,901 (2017).	EU	Former tobacco cigarette use defined as responding yes to "You used to smoke but you have stopped".	Ever e-cigarette use defined as current use, previous use, or previous try of e-cigarettes (including 1-2 uses). Current regular use defined as "every day" or "every week" use of “electronic cigarettes or similar electronic devices (e.g., e-shisha, e-pipe)”.	15.7% of former smokers reported ever use of e-cigarettes, of whom 41.3% reported regular use of e-cigarettes.

[liii] For full citation details of papers in this table, see Appendix L.

Table 9:4 Consumption rates of e-cigarettes among former cigarette smokers

Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Ruokolainen et al.	2017	Primary data collection	Cross sectional survey. Nationally representative, ages 15–39 years, n=3,461.	Finland	Former smokers not defined.	E-cigarette use of 'has tried a couple of times' defined as 'has tried a couple of times' response given to question 'Do you use electronic cigarettes or similar vaporizers?'. 'Daily or almost daily use' e-cigarette use defined as 'daily or almost daily use' response given to question 'Do you use electronic cigarettes or similar vaporizers?'. 'Has quit' e-cigarette use defined as "I have used before, but now I have quit" in response to the question 'Do you use electronic cigarettes or similar vaporizers?'.	7.7% of former smokers had tried e-cigarettes a couple of times. 1.4% of former smokers had daily or almost daily e-cigarette use. 0.9% of former smokers had quit e-cigarettes.
El-Khoury et al.	2019	DePICT (Description des Perceptions, Images, et Comportements liés au Tabagisme), 2016 and 2017.	Longitudinal study (data used cross-sectionally). Nationally representative data. Respondents aged 18–64 years, n=8,470.	France	Former tobacco cigarette use reported but not defined.	Current e-cigarette use defined as responding yes to "Do you currently use an e-cigarette?"	5.0% of former tobacco smokers reported current e-cigarette use in 2016; this was 5.5% in 2017.
Kotz et al.	2018	The German Study on Tobacco Use (Deutsche Befragung zum Rauchverhalten, DEBRA), 2016–2018	Cross-sectional survey (six waves included). Nationally representative data. Young people and adults aged 14 and over, n=12,273.	Germany	Ex-smokers defined as completely ceasing smoking.	Current e-cigarette use not defined.	1.6% of ex-smokers reported current use of e-cigarettes.

Table 9:4 Consumption rates of e-cigarettes among former cigarette smokers							
Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Friedman and Horn	2019	National Health Interview Surveys, 2014–2016	Nationally representative data; n=50,306; 25–54 year olds	USA	Former tobacco cigarette smokers defined as ever use of 100 cigarettes and not being a current smoker (i.e., reporting "some days" or "daily" use).	E-cigarette use defined as reported "some days" or "daily" use.	7.3% of former smokers are e-cigarette users.
Jaber et al.	2018	National Health and Nutrition Examination Survey, 2013–2014.	Cross-sectional survey. Nationally representative data. Adults over 18, n=5,423.	USA	Former tobacco cigarette use defined as ever use of 100 cigarettes and not reporting smoking within past five days.	Current e-cigarette use defined as use within the past five days.	2.7% of former smokers were current e-cigarette users.
Lopez et al.	2018	PATH Survey, 2013–2014	Longitudinal study. Nationally representative data. Non-pregnant women, aged 15–44, n=12,848.	USA	Former tobacco cigarette use for adults over 18 defined as not reporting current smoking at time of survey completion, with a) previous reporting of ≥100 lifetime cigarettes or b) previous reporting of current smoking but not ≥100 lifetime cigarettes. Former tobacco cigarette use for adolescents defined as reporting ever tried smoking (including 1-2 "puffs"), but not having smoked in previous 30-days.	Current e-cigarette use for adults over 18 defined as reported "some days" or "every day" use. Current e-cigarette use for adolescents defined as using e-cigarettes at least once in the previous 30-days.	3.8% of former smokers were current e-cigarette users.

Table 9:4 Consumption rates of e-cigarettes among former cigarette smokers							
Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Mirbolouk et al.	2018	Behavioral Risk Factor Surveillance System, 2016.	Cross-sectional survey. Nationally representative data. Adults over 18, n=466,842.	USA	Former tobacco cigarette use defined as ever use of 100 cigarettes and reporting current smoking "not at all".	Current e-cigarette use defined as "some days" or "every day" use. Respondents reported "every day" use of e-cigarette categorised as daily users.	7.6% of former smokers reported current use of e-cigarettes. 5.0% of former smokers reported daily use of e-cigarettes.
Vallone et al.	2019	Primary data collection	Cross-sectional survey. Nationally representative data, ages 15–34, n=13357.	USA	Former smokers not defined.	Ever JUUL use defined as those who answered 'yes' to 'Have you ever smoked a JUUL vape?' with responses (yes / no). Current JULL use defined as use of JUUL in the past 30-days. Current ENDS use defined as use of one or more of the following products in the past 30-days: e-cigarette, e-cigar, e-hookah, vape pipe, vape pen and hookah pen.	6% of former smokers had ever JUUL use. 3% of former smokers had current use of JUUL. 9% of former smokers had current use of ENDS.
Levy et al.	2017	Tobacco Use Supplement-Current Population Survey, 2014.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=163,920.	USA	Former smokers defined as ever use of 100 or more cigarettes and not smoking at time of survey.	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as having used e-cigarettes at least one day in the last 30-days. Regular use as having used 20 or more days in last month.	43.4% of former smokers who quit <1 year ago reported ever use of an e-cigarette. 16.3% reported current use and 12.7% reported regular use. 30.2% of former smokers who quit 1-3 years prior reported ever use of an e-cigarette. 9.8% reported current use and 7.4% reported regular use. 3.1% of former smokers who quit >3 years ago reported ever use of an e-cigarette. 0.5% reported current use of an e-cigarette. 0.3% reported regular use.

Table 9:4	Consumption rates of e-cigarettes among former cigarette smokers						
Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Zhu et al.	2017	Tobacco Use Supplements - Current Population Survey, 2001–02, 2003, 2006–07, 2010–11, 2014–15.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=161,054.	USA	Former smokers defined as quitting cigarettes within a certain period.	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as using e-cigarettes "every day" or "some days".	49.3% of former smokers who quit <1 year ago reported ever use of an e-cigarette. 19.0% reported current use. 36.8% of former smokers who quit 1-2 years prior reported ever use of an e-cigarette. 13.2% reported current use. 18.6% of former smokers who quit 3-5 years ago reported ever use of an e-cigarette. 4.5% reported current use of an e-cigarette. 2.3% of former smokers who quit >5 years ago reported ever use of an e-cigarette. 0.4% reported current use of an e-cigarette.
Pechacek et al.	2016	Tobacco Products and Risk Perceptions Survey (TPRPS), 2015	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=729.	USA	Former tobacco cigarette users defined as ever use of 100 or more cigarettes and current smoking "not at all".	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as using e-cigarettes within the past 30-days.	13.1% of former cigarette smokers reported ever use of e-cigarettes. 3.8% of former cigarette smokers reported past 30-day use of e-cigarettes.
Spears et al.	2017	Tobacco Products and Risk Perceptions Survey, 2015.	Cross-sectional survey, nationally representative data. Adults aged 18 and over, n= 6,051.	USA	Former smokers were defined as those who reported smoking over 100 cigarettes in their lifetime but who answered, 'not at all' to the questions 'Do you currently smoke cigarettes every day, someday, or not at all?'	Ever ENDS use defined as those who had used ENDS even once or twice.	18.5% of former smokers reported ever ENDS use.

Table 9:4 Consumption rates of e-cigarettes among former cigarette smokers

Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Weaver et al.	2016	Tobacco Products and Risk Perceptions Survey, 2014.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n= 5,717.	USA	Former smokers were defined as those who reported smoking over 100 cigarettes in their life and answering, 'not at all' to the question 'Do you currently smoke cigarettes every day, some days, or not at all?'	Ever e-cigarette use defined as ever trying e-cigarettes, even just one time. Current use is defined as use of e-cigarettes at least once during the past 30-days.	13.1% of former smokers reported ever use of e-cigarettes. 3.8 % of former smokers had used e-cigarettes in the past 30-days.
Yong et al.	2015	International Tobacco Control survey, 2010 and 2013.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n= 4,326.	UK and Australia	Former smokers not defined. Former smokers classified into 'ex-smokers quit ≤ 12 months' and 'ex-smokers quit > 12 months'.	Ever e-cigarette use not defined. Current e-cigarette use defined as people who responded 'daily', 'less than daily but at least once a week', 'less than weekly but at least once a month', or 'less than monthly' to the question 'how often, if at all, do you use an electronic cigarette?'.	<u>Ever use of e-cigarettes</u> In Australia in 2010, 2.4% of ex-smokers who quit ≤ 12 months reported ever use of e-cigarettes and in 2013, 15.5% reported ever use. In Australia in 2010, 0.6% of ex-smokers who quit >12 months, reported ever use of e-cigarettes and in 2013, 6.8% reported ever use. In the UK in 2010, 13.8% of ex-smokers who quit ≤ 12 months reported ever use of e-cigarettes and in 2013, 62.0% reported ever use. In the UK in 2010, 1.3% of ex-smokers who quit > 12 months reported ever use of e-cigarettes and in 2013, 14.0% reported ever use. *(Continued on next page)*

Table 9:4 Consumption rates of e-cigarettes among former cigarette smokers							
Study information[liii]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of former smoker**	**Definition of e-cigarette use**	**Findings**
Yong et al. *(continued from previous page)*	2015						Current use of e-cigarettes In Australia in 2010, 0.4% of ex-smokers who quit ≤ 12 months reported ever current of e-cigarettes and in 2013, 2.1% reported current use. In Australia in 2010, 0.0% of ex-smokers who quit > 12 months reported current use of e-cigarettes and in 2013, 0.4% reported current use. In the UK in 2010, 8.3% of ex-smokers who quit ≤ 12 months reported current use of e-cigarettes and in 2013, 34.7% reported current use. In the UK in 2010, 0.3% of ex-smokers who quit > 12 months reported current use of e-cigarettes and in 2013, 2.7% reported current use.

Table 9:5 presents the prevalence of e-cigarette use by never smokers, by country.

- The overall prevalence of use by never smokers remains low. In Finland, France, Germany, and a number of US studies, the percentage of never smokers who currently or frequently used e-cigarettes was below 0.5%, although the percentage of never smokers who had ever used e-cigarettes was higher in many cases, rising to 2.8% in Finland.[42,44,47,86,114]
- The majority of studies found that the prevalence of e-cigarette use among never smokers was below 5%, with two notable exceptions. Montreuil et al.[62] found that 8.4% of the sample who were never smokers were ever users of e-cigarettes in a study of Canadian youth aged 11–18 years old, while 7.2% of never smokers reported ever ENDS use in a 2015 study of US adults.[101] The findings from Canada suggest that a number of adolescents may be trying e-cigarettes without pre-existing tobacco use, although further research is required to establish whether this conclusion is replicated in other countries.
- These findings, when compared to the findings from Table 9:3 and Table 9:4, suggest that the majority of e-cigarette use takes place among those with former or current tobacco use. For example, in Finland, 7.7% of former smokers reported ever use of e-cigarettes, which rose to 30.4% of daily smokers, in comparison to just 2.8% of never smokers.[47] In the USA, Jaber et al.[61] found that 0.4% of never smokers reported current use of e-cigarettes, compared to 2.7% of former smokers and 8.2% of current smokers.

Table 9:5 Consumption rates of e-cigarettes among never cigarette smokers							
Study information[liv]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of current smoker**	**Definition of e-cigarette use**	**Findings**
Montreuil et al.	2017	Canadian Student Tobacco, Alcohol and Drugs Survey, 2014–2015.	Cross-sectional survey. Nationally representative data. Adolescents in grades 6–12 (approx. age 9-18), n= 441,900	Canada	Never smokers not defined.	Ever e-cigarette use defined as answering 'yes' to (yes / no) question about ever use of e-cigarettes. Current use is defined as past 30-day use of e-cigarettes.	8.4% of the sample who were never smokers were ever users of e-cigarettes. 1.8% of never smokers were past 30-day e-cigarette users.
Jackson et al.	2019a	Smoking Toolkit Study, 2014 and 2016.	Longitudinal survey. Nationally representative data. Adults aged 16 and over, n=40,933.	England	Never tobacco cigarette use defined by self-report as "never smoker".	Long-term use of e-cigarettes defined as current use initiated more than 52 weeks prior to baseline.	0.1% of never smokers were long-term users of e-cigarettes.
Laverty et al.	2018	Eurobarometer, 2014 and 2017.	Longitudinal study. Nationally representative data. Respondents aged 15 or over, n=27,801 (2014) and n=27,901 (2017).	EU	Never tobacco cigarette use defined as responding yes to "You have never smoked".	Ever e-cigarette use defined as current use, previous use, or previous try of e-cigarettes (including 1-2 uses). Current use defined as responding yes to "You currently use electronic cigarettes or similar electronic devices (e.g., e-shisha, e-pipe)". Current regular use defined as "Every day" or "Every week". Former regular use defined as "Every day" or "Every week" by ever e-cigarette users (including current regular users).	2.7% of never smokers reported ever use of e-cigarettes, of whom 12.8% reported regular use of e-cigarettes.

[liv] For full citation details of papers in this table, see Appendix L.

Table 9:5 Consumption rates of e-cigarettes among never cigarette smokers

Study information[liv]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of current smoker**	**Definition of e-cigarette use**	**Findings**
Ruokolainen et al.	2017	Primary data collection	Cross sectional survey. Nationally representative, ages 15–39 years, n= 3,461.	Finland	Never smokers not defined.	E-cigarette use of 'has tried a couple of times' defined as 'has tried a couple of times' response given to question "Do you use electronic cigarettes or similar vaporizers?" 'Daily or almost daily use' e-cigarette use defined as 'daily or almost daily use' response given to question "Do you use electronic cigarettes or similar vaporizers?". 'Has quit' e-cigarette use defined as "I have used before, but now I have quit" in response to the question "Do you use electronic cigarettes or similar vaporizers?".	2.8% of never smokers had tried e-cigarettes a couple of times. 0% of never smokers had daily or almost daily e-cigarette use. 0% of never smokers had quit e-cigarettes.
El-Khoury et al.	2019	DePICT (Description des Perceptions, Images, et Comportements liés au Tabagisme), 2016 and 2017.	Longitudinal study (data used cross-sectionally). Nationally representative data. Respondents aged 18–64 years, n=8,470.	France	Non-smokers reported but not defined.	Current e-cigarette use defined as responding yes to "Do you currently use an e-cigarette?"	0.1% of non-smokers reported current e-cigarette use in 2016; this was 0.2% in 2017.
Kotz et al.	2018	The German Study on Tobacco Use (Deutsche Befragung zum Rauchverhalten, DEBRA), 2016–2019	Cross-sectional survey (six waves included). Nationally representative data. Young people and adults aged 14 and over, n=12,273.	Germany	Never smokers not defined.	Current e-cigarette used not defined.	0.3% of never cigarette smokers reported current use of e-cigarettes.
East et al.	2018	Action on Smoking and Health Great Britain Youth, 2016.	Longitudinal study (baseline figures only included). Nationally representative data. Adolescents aged 11–18 years.	UK	Never tobacco use at baseline defined as "never smokers, not even a puff".	Ever e-cigarette at baseline defined as ever used, including a "puff".	2.3% of never smokers at baseline reported ever use of e-cigarettes.

Table 9:5 Consumption rates of e-cigarettes among never cigarette smokers

Study information[liv]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of current smoker**	**Definition of e-cigarette use**	**Findings**
Jaber et al.	2018	National Health and Nutrition Examination Survey, 2013–2014.	Cross-sectional survey. Nationally representative data. Adults over 18, n=5,423.	USA	Never tobacco cigarette use defined as ever use of 100 cigarettes or fewer and not reporting smoking within past five days.	Current e-cigarette use defined as use within the past five days.	0.4% of never smokers were current e-cigarette users.
Lopez et al.	2018	PATH Survey, 2013–2014	Longitudinal study. Nationally representative data. Non-pregnant women, aged 15–44, n=12,848.	USA	Never smoker status defined for adults over 18 as not smoking at time of survey completion and not reporting life-time use of cigarettes. Never smoker status for adolescents defined as never reporting life-time cigarette use (including 1-2 "puffs").	Current e-cigarette use for adults over 18 defined as reported "some days" or "every day" use. Current e-cigarette use for adolescents defined as using e-cigarettes at least once in the previous 30-days.	0.4% of never smokers (all ages) were current e-cigarette users.
Mirbolouk et al.	2018	Behavioral Risk Factor Surveillance System, 2016.	Cross-sectional survey. Nationally representative data. Adults over 18, n=466,842.	USA	Never tobacco cigarette use defined as ever use of 100 cigarettes or fewer.	Current e-cigarette use defined as "some days" or "every day" use. Respondents reported "every day" use of e-cigarette categorised as daily users.	1.4% of never smokers were current e-cigarette users. 0.2% of never smokers were daily e-cigarette users.
Vallone et al.	2019	Primary data collection	Cross-sectional survey. Nationally representative data, ages 15–34, n=13,357.	USA	Never smokers not defined.	Ever JUUL use defined as those who answered 'yes' to 'Have you ever smoked a JUUL vape?' with responses (yes / no). Current JULL use defined as use of JUUL in the past 30-days. Current ENDS use defined as use of one or more of the following products in the past 30-days: e-cigarette, e-cigar, e-hookah, vape pipe, vape pen and hookah pen.	4% of never smokers had ever use of JUUL. 2% of never smokers had current use of JUUL. 3% of never smokers had current use of ENDS.

Table 9:5 Consumption rates of e-cigarettes among never cigarette smokers

Study information[liv]		*Sample information*					*Findings*
Author	**Year**	**Name and year of survey (if secondary data analysis)**	**Sample details**	**Location of study**	**Definition of current smoker**	**Definition of e-cigarette use**	**Findings**
Levy et al.	2017	Tobacco Use Supplement-Current Population Survey, 2014.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=160,825.	USA	Never use defined as ever use of fewer than 100 cigarettes and not smoking at time of survey.	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as having used e-cigarettes at least one day in the last 30-days. Regular use as having used 20 or more days in last month.	1.4% of never smokers ever use of an e-cigarette. 0.2% reported current use and 0.1% reported regular use.
Primack et al.	2018	Primary data collection	Cohort study with assessments at baseline (March 2013) and follow-up (October 2014). Nationally representative data. Young adults aged 18–30, n=915.	USA	Never smokers not defined.	Ever use of e-cigarettes defined as ever having had 'even a puff'.	2.5% of never smokers had ever use of e-cigarettes.
Zhu et al.	2017	Tobacco Use Supplements - Current Population Survey, 2001–02, 2003, 2006–07, 2010–11, 2014–15.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n=161,054.	USA	Never use not defined.	Ever e-cigarette use defined as having used an e-cigarette even once. Current use defined as using e-cigarettes "every day" or "some days".	2.0% of never smokers reported ever use of an e-cigarette. 0.3% reported current use.
Spears et al.	2017	Tobacco Products and Risk Perceptions Survey, 2015.	Cross-sectional survey, nationally representative data. Adults aged 18 and over, n= 6,051.	USA	Never smokers were defined as those who reported that they had not smoked at least 100 cigarettes in their lifetime.	Ever ENDS use defined as those who had used ENDS even once or twice.	7.2% of never smokers reported ever ENDS use.
Weaver et al.	2016	Tobacco Products and Risk Perceptions Survey, 2014.	Cross-sectional survey. Nationally representative data. Adults aged 18 and over, n= 5717.	USA	Never smokers defined as not having smoked at least 100 cigarettes in their lives.	Ever e-cigarette use defined as ever trying e-cigarettes, even just one time. Current use is defined as use of e-cigarettes at least once during the past 30-days.	4.7% of never smokers reported ever use of e-cigarettes. 0.9% of never smokers had used e-cigarettes in the past 30-days.

9.5 REA – Conclusion

This REA aimed to identify the consumers of e-cigarettes and to report the differences in rates of consumption between tobacco consumption and e-cigarette consumption. To do this, a rigorous and relevant evidence review was conducted, reviewing the demographics and characteristics of consumers of e-cigarettes as well as the consumption patterns of e-cigarettes by different types of user, and duration of cigarette use. This discussion section reviews the findings from these two pieces of work and offers guidance for future research in this field.

The majority of evidence identified within this REA relates to the demographics and socioeconomic characteristics of those who use e-cigarettes. One overall conclusion is that, while it is not possible to identify all those core constituencies who are most likely to use e-cigarettes, **e-cigarette users are more likely to be: young; unmarried; male; of a sexual or gender minority; have a higher income; have a higher level of education; and have family or friends who smoke**. A number of these characteristics overlap with tobacco users, such as being male or being from a sexual or gender minority, while others are more distinct, such as a higher level of education. In summary, the overall findings encompassed:

- Younger adults were more likely to have ever used e-cigarettes than older adults, with older teens being more likely to use e-cigarettes than younger teenagers. However, findings were more mixed as to recent use, with evidence suggesting that both older (and younger) teenagers self-reported use within the last 30-days. Young adults and older teenagers were more likely than older adults to report recent use. However, trends pertaining to ever use and recent use among younger people did not necessarily translate into long-term use. Some studies suggested that long-term use is more common among the middle-aged, but findings varied;
- Gender identity and sexual orientation played a key role in e-cigarette initiation. In the majority of studies, men were more likely to report e-cigarette use in comparison to women, and those identifying as sexual or gender minorities were more likely to use e-cigarettes than heterosexual and cisgender people. Both findings were consistent with tobacco use evidence patterns;
- Evidence on the impacts of socioeconomic factors for e-cigarette use also varied. There was no clear trend in use between rural and urban areas, and no clear indication as to the relationship between employment and use of e-cigarettes. When exploring levels of education alongside behaviours, a number of studies suggested that tobacco smokers who switched to e-cigarettes were more likely to be educated, which may follow a different pattern of tobacco use; those with lower levels of education were more likely to be tobacco users. With regard to income, while a negative relationship with e-cigarette use was identified, JUUL users were found to have higher incomes than others; and,
- Household factors played an important role in e-cigarette use. For example, having a family member or friend who smoked or used e-cigarettes was more likely to lead to e-cigarette use; a finding which also emerged in studies looking at social acceptability of e-cigarette use. These studies found that, at a countrywide level, more restrictive policies led to a decrease in seeing vaping or e-cigarette use as socially acceptable. This indicates that social acceptability levels play a large role in e-cigarette initiations and uptake. The association between family, friends and e-cigarettes also extended to tobacco smoking; respondents with family and friends who smoked tobacco cigarettes were also likely to use e-cigarettes. Finally, those who were married were less likely to use e-cigarettes than their divorced, widowed, or separated counterparts.

There are a number of legislative and policy factors that may influence the take up of e-cigarettes. For example, using a framework in which countries were 'ranked' as more (or less) restrictive, we highlighted a number of studies which assessed if stricter regulatory environments reduced the social acceptability of e-cigarette use in public spaces. Qualitive research suggests that location plays an important role in using e-cigarettes in comparison to tobacco cigarettes. Lucherini et al.[56] found that young people perceived that the ability to smoke inside made them more likely to use an e-cigarette throughout the day. In interviews carried out by Robertson et al.,[106] dual tobacco cigarette and e-cigarette users who smoked daily reported that they switched between tobacco cigarettes and e-cigarettes to "*manage*" smoke-free areas where tobacco smoking was prohibited. This suggests a relationship between smoke-free initiatives and e-cigarette use, although no studies within this review used data to identify the impact of smoke-free initiatives on e-cigarette use. Furthermore, social acceptability of e-cigarettes, which has an impact on e-cigarette use in public spaces, does not always align with restrictive e-cigarette policies. In the US, for example, a less restrictive legislative framework exists alongside low social acceptability, which may limit the take up of e-cigarette use. This suggests that legislation does not entirely determine social acceptability of e-cigarette use.

In addition to reflecting on the social acceptability of e-cigarette use, it is clear that bans on product sales have some impact on use. For example, Yong et al.[50] found that just 6.6% of former or current smokers in Australia, (where there is a more restrictive legislative environment than the UK) were regular e-cigarette users in comparison to 18.8% of those in the UK. The authors argued the most plausible explanation to such differences were likely to be the link between the "*normative*" environments, regulatory environments as well as social acceptability trends. The use of online sales to overcome bans on e-cigarette use, however, do not necessarily indicate that such bans are inherently ineffective, although the association between young people and e-cigarette use may be related to internet use among younger groups.

In exploring public health campaigns alongside that of legislation, including restrictions on advertising, it was found that adverts were most likely to influence young people, with exposure to e-cigarette advertising in shops associated with the use or intention to use e-cigarettes. As young people have been identified as those most likely to use e-cigarettes, it may be concluded that advertising bans, and graphic warnings, such as those enacted by the EU TPD, may be particularly effective in reducing the prevalence of e-cigarette use among young people.

Trends in the consumption of e-cigarettes are more challenging to identify. This may be for two reasons: firstly, the majority of evidence uncovered in this REA is cross-sectional in nature. Although longitudinal data sources have been used,[46,67,70] this is often used cross-sectionally and does not present trends over time. Secondly, the REA identified huge variance of measurements of current use of e-cigarettes, which fall into three main categories:

- Past-30-day measures[42,48,49,51,62–64,70,82,94,98];
- Frequency measures to indicate current use, such as daily, weekly or monthly use, and / or combining multiple options into a current or regular use measure[44,46,61,72,73,90,94]; and
- Self-reporting status measures, for example, asking respondents whether they are a 'current user' of either tobacco cigarettes or e-cigarettes.[47,67,89,114]

This makes it particularly difficult to compare the rates of e-cigarette use between countries. One key area for further research is the standardisation of these measures to ensure comparability of findings.

With this caveat in mind as to assessing trends in the consumption of e-cigarettes, the evidence uncovered suggests the following key findings. Tobacco smokers were the group most likely to report **ever use** of an e-cigarette, in comparison to both former tobacco smokers and never smokers. Use among tobacco smokers was relatively common, reported by between one-fifth and one-half of current smokers. The highest rate was reported in the USA, where 54.3% of adult smokers in the US reported ever use of an e-cigarette.[101] However, **current use** of e-cigarettes by current tobacco smokers was less common than ever use, suggesting that while many current smokers try e-cigarettes, this does not lead to long-term use. For example, across the EU, 37.9% of current smokers reported ever use of e-cigarettes, of whom 27.0% reported regular use of e-cigarettes.[46] In Canada, 75.7% of current smokers were ever users of e-cigarettes, compared to the 46.6% of current smokers who had been e-cigarette users in the past 30-days.[62]

The prevalence of daily use of e-cigarettes and current use of tobacco cigarettes was less commonly reported, and, where reported, would seem to be low. In those qualitative studies exploring the impact of policy on behaviours, it was suggested that tobacco smokers are more likely to use e-cigarettes when they are unable to smoke, with the sensation of smoking perceived as important when switching from cigarettes to e-cigarettes. The low prevalence of daily e-cigarette use, especially among daily cigarette smokers, seems to suggest that while users may ‘switch’ as necessary (if, e.g., smoking is not allowed in one or other location), tobacco smoking is preferred to e-cigarette use when this is an available option.

Among former smokers, the current use of e-cigarettes varied by country, although it remains low in some areas. For example, in Australia, 2.5% of former smokers reported current use of e-cigarettes in the past-30 days,[50] compared to 5.5% of former smokers in France,[114] and 1.6% of former smokers in Germany.[86] One area of notable difference between other countries is the role of age in e-cigarette use among former smokers. Ever use was high among adolescents in Canada, with 77.6% of former smokers in grades 6–12 (approximately 11–18 years old) reporting ever use of e-cigarettes. This dropped to 10.7% among respondents aged 15–24 years.[48,62] In contrast, in a survey of 25–54 year olds in the USA, 7.3% of former smokers report e-cigarette use ‘some days’ or ‘daily’,[90] while in a survey of former smokers over 18, just 2.7% reported using e-cigarettes within the past five days.[61] This may suggest that frequent use of an e-cigarette, possibly for smoking cessation, is more likely among those aged 25 years and over in the USA. Further research is required to identify the factors leading to this change, including different measures included in these surveys and different socioeconomic contexts.

In addition to differences by age of sample population, there were also differences by time since quitting smoking. In Levy et al.,[42] of former smokers who quit less than one year ago, 16.3% reported current use and 12.7% reported regular use of e-cigarettes. For those who quit more than three years ago, this declined to 0.5% for current use and 0.3% for regular use. However, this may reflect the changing availability (or acceptability) of e-cigarettes. For example, 3.1% of former smokers who quit more than three years ago had ever tried an e-cigarette, compared to 43.4% of those quitting in the past year.[42] Further research is required to assess whether these changes are related to availability of products or the decreased use of cessation tools over time since quitting.

The overall prevalence of use by never smokers remains low. In Finland, France, Germany, and a number of US studies, the percentage of never smokers who currently or frequently use e-cigarettes was below 0.5%, although the percentage of never smokers who had ever used e-cigarettes was higher in some cases, rising to 2.8% in Finland.[42,44,47,86,114] The majority of studies found that the prevalence of e-cigarette use among never smokers was below 5%, with two notable exceptions. Montreuil et al.,[62] in a study of Canadian youth aged 11–18 years old, found that 8.4% of the sample who were never smokers were ever users of e-cigarettes, while in a study of US adults,[101] 7.2% of never smokers reported ever ENDS use. The findings from Canada suggest that a number of adolescents may be trying e-cigarettes without pre-existing tobacco use, although further research is required to establish whether this conclusion is replicated in other countries.

In conclusion, the REA has found that e-cigarette use is most likely to take place among current or former smokers. Demographically, e-cigarette users are more likely to be young; not married; male; of a sexual or gender minority; have a higher income; have a higher level of education; and have family or friends who smoke. While some indicative findings point to differences in consumption rates across countries, a standardised, global set of measures would be beneficial in identifying differences in consumption rates, allowing for the impact of local legislation and policy to be more easily evidenced. The development of such measures must be a swift goal for the academic community to determine the relationship between e-cigarette use and tobacco use.

Work strand 4 – Summary

- Younger adults and older teenagers were more likely to have ever used e-cigarettes and to have used them recently. Middle-aged users were more likely to be long-term consumers, although not all studies agreed on this point. The likelihood of consuming e-cigarettes was also associated with specific characteristics pertaining to gender identity and sexual orientation. It was more likely that e-cigarettes would be used if the consumer was a man and / or part of a sexual or gender minority.
- Socioeconomic factors also play a role in the consumption of e-cigarettes, although their impact was mixed. For example, it was observed in several studies that people with higher levels of education were more likely to quit tobacco cigarettes and switch to e-cigarettes. It was not clear if living in either rural or urban areas, as well as being in employment or not, had any kind of association with the use of e-cigarettes. Income was found to be negatively correlated to the likelihood of being an e-cigarette user, with the exception of JUUL users who were found to have higher levels of income. The household's characteristics also had an impact on the likelihood of using e-cigarettes. People who had family members or friends who smoked tobacco or used e-cigarettes were more likely to use e-cigarettes. People who were divorced, widowed or separated were also more likely to consume e-cigarettes than people who were married.
- Further factors that may influence the use patterns of e-cigarettes are the differences in regulatory environments in different countries. As tobacco products, e-cigarettes are also regulated with more or less restrictions in different countries. One of the factors, which is also linked to tobacco regulation, that appeared to be associated with use of e-cigarettes is whether cigarettes were not allowed in specific locations while e-cigarettes were. In such cases, e-cigarettes were used as an alternative to smoking. However, a less restrictive regulation on the use of e-cigarettes did not directly imply a larger consumption of this product. For example, the social acceptability of e-cigarette use was found to be partially independent of the regulatory framework, and in countries such as the USA, where e-cigarettes are less strictly regulated than in other countries, the take up of e-cigarettes may be also hindered by low levels of social acceptability of this product.
- Public health campaigns and advertisement also play a role in the use of e-cigarettes. The presence of health information on smoking cessation which suggests vaping as a potential tool to quit smoking may encourage some non-

Work strand 4 – Summary

smokers to start vaping. A similar effect was also found in studies on commercial advertising of e-cigarettes.

- E-cigarette users were found to consume more total nicotine than tobacco users and to use e-cigarettes for longer periods due to the absence of a ‘finish’ point. E-cigarette liquids are sold with different concentrations of nicotine and most of the respondents reported the use of low or medium concentrations, although one-fifth of respondents were not aware of the nicotine content of their last or current e-cigarette. However, e-cigarette users tended to start using their devices later in the morning than cigarette smokers, which is interpreted as an indication of lower dependence on nicotine in e-cigarette users.
- Tobacco users were more likely to be ever users of e-cigarettes when compared to former smokers and never smokers, although only a portion of tobacco smokers became long-term users of e-cigarettes. Daily use of e-cigarettes and tobacco cigarettes was less common than an occasional use of e-cigarettes by current smokers. The prevalence of e-cigarette users among former smokers varied from country to country and it also depended on when they had quit smoking; those who had quit more recently were more likely to use e-cigarettes. Never smokers were less likely to be e-cigarette users.

10 Integration of findings

10.1 Approach to integration of findings

In mixed methods studies, the process of integrating findings is important to *"gain a more complete picture and provide a 'whole which is greater than the sum of the parts'"*.[118 (p2)] Triangulation techniques, specifically a triangulation protocol or matrix, can be applied to integrate those separately analysed data to explore where findings converge, complement, contradict or explain each other.[118,119]

In this project, the research team developed a matrix to enable systematic and transparent integration of findings. Following completion of the four work strands, the matrix was populated with key findings from each strand, which were then grouped into themes. This approach involved three of the four types of triangulation as defined by Denzin[120] (see also Yin[121])[lv]:

- **Methodological triangulation**: this project involved multiple methods of data collection and analysis, specifically secondary analysis of survey data and a REA of existing literature;
- **Data triangulation:** this project involved multiple data sources, specifically multiple surveys and existing literature; and
- **Investigator triangulation**: this project involved multiple researchers across different work strands.

The matrix below proves a brief overview of the key findings from each work strand and conclusions which summarise the findings across work strands. It is intended to provide the reader with a helpful summary, which is then developed further in the discussion section at Chapter 11.

[lv] The fourth (theory triangulation) does not apply in this case.

10.2 Integration matrix

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland Tobacco cigarettes (work strand 1)	***Profile of starters and quitters Tobacco and e-cigarettes (work strand 2)***	***Trends across Europe Tobacco cigarettes (work strand 3)***	***E-cigarette REA Tobacco and e-cigarettes (work strand 4)***	
Understanding trends in the context of tobacco control legislation and policy					
Overall trends in smoking behaviors (both cigarettes and e-cigarettes)	**Time period: 2008–2016 (eight years)** ***All*** • **Tobacco cigarette smoking rates have been in decline** in both England and Scotland. Those who smoke are also reporting smoking fewer cigarettes. ***Adults*** • In both countries the number of heavy adult smokers has fallen, while the numbers of light/medium smokers have increased, **indicating that smokers are reducing the intensity of their tobacco consumption.** • Most adults who smoked also reported being **willing to stop smoking altogether**. • **Smoking rates and intensity remain slightly higher in Scotland than England**. The highest proportion of smokers in England smoke "lightly", while those in Scotland smoke "moderately".	**Time period: 2015/16–2016/17 (one year)**[lvi] ***All*** • Figures suggest a **decrease in tobacco cigarette use and an increase in e-cigarette use** among both adults and children. • Both adults and children are **more likely to use cigarettes than be dual users or solely use e-cigarettes.** ***Adults*** • **Intensity of tobacco cigarette smoking remained stable.** • Non-smokers were the most stable group (97% remained non-smokers the following year), suggesting **minimal uptake among adults.** • Those who started smoking during the study period were **more likely to have taken up cigarettes than e-cigarettes**[lvii]. • Patterns suggests that **heavier or more regular adult smokers are less likely to quit smoking regular cigarettes and more likely to re-start**[1]. This remained true for dual users and e-cigarette only users.	**Time period: 2006–2017 (11 years)** • Since 2006, **the proportion of people in European countries smoking tobacco cigarettes has fallen. The decline was initially steep but has slowed.** This pattern is true for most, but not all, countries (e.g., France and Slovakia). • In the UK, the smoking rate decreased from 32.7% to 17.5%, **the largest decline among the 27 EU countries included in the analysis.**	**Time period: 2011–2019 (eight years)** • **Tobacco smokers were the group most likely to report ever use of an e-cigarette**, in comparison to both former tobacco smokers and never smokers. • Current use of e-cigarettes by current tobacco smokers was less common than ever use, suggests that **while many current smokers try e-cigarettes, this does not lead to long-term use**. • **The overall prevalence of use by never smokers remains low,** although there is conflicting evidence as to whether this is dependent on age, with a number of Canadian studies finding this was higher among adolescents than among older adults.	• Figures suggest a **decrease in tobacco cigarette use and an increase in e-cigarette use** among both adults and children. The evidence suggests **gradual patterns of cutting down.** For example, heavier smokers were shown to be less likely to quit but the numbers of heavier smokers are declining and there is a pattern of e-cigarette users moving from dual to sole e-cigarette use. • **Differences in smoking rates and intensity remain between England and Scotland, and among EU countries**, with England showing comparatively high reductions in smoking. • **Tobacco cigarette smoking remains more prevalent than e-cigarette use.** • **Generally, those taking up e-cigarettes are tobacco cigarette smokers**, however there is some evidence which suggests that take up by never smokers is more of an issue among younger age groups (e.g., adolescents). • The **evidence does not allow firm conclusions to be drawn on whether e-cigarettes are working as a cessation tool.**

[lvi] Figures on quitting and re-starting relate to a different time period (2010/11–2013/14).
[lvii] This is likely to capture some people re-starting.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland ***Tobacco cigarettes*** ***(work strand 1)***	***Profile of starters and quitters*** ***Tobacco and e-cigarettes*** ***(work strand 2)***	***Trends across Europe*** ***Tobacco cigarettes*** ***(work strand 3)***	***E-cigarette REA*** ***Tobacco and e-cigarettes*** ***(work strand 4)***	
	Children / young people • **Smoking rates were similar across England and Scotland,** however young people in Scotland tended to smoke more cigarettes on average than their peers in England. • Young people were much **less likely to report willingness to quit, relative to adults.** • In England, most young people were **aware of the negative impact of smoking,** particularly on health. However, these attitudes remained broadly stable and had not increased despite the fall in young people who smoked in England. Attitudes towards smoking among young people in Scotland became less negative over time.	• Adult e-cigarette users were **more likely to be sole users than dual users**. • **E-cigarette consumption is more transient than cigarette smoking.** A lower percentage of adult e-cigarette users remained users in the next survey wave when compared to cigarette users. • **Dual users were less likely than sole e-cigarette users to have quit the year after.** Results indicate that some adults may be moving from dual use to sole e-cigarette use and then quitting, but more data would be required to establish this pattern. Dual users were also more likely to have quit e-cigarettes than tobacco cigarettes. ***Children / young people*** • In contrast to adults, **children were more likely to be dual users than solely use e-cigarettes.**			
Impact of legislation / policies	• While the **ITSA did not show any significant relationship between each individual piece of legislation and smoking cessation or the average number of cigarettes smoked**, this does not mean that they had no impact on smoking. Instead, **it is likely that they have collectively and partially contributed to the general downward trends in smoking prevalence and intensity** in young people and adults in England and Scotland. • For example, the descriptive analyses showed that the proportion of young people buying cigarettes in shops and	N/A	• Overall, **there has been a slight increase in the extent of tobacco control regulation in Europe.** This has varied from country to country. Most countries experienced little change or some increase, but a few saw regulations relaxed (e.g., Malta and Slovakia). • Simple analyses indicate that **countries with more tobacco control laws tend to have a lower prevalence of smokers**.	• **There are a range of regulatory approaches towards e-cigarettes.** Restrictions applied in different countries include banning the sale of e-cigarettes or allowing sale only when prescribed by a doctor, requiring plain packaging and advertising bans. • Several authors placed the **UK at the least restrictive end of the spectrum.** • There is contradicting evidence as to effectiveness of regulatory approaches and health campaigns, including the effectiveness of the same	Legislation may be working to achieve specific policy goals (e.g., restricting access to tobacco cigarettes or influencing social acceptability of e-cigarettes). However, the extent of tobacco control legislation does not seem to explain the decline in smoking rates, either within the UK or across Europe. As suggested in the REA, the success of different measures will depend on the context, including individual and societal factors. In particular, the way in which e-cigarettes are presented to the public through the media, public health campaigns and advertising appears to be a key factor. In summary, implementation of tobacco control legislation or policies alone does not seem to explain the trends in either cigarette or e-cigarette use.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland ***Tobacco cigarettes*** ***(work strand 1)***	***Profile of starters and quitters*** ***Tobacco and e-cigarettes*** ***(work strand 2)***	***Trends across Europe*** ***Tobacco cigarettes*** ***(work strand 3)***	***E-cigarette REA*** ***Tobacco and e-cigarettes*** ***(work strand 4)***	
	from vending machines had declined and that over time, young people in England were more likely to be refused cigarettes when attempting to buy them in shops. **These patterns are consistent with relevant legislation having had intended effects.**		• The association between regulation and smoking behaviour appears to take some years to have an effect. • This association was significant when other factors were not controlled for but was not strong. **Therefore, the extent of tobacco control legislation does not seem to explain the overall decline in prevalence.**	European Directive in different countries • **The national regulatory environment - which impacts use in the public spaces - is thought to influence whether e-cigarettes are seen as socially acceptable**. Smokers also reported using e-cigarettes to "manage" smoke-free places where tobacco cigarette smoking was not permitted. However, regulation was not always the determining factors. In particular, communications from other influencers such as the media and health organisations was also thought to play a role in shaping perceptions. • **Public health campaigns were found to be most likely to impact young people, and exposure to e-cigarette advertising is associated with the use or intention to use e-cigarettes.**	
Exploring wider factors impacting smoking behaviours					
Age	• Among adults, the lowest rates of smoking were consistently found in oldest age groups. Prevalence has fallen the most among those between 35-44, followed by younger groups. • The teenage years remain the most likely time to start smoking. Among adults the median age for starting smoking was consistently 16. Most young smokers started between 12-13; but the age	• Among adults, age was significant for take up. Those aged 16–24 were most likely to take up and re-start smoking, with rates uptake decreasing as age increased. However, age was not significant for quitting. • Smoking rates for both cigarettes and e-cigarettes among children increased by age. • Users of e-cigarettes tended to be younger while dual users tended to be older.	N/A	• Younger adults were more likely to have ever used e-cigarettes than older adults. Older teenagers were more likely to have ever used e-cigarettes than younger teenagers or children. • Younger adults - and those in their late teens - were more likely to be recent users than older adults. However, among teenagers there was evidence suggesting that both older and younger groups were the most	The teenage and young adult years are a key time for take up of both tobacco and e-cigarettes. There is some evidence that e-cigarettes are particularly being taken up in the younger age groups, with tobacco cigarette smoking also falling the most in these younger groups. However, there is also broader evidence of younger people being more likely to change their habits.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland Tobacco cigarettes (work strand 1)	***Profile of starters and quitters Tobacco and e-cigarettes (work strand 2)***	***Trends across Europe Tobacco cigarettes (work strand 3)***	***E-cigarette REA Tobacco and e-cigarettes (work strand 4)***	
	rose during the study period to between 14-15.			likely to have used e-cigarettes recently. • Despite tending to be the most likely to have tried e-cigarettes and used recently, younger e-cigarette users were not the most likely to maintain their use over a long period of time. Some studies found that continued use was most likely in middle adult age brackets.	
Gender and sexual orientation	• Among adults and children, prevalence declined among males and females, with no significant differences observed. • However, the decline in heavy smokers was more pounced in men in England and women in Scotland. Male smokers also used more intensely in Scotland, but not in England.	• Gender was not significant for quitting, but women were less likely to re-start than men. • The difference in overall smoking prevalence between boys and girls seems to be small. However, boys were more likely to smoke cigarettes at younger ages, but girls were more likely to smoke from the age of 13 upwards. Boys were more likely to try e-cigarettes than girls at any age. • Among children, different characteristics were related to smoking by gender (see below for further details). • Men were more likely than women to be both sole e-cigarette users and dual users.	N/A	• The balance of evidence indicated that men were more likely to use e-cigarettes than women. However, this was contradicted by other studies which showed either that women were more likely to use e-cigarettes than men or that there was no statistically significant difference. • Sexual and gender minorities were more likely to be e-cigarette users than heterosexual and cisgender individuals.	Differences were observed in smoking patterns between males and females, but findings were not consistent. Therefore, overall findings do not seem to suggest that smoking cigarettes or e-cigarettes is clearly more of an issue for one gender than the other. Most studies defined gender as being male or female, however studies which also considered gender minorities found that the latter groups were more likely to use e-cigarettes than cisgender individuals. Similar findings emerged in respect of sexual minorities.
Education and employment	• Adults without a degree were almost twice as likely to smoke in England but this relationship was not seen in Scotland. • No differences were observed in overall prevalence rates when comparing children with and without a history of truancy. • However, young people who had played truant or experienced exclusion were more likely to start smoking at a younger age and smoke more intensely and	• Adults with higher qualifications were more likely to start and less likely to quit and re-start smoking than those with less qualifications. • Adults in employment were less likely to start and more likely to quit smoking. • Children who see the importance of doing well in GCSEs or standard grades were less likely to smoke than those who did not.	N/A	• There was mixed evidence as to whether lower or higher education is positively associated with e-cigarette use, however some studies did suggest that tobacco smokers who switched to e-cigarettes were more likely to be more educated. • There was also mixed evidence as to whether the employed or unemployed were more likely to use e-cigarettes. Some studies found that it was more	Secondary data analysis predominantly suggests a positive association between tobacco smoking and lower levels of education and/or unemployment. However, these relationships may not hold for e-cigarettes. The more educated smoker or those in higher grade occupations may be more likely to use e-cigarettes as a cessation tool.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland ***Tobacco cigarettes*** ***(work strand 1)***	***Profile of starters and quitters*** ***Tobacco and e-cigarettes*** ***(work strand 2)***	***Trends across Europe*** ***Tobacco cigarettes*** ***(work strand 3)***	***E-cigarette REA*** ***Tobacco and e-cigarettes*** ***(work strand 4)***	
	be less likely to be willing to quit. Those with experiences of truancy were also more likely to buy cigarettes from shops and found these purchases easier to make. • The unemployed were significantly more likely to smoke than the employed.	• Smokers of e-cigarettes were more likely to be in work than dual users or sole cigarette smokers.		likely in "higher social grade roles".	
Socioeconomic factors	• No differences were observed in prevalence rates when considering children who did and did not receive free school meals. However, those who did receive free school meals were less likely to be willing to quit.	• Those in managerial and professional occupations were less likely to start, more likely to quit and less likely to re-start than those in semi-routine and routine occupations. • People who used e-cigarettes were more likely to be in professional and managerial occupations than dual users or those who smoked cigarettes only. • For girls, the father's highest qualification (which may be a proxy for household socioeconomic status) was significant, with those whose fathers held higher qualifications being less likely to smoke.	• When other factors were not controlled for, countries with less social inequality tend to have a lower prevalence of smokers. However, when other factors were controlled for, the association was significant, but not strong.	• Studies found a negative relationship between e-cigarette use and income. However, e-cigarette users were found to be more affluent than cigarette users. Young e-cigarette users and JUUL users were more likely to have higher incomes.	Studies used a number of different measures or proxies of socioeconomic status, which makes it difficult to reach firm conclusions. However, some associations were made between lower socioeconomic status and tobacco cigarette smoking. Again, this relationship may not be mirrored for e-cigarette users, particularly for young people and users of certain devices (i.e., JUUL).
Health	• People with a heart problem were consistently less likely to smoke and more likely to want to quit in England. No differences were observed in Scotland.	• Existing health conditions, particularly clinical depression, and new health diagnoses were significantly related to both quitting and re-starting. However, no health variables were significant for take up. • General measures of poor wellbeing, such as GHQ or SF-12, were not significantly related to take up, quitting or re-starting once other characteristics had been controlled for. This suggests smoking is linked to only the most severe conditions. • Interactions between clinical depression and physical poor health (having a limiting long-term illness)	N/A	Relationships were identified between e-cigarette use and both physical and mental health conditions (including specific physical and mental health conditions and self-reported general health scores), however the directions of the associations were not clear.	Connections have been made between both cigarette smoking and e-cigarette use and various physical and mental health conditions. The data suggests that more serious conditions are more likely to impact smoking behaviours and can encourage both quitting and take up of cigarettes. Associations between health and e-cigarette use could suggest that poor health encourages use of these products as a cessation aid, however a key limitation of the existing research is that it does not enable conclusions to be made on the direction of associations.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland Tobacco cigarettes (work strand 1)	***Profile of starters and quitters Tobacco and e-cigarettes (work strand 2)***	***Trends across Europe Tobacco cigarettes (work strand 3)***	***E-cigarette REA Tobacco and e-cigarettes (work strand 4)***	
		were also not significant in influencing smoking behaviours. • Data suggests that some diagnoses will encourage people to quit but behaviour is time limited. Pregnancy was also associated with quitting • Whether a child drinks alcohol was associated with likelihood of smoking. • Dual users were most likely to have a longstanding illness or disability relative to those who smoked only cigarettes or e-cigarettes. Most smokers (cigarettes, e-cigarettes and dual smokers) reported their general health as 'good'. However, dual users and cigarette smokers were significantly more likely to rate their health as 'fair' or 'poor' than e-cigarette users.			
Race/ethnicity /nationality	N/A	• Those born outside the UK were more likely to start smoking. • Individuals from non-white backgrounds were more likely to re-start smoking than individuals from a white background.	N/A	• There were mixed findings, but a number of studies suggested that e-cigarette use is the most prevalent among white people.	The data suggests that tobacco cigarette smoking is more common in minority groups. However, early findings suggest that this relationship is less clear – and may even be reversed - for e-cigarette use, with white groups sometimes being the most prevalent users.
Relationships and household factors	• Most young smokers still perceived that their families would want them to quit. However, the data does not show whether this perception impacted behaviours.	***Adults*** • Adults who were married or in a civil partnership were less likely to start smoking tobacco cigarettes and re-start and more likely to quit. • Those who vaped were significantly more likely to be married or in a civil partnership than those who were dual users or only smoked tobacco cigarettes. • Adults were less likely to start, re-start and more likely to quit if they lived with non-smokers. However, the ratio of smokers to non-smokers and the household size was important. For example, the	N/A	• Having a family member or friend who smoked or used e-cigarettes was found to be associated with e-cigarette use, conventional cigarette use, and dual use. • However, having family and friends who do not smoke may also encourage people to take up e-cigarettes as a cessation aid. • There was an association between household smoking and e-cigarette use in young people and adults. • Studies found that e-cigarette use was more closely associated with those who had	The smoking habits of family, friends and household members – particularly household members – appear to influence smoking habits, both positively and negatively. Further to this, positive relationships appeared to act as a protective factor, which may particularly act to prevent children from smoking.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland Tobacco cigarettes (work strand 1)	***Profile of starters and quitters Tobacco and e-cigarettes (work strand 2)***	***Trends across Europe Tobacco cigarettes (work strand 3)***	***E-cigarette REA Tobacco and e-cigarettes (work strand 4)***	
		presence of non-smokers in the household increased the likelihood of an individual quitting if the household was a two-adult household containing one non-smoking household member or if the household was a larger household, containing more than two adults, and containing a greater number of non-smokers than smokers. • The presence of children in the household was not related to quitting for adults. ***Children and young people*** • **Boys:** Boys who used social media and who had poor social skills were more likely to smoke, as well as boys who were often physically bullied. The father's smoking habits, and mental health were also associated with smoking behaviours in boys. • **Girls**: Conversely, the mother's smoking habits were associated with smoking in girls as well as the strength of the father-daughter relationship. • **All**: Both boys and girls who admitted to bullying others and drinking alcohol were more likely to smoke.		never been married, or who were divorced, widowed or separated, than with married people.	
Region/urban or rural status	N/A	• In adults, rural or urban location were not significant for quitting. • Boys in urban areas were more likely to smoke than boys in rural areas, however the same relationship was not found for girls.	N/A	• There was mixed evidence suggesting that living in both an urban and rural area was more associated with e-cigarette use.	The evidence considered in this study does not suggest that this factor is key to explaining smoking behaviours.

Themes	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Conclusions
	Trends across England and Scotland Tobacco cigarettes (work strand 1)	***Profile of starters and quitters Tobacco and e-cigarettes (work strand 2)***	***Trends across Europe Tobacco cigarettes (work strand 3)***	***E-cigarette REA Tobacco and e-cigarettes (work strand 4)***	
Comments on the evidence available					
Overarching evidence base	N/A	N/A	• When evaluating the success of tobacco regulation and other measures it should be recognised that these may take five to seven years to have a measurable effect on behaviour at the population level. • The Tobacco Control Scale is produced by expert review, and how valid and comprehensive it is may need revisiting.	• There was huge variance of measurements of current use of e-cigarettes, making it particularly difficult to compare the rates of e-cigarette use between countries. Standardisation of these measures would allow better comparability of findings. • The majority of the studies used large-scale survey datasets to draw conclusions on associations between e-cigarette use and demographic, socioeconomic and health factors. This makes it difficult to draw conclusions on the directions of associations because most surveys just took a snapshot of factors such as health at a point in time. For example, clear relationships were seen between health conditions and e-cigarette use. However, it was not clear from the data whether those with certain pre-existing conditions were more likely to take up e-cigarettes, or whether the conditions had emerged / worsened following uptake.	The research has highlighted a number of considerations for further research which will be further explored in the discussion section.

11 Discussion and conclusion

11.1 Introduction

It is a well-rehearsed argument that, while smoking in Britain has reduced over the last decades (from 46% in 1974 to 14.7% in 2018),[1] it remains one of the key causes of early death in the developed world.[122] In the last decade a range of national and international legislation, regulation and accompanying public health initiatives have been put in place to raise awareness of the risks of tobacco consumption with the objective to further reduce the harms caused by smoking. Despite the extent and range of these policies, a core group of individuals still smoke. After a decade of active policy making, it is timely to take stock of the effects of recent legislation on the consumption of tobacco products, identifying their impact (if any) on reducing and mitigating smoking behaviours.

The programme of work reported here, set out to explore the impact and consequences of these overarching policy changes implemented over the last decade, focused toward tobacco consumption and supply in England and Scotland. Identifying the impact of e-cigarettes was also a priority, to enable comparisons and assess the contribution of e-cigarettes in reducing the harms caused by tobacco smoking. Four core research questions guided this research:

1. Have the prevalence, intensity and attitudes towards smoking in the UK changed with the implementation of recent tobacco regulations? Do effects vary across characteristics such as age, ethnicity, socioeconomic status or gender?

2. What are the characteristics of individuals who start or stop smoking?

3. How does the UK compare with other European countries in terms of trends in smoking consumption? How do inequalities in smoking in the UK compare to those in other countries?

4. What can current literature and available data tell us about the use of e-cigarettes?

To respond to these questions, a multi-method approach was delivered across four work strands. Through descriptive and inferential analysis of four national surveys (HSE, SHeS, SDD, and SALSUS), **work strand one** (Chapter 6) explored the impact of three tobacco policies enacted between 2007-2011 on the smoking prevalence among adults and children. This included the Smoke-free Regulations, the Tobacco Advertising and Promotion Regulations, and the Protection from Tobacco (Sales from Vending Machines) Regulations. This analysis was supported by findings from **work strand three** (Chapter 8), to ensure that the context of socioeconomic inequality in smoking prevalence (alongside that of legislative controls) could be appropriately addressed.[28] Applying the Eurobarometer Survey as well as two country-level indicators (the Tobacco Control Scale and the Gini Coefficient), this work strand examined the relationship between prevalence of smoking, the extent of tobacco controls, and the level of social inequality in any one country, with comparisons made between countries and across time.

Work strand two (Chapter 7) applied the national survey of USoc (Wave 2 and Wave 5) to deliver a comprehensive profile (through descriptive and inferential analysis) of different groups of smokers, specifically: adults who take up, quit or start smoking again after previously quitting; and children who smoke. In addition, this analysis used Wave 8 and Wave 9 of USoc to explore the use of e-cigarettes among adults and children. This profiling was perceived as important to understand in what areas (and with whom) legislation may change behaviours.

Finally, **work strand four** (Chapter 9) complements the analysis of work strand three around e-cigarettes, delivering a REA which details the current literature on e-cigarette consumption in the UK and internationally. The outcomes of this REA ensured the delivery of a descriptive profiling of the demographic and socioeconomic characteristics of e-cigarette users, linked the impact of tobacco control legislation with e-cigarette consumption, and highlighted any significant gaps in the emerging evidence.

In this chapter, we first build on the triangulation matrix (Chapter 10) to explore the overall trends in tobacco smoking and e-cigarette use behaviours (adults and children) and the impact (if any) of policy and legislation. We then go on to identify the limitations of this report. Finally, a short conclusion is provided.

11.2 Overall trends

Within this section, we first highlight those findings across all four work strands exploring adults' and children's behaviours around tobacco and e-cigarette use to explore changes in prevalence and profiling those groups that are taking up smoking, quitting smoking, or re-starting smoking. The impact of the legislation on changes in profiles is then discussed, identifying if specific policies, legislation or regulation had a greater or lesser impact on behaviours.

11.2.1 Adults (16+) cigarette smoking

We have previously discussed that fewer people are smoking, with the prevalence of smoking in England and Scotland declining. In 2008, 22% of adults in England and 26% in Scotland were current smokers, falling to 18% in England and 21% in Scotland in 2016. Similarly, the willingness to stop smoking has remained high, with (in 2016) two-thirds of individuals wishing to stop smoking in England and almost three-quarters in Scotland.

In exploring overarching **smoking prevalence, intensity and attitudes in England and Scotland** (Chapter 6) our analysis reflected much of the literature in demonstrating the centrality of demographics and socioeconomic factors to smoking behaviours.[16] When exploring variation in smoking by gender, age, education, employment, and health, a number of core areas were found, reflecting and expanding prior research. In exploring the differences in smoking between **sex,** previous research has shown that men are more likely to smoke in comparison to women, although the differences have diminished over time,[123] and this was demonstrated in our analysis. Differences in the prevalence of smoking behaviours in men were seen between Scotland and England, with the former more likely to smoke than the latter (2016), a finding which is replicated among women in the two countries, although the overall prevalence among women remains lower. The rate of smoking has decreased more steeply in women between 2008 and 2016 when compared with men, although differences were found between England and Scotland. In addition, men are more likely to smoke heavily (20 cigarettes or more a day) than women (2016).

Age is still seen as impacting on smoking behaviours. In England, while smoking rates have consistently been lowest in the older age groups and highest among those aged

25–34, the greatest decline over time is in the age groups of 16–24. Reflecting these changes in England, there has been a general decline in smoking in Scotland across most age groups. The age group in Scotland most likely to smoke in 2016 were aged 45–55, although it is likely we are seeing cohort effects here, with the younger adjacent age range (35–44) the highest smokers in 2008. The type and extent of **education** received by individuals still has an impact on smoking behaviours in England, although the pattern differed in Scotland. In England in 2016, people without a degree were around twice as likely to smoke as those with a degree. However, no such association was found in Scotland, which may reflect the overall general higher rates of smoking in Scotland or wider deprivation.[124] In both countries, **unemployed** people were more likely to smoke than those in paid employment (2016). As has been previously reported,[125] the **health** of individuals may be a precipitating factor for not smoking, with those with a known heart condition consistently less likely to smoke than those who had not received any such diagnosis (2016). That one-fifth of individuals still smoke in Scotland on receipt of diagnosis is likely to be owing to a range of factors, such as overall deprivation,[126] a lack of psychosocial smoking cessation interventions, or the 'dose' effect (see also Section 11.2.3) which may interact with any stop smoking initiatives.[127]

In exploring those adults who quit, take up or start smoking again after previously quitting (Chapter 7), the impact of demographic and socioeconomic characteristics on behaviours seen across England and Scotland was strongly reflected and extended in our analysis.

In profiling those **who quit smoking** (between Waves 2 and 5 of USoc, 2011–2014), in line with previous literature, **heavy smokers** were found to be less likely to quit,[18] with those smoking fewer cigarettes (up to 10 a day) in Wave 2 more likely to have quit by Wave 5. Those who were **employed** were more likely to stop smoking than those unemployed. Mirroring our previous findings from England (see above and Chapter 6), **education** had an impact on quitting behaviours with those holding a degree twice as likely to quit smoking compared to those that continued to smoke. However, we were able to extend our analysis in Chapter 7 and, as has been reported in previous research, the family (and peer) environment is crucial in changing behaviours.[19] Those who were **married or in a civil partnership** were significantly more likely to quit smoking than those who were separated or divorced. Similarly, the **household context** is an important factor in quitting, with respondents who lived in a two-person household with a non-smoker, more likely to quit.

Multivariate analysis provided further insight into the impact of those different demographic and socioeconomic factors on **quitting smoking**. Controlling for a range of characteristics (see Appendix D), we were able to detail specific influences on behaviours. The 'dose' response (i.e., **heavy smokers**) remained, with lighter smokers – those who smoked fewer than ten cigarettes per day at Wave 2 – more than three times more likely to quit by Wave 5 than those smoking more than 20 cigarettes per day at Wave 2. The **household context** similarly remained a factor with individuals far more likely to quit if, in a two-person household, one was a non-smoker. While this finding reflects previous literature,[20] further nuances were identified, with any protective factors of non-smokers disappearing if the household contained more than two adults and a greater number of smokers than non-smokers. A range of **health factors** were found to impact on quitting behaviours. Those living with clinical depression or long-term illness at Wave 2 were less likely to quit by Wave 5, although pregnancy had a positive impact on quitting behaviours. **New diagnoses** were found to have an impact on smoking behaviours. Those who had a heart condition diagnosed between Wave 2 and Wave 5 were more than four times more likely to quit smoking, those with a new diagnosis of high blood pressure twice as likely to quit, and those diagnosed with cancer two and a half times more likely to quit. It was found that **the impact of such new diagnoses as 'levers' for behaviour change was time-limited**. That is, diagnoses of these three conditions prior to Wave 2 were not significantly related to quitting. In contrast to our previous findings (Chapter 6) and the descriptive findings in Chapter 7, age, gender, region or urban / rural status were not significant in this model.

Our analysis of USoc data (Chapter 7) also profiled the demographic and socioeconomic characteristics of **those adults that took up smoking** between Wave 2 (2011) and Wave 5 (2014). Reflecting our prior findings (Chapter 6), **young people** (aged 16–24) were far more likely to start smoking than those in other age groups. However, people reported starting smoking at any age, including those aged 65 and over. The protective factor of family or peers was similarly seen with **single individuals** more likely to start smoking than those married or in a civil partnership; more than three-quarters of new starters were single compared to one-quarter of respondents who had never smoked. Building on previous research,[21,22] socioeconomic patterns were also seen. Those who were **unemployed** were more likely to take up smoking, with **education** similarly impacting on take up; almost half of new smokers had no qualifications when compared to those that had never smoked. The protective factor of non-smokers in the **household** was similarly replicated, with respondents living in a two-person household being less likely to start smoking. Again, the regression analysis (Appendix D) confirmed the centrality of demographic and socioeconomic factors, with **age** (16–24), **single status**, low (or no) **educational qualifications** and **household status** (higher numbers of smokers) all strongly related to taking up smoking at aged 16 and over. However, no health variables were found to be statistically significant in the model.

Our final exercise in assessing those factors related to adult smoking was to explore those who had stopped smoking prior to Wave 2 but had taken up smoking again at Wave 5; who we refer to as **re-starters.** Similar demographic and socioeconomic characteristics were all found to influence re-starting behaviours. These included **age**, **single status**, and **household status**. Where socioeconomic factors differed in our analysis was that, in contrast to previous research,[21] **unemployment did not** seem to **have an impact on re-starting**. However, of those **employed**, socioeconomic class did seem to influence re-starting behaviours, with respondents in **professional or managerial occupations significantly less likely to re-start**. Similarly, while previously we had found that health conditions had no significant impact on whether individuals took up smoking between waves (see above), in this analysis, we found **health conditions** to be a **protective factor**; those living with a long-standing illness or disability or high blood pressure were all less likely to take up smoking.

11.2.2 Children (10–15 years) cigarette smoking

In exploring smoking prevalence in children across England and Scotland (Chapter 6) as well as profiling the characteristics of those children who smoke (Chapter 7), again, many of our findings aligned with prior research.[128]

Reflecting those findings in adults, the proportion of young people smoking has fallen over the last decade, from 9% in both England and Scotland in 2006 to 3% and 5% (respectively) in 2016, although young people in Scotland seemingly smoke more heavily than those in England. In exploring the trends in smoking among children (Chapter 7), it was found that smoking increases by age moving from around 1% at aged 10 to 20% at age 15 (Figure 7:19). Such smoking behaviours are seemingly carried out in full knowledge of the harms that cigarette smoking can cause. In 2008, nearly all young people in England recognised that smoking causes lung cancer, with a similar proportion in Scotland agreeing that smoking causes heart disease. However, such perceptions do seem to be negated by other (inaccurate) beliefs. For example, in England, two-thirds of young people in 2008 agreed that smoking helps people relax if they feel nervous and over one-fifth that smoking keeps people slimmer. In contrast to the data seen in adults (see above), in both England and Scotland, of those young people that smoked, fewer reported a willingness to stop smoking. This fall was more pronounced in England than Scotland. In 2010, young smokers in Scotland were more than twice as likely to say they would be willing to stop smoking as their peers in England.

Again, and reflecting prior literature,[129] demographic and socioeconomic characteristics were central to smoking behaviours. While the difference between overall smoking rates and gender is small, there are differences in the age at which children start smoking. Boys start smoking younger than girls at ages 10–13, but the latter have a higher rate of smoking at ages 14–15. In modelling those socioeconomic factors that may be impacting on smoking behaviours (Chapter 7), **family characteristics** seem to be crucial. Following prior literature, children and teenagers were more likely to smoke if their parents currently smoked or had smoked in the past.[23] Girls were more likely to smoke if their father had no formal qualifications, was in a routine or lower supervisory role or was unemployed. Household tenure was significantly associated with smoking, children in owner occupied accommodation being far less likely to smoke.

Family relationships were also found to be central to smoking behaviours. Although previous research has found the father's presence in the household to be important in mediating smoking,[24] we were able to develop this literature, identifying the importance of the **quality of the relationship** in reducing or stopping smoking. Girls were more likely to smoke if their father was not present in the household. However, they were even more likely to smoke if their father was present, but the girl perceived they did not speak to their father about things that mattered. The impact of the quality of the relationship between boys and their fathers differed from that of girls. Boys whose fathers had poor mental health were five times more likely to smoke. In addition, boys whose father had poor mental health were also more likely to smoke than boys whose father was absent. Children were also more likely to smoke if they perceived that their **family was unsupportive** or disinterested.

A number of children's behaviours were associated with being significantly more likely to smoke. Those who **truant are more likely to start smoking earlier**. Similarly, children who admitted they **bullied other children** were more likely to smoke as were those who regularly **drank alcohol** or had friends who regularly drank alcohol.

Family attitudes towards smoking were also found to have an impact on a child's smoking behaviours although this finding was more nuanced with children smoking secretly, leading to few opportunities by parents to influence or stop such smoking. Children were categorised into three groups: non-smokers, smokers whose family knew they smoked and smokers whose family were unaware (secret smokers). In England, perceived family attitudes did not change over time, with about half of young people who smoked saying their family did not know they smoked. Only a minority of families seemingly did nothing or encouraged children to smoke. An overwhelming majority of young people in both England and Scotland who were secret smokers reported that their families would stop them or persuade them to stop smoking.

In our analysis we explored how **young smokers obtained access to cigarettes**, with those options including buying cigarettes from shops, from other people (including family and friends), from vending machines, being given them by family or friends, or taking them. The most common means of getting cigarettes reported by young smokers in England and Scotland (Chapter 6) was being given them by family and friends. In contrast to some past international literature,[17] the sharpest falls seen were in buying cigarettes from shops, with further reductions in those reporting access from tobacco vending machines. We discuss the likely cause of such changes later in this chapter (see Section 11.2.5).

11.2.3 Adults (16+) and e-cigarettes

E-cigarette use in the UK has increased steeply in recent years, reaching an estimated 3.6 million adult users in 2019.[33] We argued in Chapter 9 that, as the use of e-cigarettes has grown, so has the emerging public health and policy debate over the implications of their use. We applied a multimethod approach to identifying the demographic and socioeconomic characteristics of those who use e-cigarettes. Through the secondary analysis of Wave 8 and Wave 9 of USoc (Chapter 7), we explored whether individuals are moving from cigarettes to e-cigarettes and if dual use is a precursor to either using e-cigarettes only or giving up entirely. In addition, the REA responded to two further research questions (Chapter 9). First, we explored the demographic and socioeconomic characteristics of e-cigarette users; second, we compared e-cigarette use to tobacco use.

The secondary analysis (Chapter 7) confirmed a **small increase in e-cigarette use** between Wave 8 (2016–2018) and Wave 9 (2017–2019) with regular weekly users increasing from 4.1% to 4.7% and all current users (including both regular and infrequent users) increasing from 5.6% to 6.2%. Our analysis also demonstrated that around 3% of adults started using e-cigarettes between Wave 8 and Wave 9. Findings indicate that e-cigarettes may have been used as a **route to stopping smoking**: the decline in e-cigarette use among existing users between Wave 8 and Wave 9 was steeper than the decline in smoking between existing smokers over the same time period. Furthermore, those who used **e-cigarettes were twice as likely to have stopped** between Wave 8 and Wave 9 than those who smoked traditional cigarettes.

While the different definitions around use of e-cigarettes alongside tobacco (dual users) make it challenging to identify trends (e.g., some studies applied a 30-day measure to indicate current use of either tobacco cigarettes or e-cigarettes, while others asked individuals to report as current users), between 0.8%[47] and 27%[46] of tobacco users also **currently** or **regularly used e-cigarettes**. In exploring dual use, the figures suggested that this was the least 'stable' group, with individuals most likely to move to a different state between the two USoc waves. There are indications that for this group**, e-cigarettes may not be used as a smoking cessation tool**. Of the respondents who were dual users in Wave 8, these individuals were far more likely to 'drop' e-cigarettes than cigarettes by Wave 9 and only smoke cigarettes. Similarly, when we explored quitting behaviours, we found that a lower proportion of dual users in Wave 8 went onto quit smoking in Wave 9. These findings are supported by evidence drawn from the REA (Chapter 9). For example, dual users spent more on cigarettes than e-cigarettes,[89] and were more likely to switch between cigarettes and e-cigarettes for convenience, either to be able to smoke inside in 'smoke free' areas,[56] or to 'hoard' or 'save' their cigarettes.[106]

However, despite this finding, the picture would seem to be more nuanced, with **some dual users seemingly using e-cigarettes as a smoking cessation tool**. These behaviours were linked to those who smoke more 'lightly'. Dual users who go onto quit or move to solely using e-cigarettes smoked significantly fewer cigarettes per day than the other groups. This finding strongly reflects the 'dose' effect in quitting for cigarette smokers; those smoking fewer than ten cigarettes per day were three times more likely to quit than those smoking more than 20 cigarettes per day (see 11.2.1, above). In addition, while those dual users who smoke heavily may not be using e-cigarettes seemingly as a smoking cessation aid, they may be using these as **part of a pattern of reduction**, although the decline in the mean number of cigarettes smoked per day by dual users between Waves 8 and 9 was not statistically significant.

In exploring the **demographics and socioeconomic characteristics** of those who use e-cigarettes or those who use e-cigarettes alongside tobacco smoking (dual users), many of the findings differed from those who solely smoked tobacco cigarettes. While we did find that **men were more likely than women to vape**, reflecting smoking behaviours in England, and **users of e-cigarettes tended to be younger,** mirroring the profile of those that are most likely to start smoking cigarettes, the clear majority of our findings seemingly **reversed** those previously discussed (see 9.4.2 above). In contrast to sole tobacco smoking, individuals who used e-cigarettes were **more likely to be employed** and **in managerial and professional occupations** than dual users or those who smoked cigarettes only. Respondents who vaped were also **more likely to be married or in a civil partnership**, with **higher self-reported health** than that of dual users or solely smokers of cigarettes.

Through the REA (Chapter 9), these findings were able to be further explored and expanded. Our secondary analysis highlighted that **men were more likely than women to vape** and while the balance of evidence from the REA supported this, there were a number of studies that showed either women were more likely to use e-cigarettes than men, or that there was no statistical difference.

In exploring the ages of those that use e-cigarettes, the literature confirmed that **younger adults were more likely to be recent users of e-cigarettes**, with those aged 18–39 more likely to have used e-cigarettes in the last five days compared to older age groups.[61] Younger adults were also more likely to be **regular e-cigarette users** when compared to older adults,[71] although there was conflicting evidence on daily use. However, this finding is more nuanced than seen in the secondary analysis of the two waves of USoc (above and Chapter 7). It was found that **younger e-cigarette users were less likely to use e-cigarettes over a long period** when compared to older adults,[50] with continued use most likely in middle age brackets. Those aged **35–54 were more likely to have used e-cigarettes for over 12 months** than younger or older adults.[67,68]

While the secondary analysis (Chapter 7) demonstrated that e-cigarette users were more likely to be in **employment** and, where working, to hold professional or managerial positions, the evidence from the REA (Chapter 9) was more mixed. Two studies seemingly confirmed that finding,[71,80] agreeing that e-cigarette use was more common among those in employment. In contrast, two further papers[45,47] clearly identified that those who were unemployed were more likely to use e-cigarettes. To further complicate the picture, one study confirmed that long term consumption of e-cigarettes was more likely by those in professional or managerial positions.[89]

Differences were also found between the secondary analysis (Chapter 7) and the REA (Chapter 9) when e-cigarette use was explored against **marital status**. While the former found e-cigarette users were more likely to be married or in a civil partnership, the majority of the existing literature refuted this finding, highlighting that e-cigarette use was more closely associated with those who were single, divorced, widowed or separated.[41,42,61] Similarly, while the analysis found that e-cigarette users were more likely to report better **health**, the literature argued the reverse, highlighting that e-cigarette users reported more physical health conditions than non-users.[67] It is likely that these contrasting findings are due to the different populations explored within these studies, as well as the self-reported length of use. For example, two studies[72,80] that highlighted those in poor health were more likely to use e-cigarettes explored such use among those who already self-reported a range of chronic conditions, including those with cancer, cardiovascular disease, COPD and chronic bronchitis. It can be argued that those with existing long-term conditions would be more likely to swap from tobacco smoking to e-cigarettes, and neither study compared such changes across the general population. In addition, a further study[67] only looked at those long-term users of e-cigarettes. In our secondary analysis, only two waves could be explored, limiting how far we could segment the health experiences of e-cigarette users over time.

Within the REA (Chapter 9) we were also able to look at a range of further demographic and socioeconomic characteristics that may impact on e-cigarette use. Along with sex (see above), a range of papers reported that **sexual and gender minorities** were more likely to be e-cigarette users than heterosexual and cisgender individuals.[45,72] While we were unable to explore this question in the secondary analysis (Chapter 7) owing to small sample sizes, these findings seem to mirror previous research which has highlighted a higher prevalence of cigarette smoking among those from lesbian, gay, bisexual, and transgender (LGBT) communities[130] when compared to heterosexual individuals. However, a recent paper[131] detailed that this long disparity between LGBT and heterosexual individuals would seem to be narrowing, perhaps reflecting the reductions seen across all populations. It may be that while individuals from the LGBT communities have quit cigarette smoking, their use of e-cigarettes has increased.

While we explored the prevalence of e-cigarette use across **race and ethnicity**, data provided from much of the international literature was difficult to apply to the UK context. Most of the research (particularly drawn from North America) applied classifications that necessarily differed from those applied in the UK (i.e., by the Office for National Statistics). Where relevant to the UK context, the findings were contradictory. One study found that non-white ethnicities were more likely to ever have used an e-cigarette across the UK and Australia,[50] while a second found that long-term e-cigarette consumers were more likely to be drawn from a white ethnic background.[67] In further exploring these conflicting findings, the balance of evidence is likely to lean more toward higher e-cigarette use in white populations.[113,132] However, *"e-cigarette awareness, 'ever use' and current use appear to be patterned by a number of sociodemographic factors"*,[133 (p e89)] and further research on the range of intersectionality will be necessary if we are to fully understand the impact of race or ethnicity on e-cigarette use.

Throughout this analysis, we have highlighted the **centrality of relationships** (family and friends) as well as **household factors** in smoking behaviours (see 11.2.1, 11.2.2). These findings were reflected in the literature on e-cigarette use. Having a family member or friend who used e-cigarettes or tobacco cigarettes was associated with e-cigarette use, tobacco cigarette smoking and dual use.[133] Similarly, having family and friends who do not smoke may encourage people to take up e-cigarettes as a smoking cessation aid.[97] Finally, adults who reported another smoker in the house were more likely to report e-cigarette use.[52]

11.2.4 Children (10–15 years) and e-cigarettes

National and international media as well as public health officials in the USA[134] have stated that e-cigarette use among children has become an 'epidemic', arguing that such practices are a gateway to smoking tobacco.[135] However, within our secondary analysis and REA there would seem to be as yet limited evidence to support such statements in the UK, although the REA did not directly explore the issue of e-cigarettes as a gateway to tobacco smoking.

In exploring Waves 8 (2016–2018) and Wave 9 (2017–2019) of USoc (Chapter 7), we found the overall proportion of current users of e-cigarettes, both regular and infrequent, to have increased only slightly between Wave 8 and Wave 9, with fewer than 1% of children using e-cigarettes at least once a week. Reflecting tobacco smoking behaviours, rates of e-cigarette use increase with age, to around one-fifth of boys and girls at age 15. In exploring dual use (those children who smoked both tobacco and e-cigarettes), e-cigarette use was lower than the rate of smoking, with less than 1% of boys and girls using both. From this survey, it was not possible to understand the directionality of smoking behaviours, i.e., if e-cigarettes are first being used, with children then adopting tobacco smoking, or children first using tobacco cigarettes before moving onto using e-cigarettes. However, given that children are less likely to use e-cigarettes than to smoke cigarettes, it may be that e-cigarettes are being 'swapped' with cigarettes when the latter are unavailable.

There are indications that the prevalence in the UK may be substantially lower when compared with e-cigarette behaviours among children in North America. In drawing on the REA (Chapter 9) to explore the prevalence of **e-cigarette use by those who had never smoked**, one study[62] that carried out a secondary analysis of a Canadian child and youth focused survey (ages 9–18) found that never-smoking youth in Canada were four times more likely to report ever use of e-cigarettes in comparison to the population of a UK-focused study (age 11–18)[108]. Both papers report a higher prevalence than seen in our secondary analysis of USoc (above). However, as the age ranges incorporated in their analysis are wider than those applied in our analysis (ages 10-15), the findings are not directly comparable. As we have discussed, e-cigarette use increases with age and it is likely that it is these age effects that are impacting on the reported prevalence rates.

Within our secondary analysis (Chapter 7), we were unable to **explore the use of e-cigarettes by children that had formerly smoked**. One paper in the REA (Chapter 9), identified that among former child or young adult smokers (aged 11–18), over three-quarters had ever used e-cigarettes. Again, this fell over three-fold when use in the last month was explored, with one-fifth of former smokers reporting using e-cigarettes in the past 30 days.[62]

In exploring the prevalence of e-cigarette use by children who are **dual users**, we found in the UK that e-cigarette use was lower than the rate of smoking. In comparison, a study identified in the REA and based in the US identified dual use by almost one in ten of those aged 9–18 in 2015,[70] with a further paper[64] (again based in the US) finding that over one-half of current tobacco smokers in 2015 reported using e-cigarettes in the last 30 days. Again, both papers used wider age ranges which may be impacting on the reported increase in prevalence.

From the evidence, it would seem that the use of e-cigarettes by children aged 10–15 in the UK is yet to be the epidemic perceived by the wider media. However, that over one-fifth of boys and just under one-fifth of girls aged 15 have ever used e-cigarettes is of concern given that, as yet, the short and long-term health impacts are unknown.

11.2.5 The impact of policy and legislation on cigarette and e-cigarette use

In detailing the prevalence of tobacco and e-cigarette use in England and Scotland as well as the profile of adult and child smokers, we have demonstrated that a myriad of demographic and socioeconomic characteristics are central to smoking behaviours, including: age, sex, race and ethnicity, housing status, employment status, peer and family relationships, and health and individual characteristics (e.g., alcohol behaviours). In addition, it would seem that the previously accepted profiles of those who continue to smoke cigarettes are changing with the steep growth of e-cigarette use. Legislating to reduce the harms caused by tobacco and discourage e-cigarette use among never smokers in such a multifactorial environment is likely to be challenging.

As we have previously highlighted, the central role of this study is to explore the impact and consequences of the overarching policy and legislative changes implemented over the last decade, focused toward tobacco consumption and supply in England and Scotland (Chapter 6) as well as drawing on secondary analysis of European surveys (Chapter 8). In addition, we explored the impact of the regulatory landscape on the use and commercialisation of e-cigarettes within the REA (Chapter 9).

To further understand the **potential impact of specific smoking legislation on prevalence in England and Scotland** (Chapter 6), an ITSA was applied. Three pieces of legislation were included owing to their scale and potential reach: the Smoke-free Regulations[lviii]; *The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012*; and *The Protection from Tobacco (Sales from Vending Machines) (England) Regulations 2010*.[lix] To assess if such legislation reduced smoking, two outcome variables were explored: the prevalence of current smokers; and the mean number of cigarettes smoked per day. Recognising that pre-publicity of such legislation and lead-in time may impact on behaviours,[14] we compared smoking rates and tobacco consumption (mean number of cigarettes smoked) for the ‘pre-intervention’ and ‘post intervention’ phases.

In examining the impact of the Smoke-free Regulations and *The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations 2012* on **adult smoking prevalence and tobacco consumption**, despite the development of a range of models, neither piece of legislation was found to have a statistically significant effect. While each of the models indicated a gradual decrease of prevalence over time, there was no ‘step-change’ following the enactment of such statutory controls. Similarly, neither model was significant when the outcome variables, (number of current smokers and mean number of cigarettes smoked a day), were examined separately by age and sex, indicating that these pieces of legislation did not impact on men and women differently, or by different age groups.

A similar picture was found when carrying out an ITSA exploring the impact of *The Protection from Tobacco (Sales from Vending Machines) (England) Regulations 2010* on **the prevalence of smoking by children, and the number of cigarettes smoked per day**. While mirroring the changes in adults, evidencing a reduction in smoking over time, the piece of legislation itself had no statistically significant impact. However, this finding may be somewhat more complex than has been identified by the modelling. As we have discussed above (see Section 11.2.2), the number of children reporting being able to buy cigarettes from shops halved between 2006 and 2016 in both England and Scotland. Similarly, access to cigarettes from vending machines in England fell to almost zero over the same time period, indicating that legislation may be impacting on behaviours, despite any models clearly being non-significant.

In consequence, while the cumulative impact of the number and extent of legislative actions around smoking during the selected time period is likely to impact on prevalence and consumption, it is not possible in this dataset to identify whether

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[lviii] *Smoke-free (Vehicle Operators and Penalty Notices) Regulations 2007*, the *Smoke-free (Penalties and Discounted Amounts) Regulations 2007*, and the *Smoke-free (Premises and Enforcement) Regulations 2006.*

[lix] For full details of the legislation see Table 6:4 and Appendix A.

specific single pieces of legislation are effective alone. Given that several pieces of smoking legislation have been passed and enacted in quick succession and have targeted a range of areas (including sales, advertising, prices, areas in which smoking is permitted and age restrictions), it is these cumulative impacts along with public health activity that are likely to have reduced smoking rates in England. It may be that further modelling against cumulative legislations may be a stronger predictor of smoking cessation than any single legislation. The challenges of the data in drawing these conclusions are discussed in the Limitations section below (Section 11.3).

In exploring the **impact of tobacco legislation in Europe**, again the centrality of socioeconomic characteristics came to the fore (Chapter 8). Two specific objectives of this work strand examined the association between prevalence of tobacco smoking and the extent of legislative measures in each European country, as well as levels of social inequality. It was found that simple analyses demonstrated that countries with more tobacco control and less social inequality tended to have a lower prevalence of smokers. However, it is social inequality, rather than legislation, that has the most immediate impact: a reduction in smoking prevalence following a decline in social inequality becomes apparent two years after the change in inequality, while legislation seemingly takes between five to seven years to have an effect. Such findings mirror those analyses in England and Scotland and within the literature, identifying, for example, that unemployment is likely to affect smoking behaviours and re-starting. Bringing the extent of tobacco control and social inequality together, neither fully explain the decline in smoking prevalence.

In the REA (work strand four, Chapter 9), we examined if **national policies have affected e-cigarette consumption patterns**. In analysing the literature in this area, we first applied a framework of national regulatory approaches ranging from the most to least restrictive (see Figure 9:4 and below) and explored their impact on four areas: social acceptability; use in public spaces; reduction in the number of e-cigarette users; and taxation and pricing. In addition, we assessed the impact of advertising on e-cigarette use and perception.

Australia has the most restrictive regulatory framework, with statutes forbidding the sale of vaping liquid containing nicotine unless prescribed by a doctor to support smoking cessation, and in one state the sale of all devices and vaping liquids are banned.[55,71] While Canada has similar restrictive regulations banning the sale of e-cigarettes and liquids containing nicotine, there has been weak implementation of these statutes, enabling manufacturers to launch products despite their prohibition.[111] The US initially adopted a less restrictive approach allowing vaping products to be sold and advertised without specific constraints. However, in 2016 all tobacco products, including e-cigarettes, were placed under the regulatory authority of the US Food and Drug Administration (FDA) with the consequence that the sale of vaping products to minors and the distribution of free samples are now banned. Discussions are also ongoing as to whether to introduce further prohibitions on the sale of flavoured e-cigarettes, likely to be implemented in 2022.[111] Across the literature explored, the UK was perceived as having the least restrictive regulation or legislation governing the sale, use and advertising of e-cigarettes.[50,55,110] In addition, England was also the first country in the world to encourage the use of licensed e-cigarettes for harm reduction in the treatment of tobacco dependence.[50]

There would seem to be some indication that more restrictive regulations or policies lead to lower **social acceptability of the use of e-cigarettes in public**. For example, one study that explored perceptions in the UK and Australia found far fewer individuals in Australia perceived e-cigarette use as socially acceptable.[55] These differences (between the UK and Australia) were replicated in a further study with, in addition, lower levels of social acceptability reported in the US and Canada.[110] The inclusion of the US in these findings, despite their previous *laissez-faire* approach, may reflect the recent regulatory move to the FDA. A similar pattern was seen when exploring the social acceptability of **vaping in public and in smoke-free public spaces**. A higher proportion of respondents in the UK feel comfortable smoking in public places or smoke-free places than those in Australia.[55]

In exploring the role played by national regulatory approaches in **reduction and cessation of e-cigarette use**, two findings emerged. The first was that there may be indications that restrictive regulations discourage the use of e-cigarettes among those who have never smoked, as seen in the extremely low prevalence of e-cigarette use among never smokers in Australia.[71] However, this pattern changes when the prevalence of e-cigarette use among former or current tobacco smokers are included in any analysis, with former or current smokers between one-fifth and one-quarter of ever users of e-cigarettes.[50] Such findings may reflect prescribing of e-cigarettes by primary care physicians as a tool to stop smoking. However, it would seem more likely that these figures are a result of users in Australia subverting the strict regulations through either going online to purchase vape liquid or e-cigarettes[111,112] or by being supplied through a 'growing black market'.[50]

The second finding was that **new policies and health campaigns can potentially reduce the prevalence of e-cigarette users**. One study based in France (that also incorporated tobacco smokers) identified that new stricter control regulations (e.g., plain packaging, graphic warnings) coincided with a reduction in e-cigarette use, from 3.9% of the population in 2016 to 3% of the population in 2017.[114] However, a range of smoking cessation programmes had been set up concurrently and it may have been the combination of regulations or statutory enactments *alongside* any public health programmes that produced this reduction in e-cigarette behaviours, rather than the restrictive policies themselves.

There was a paucity of literature that explored the **impact of taxation and pricing** on the use of e-cigarettes. Where reported, such policies would seem to have limited impact. One study identified that there was a higher prevalence of regular users of e-cigarettes in states with low cigarette taxes and low spending on tobacco control when it could be expected that fewer people would adopt e-cigarettes in this environment given such low taxes; waiting to 'switch' until they perceived tobacco taxes to be too high. The same study found that taxes on e-cigarettes themselves did not seem to affect their use.[42] A further study conducting a price experiment with smokers in four countries also found some contra-indicated findings with the only individuals likely to 'swap' to e-cigarettes on higher tobacco prices being non-daily smokers.[79]

Whatever the level of regulation in any country, it is clear **that policies to control, restrict or ban e-cigarette advertising are likely to minimise e-cigarette use**. One study that explored the impact of point of sale (POS) e-cigarette advertising on young people found that exposure to such adverts and recall of the advert was associated with the intention to use or use e-cigarettes. The authors concluded that being exposed to e-cigarette advertising was comparable to the effects of being exposed to tobacco advertising.[58] These findings were supported by a further study[52] which applied a two-wave survey to measure receptivity to e-cigarette advertisements. It was found that a higher receptivity to e-cigarette advertisements in Wave 1 was associated with increased vaping at Wave 2.

Throughout our analysis, the centrality of demographic and socioeconomic factors has proven to be 'stronger' than any resulting single policy. Despite the plethora of policies to reduce smoking, no single policy seems to have had a specific impact, such findings seemingly aligned with wider literature.[136] Rather, it seems to have been the cumulative impacts of these policies, alongside health campaigns (e.g., 'Stoptober') that has resulted in the overall reduction in smoking. In contrast, findings from the REA suggest that restrictive policies (including limiting access to products as well as advertising) around e-cigarettes appear have had some impact on the prevalence and social acceptability of e-cigarette use, particularly those who have never smoked.

11.3 Limitations of the research

There are a number of factors inherent in this research project which may be described as limitations. These are presented by work strand so as to identify the unique challenges involved in the multimethod approach taken for this research.

11.3.1 Work strand one: Smoking prevalence, intensity and attitudes in England and Scotland

One limitation in work strand one relates to the time period of this study. Owing to the rapid development of tobacco control legislation from 2005 to 2016, it is not possible to definitively establish a causal link between any one piece of legislation and changes in tobacco consumption. As we have discussed, many factors will influence smoking behaviour, including lagged effects of previous legislation and the cumulative impact of the multiple legislations passed within this period. Other factors include changes in attitudes, awareness and acceptability, tobacco prices and austerity, e-cigarette use, and the availability and effectiveness of smoking cessation services nationally and in specific regions. It is also difficult to assess the influence of wider societal change on the development of legislation, and whether legislation may be reactive to pre-existing trends in consumption and / or the demographics of cigarette and e-cigarette users.

In addition, there are challenges with the availability of data and the reported time lags between the implementation of policy and the effect being visible or identifiable in data sources. Datasets were selected in order to maximise the use of datasets which include questions on smoking, with datasets included from 2006 to 2016. However, a number of policies had been introduced by 2006, including the smoking bans which were introduced in Scotland in 2006 and the rest of UK in 2007, while a full display ban was introduced from 2015. This means that while this data can be used to investigate the impact of legislation on smoking prevalence within the UK, it is possible that some of the effects may be seen more clearly in data produced outside of the survey waves selected for analysis within this report. Data from the Tobacco Control Scale (TCS)[27] indicates that policies may take up to seven years to become 'visible' in their impact on tobacco prevalence, suggesting future research may wish to expand the years of data studied in the future to provide a more in-depth understanding of the impact of these policies.

The wording of questions also varied within the surveys included in the analysis. Directly comparable smoking questions were asked on the Scottish and English adult surveys, however the questions asked on the Scottish and English child surveys often diverged. Question wording is provided alongside reporting of results, and these differences should be borne in mind when making comparisons.

11.3.2 Work strand two: Profile of starters and quitters

Within work strand two, a primary limitation is the lack of information on when people took up regular smoking which makes it difficult to determine whether smoking policies introduced during that time may have influenced the change in behaviour. With the rate of smoking in children, the low rate of smoking means that the analysis is based on relatively small sample sizes, meaning that nuance in the impact of different household, family and child characteristics may not be identified in the analysis. In addition, it was necessary to combine waves of data and take data from alternating years. However, information was still available for children in every year of age, and while some age groups are drawn from different waves, this is unlikely to have an impact on findings.

11.3.3 Work strand three: Tobacco Control Scale

The analysis in work strand three draws on cross-sectional data, which leads to a number of limitations in the analysis. Use of cross-sectional data prevents the analysis from identifying causal inference. Additionally, the individual-level dataset is made up of a series of cross-sectional datasets combined, and for each participant information is included for one point in time, which means that it is not possible to directly estimate the effect of a predictor at wave 1 on an outcome at wave 4.

It is also likely that factors not included in the modelling explain some of the associations observed between TCS score, Gini coefficient, and smoking. The small number of time points limited our ability to statistically compare effects for each country or at each wave. It is also difficult to fully control for cultural factors, although our analysis controlled for the fact that there may be some correlation of behaviours within each country. Moreover, the analysis uses that to account for the differences in the countries' populations sizes at each wave, hence estimates presented are representative for the total EU27 population, to avoid the underestimation of standard errors.

Finally, the TCS also has a number of challenges. The TCS is not comprehensive of all tobacco control measures, for example it does not include the legal age for purchasing cigarettes and criminalising 'proxy purchasing'. It may therefore capture regulations in some countries better than others.

11.3.4 Work strand four: E-cigarette Rapid Evidence Assessment

The REA identified huge variance of measurements of current use of e-cigarettes. A range of studies applied past-30-day measures, others used frequency measures (including daily, weekly or monthly) to indicate current use, while still others used self-reporting status measures, asking individuals if they were 'current users' of tobacco or e-cigarettes. This makes it particularly difficult to compare the rates of e-cigarette use between countries.

Trends in the consumption of e-cigarettes are more challenging to identify. This may be for two reasons: firstly, the majority of evidence uncovered in this REA is cross-sectional in nature. Although longitudinal data sources have been used,[46,67,70] this is often used cross-sectionally and does not present trends over time. Secondly, the REA identified huge variance of measurements of current use of e-cigarettes, which fall into three main categories:

- Past-30-day measures;
- Frequency measures to indicate current use, such as daily, weekly or monthly use, and / or combining multiple options into a current or regular use measure; and
- Self-reporting status measures, for example, asking respondents whether they are a ‘current user’ of either tobacco cigarettes or e-cigarettes.

This makes it particularly difficult to compare the rates of e-cigarette use between countries. One key area for further research is the standardisation of these measures to ensure comparability of findings.

In addition to challenges relating to the methodology of the papers referenced in the REA, there were also challenges relating to the research questions. Broad research questions were used in order to provide the greatest overview of the current use of e-cigarettes in an international context. We would recommend that future research projects adopt a more targeted approach in a REA, to ensure that appropriate conclusions can be drawn from these findings.

11.3.5 Public and patient involvement

One limitation underpinning this study, may be the lack of representation in a public and patient involvement group. Input from a public and patient involvement group, such as representatives from Cancer Research UK, Ash, Forest, or other charities related to smoking and tobacco, may have provided further insights into aspects of tobacco use that are more cultural or sociological in nature, including the role of advertising, marketing, and celebrity culture on tobacco use. In addition, representation from a diverse group of patients may have supported the research team in its focus on the impact of tobacco control policies on smoking prevalence among members of Black, Asian and Minority Ethnic communities. While some of the evidence regarding smoking cessation has emerged from the literature itself, by including the perspectives of those managing smoking cessation services, or those supported by them, we may have more clearly identified the most successful strategies in helping people to quit smoking at a grass roots level. Future projects focusing on tobacco control, regardless of methodology, are likely to benefit from substantial public and patient involvement throughout the project.

11.3.6 Illicit tobacco use

The focus of the study is the use of tobacco control measures to address mainstream sources for tobacco. This is related to the aims of the measures, which focused on legitimate sources of tobacco sales (such as restrictions on vending machines and restricted displays in small and large shops) and which did not address illicit sales directly. However, we recognise the ongoing challenges related to tobacco smuggling and ‘under the counter’ or ‘black market’ sales. It is important to recognise that illicit access may change following Britain’s exit from the European Union and for ongoing policy to reflect the importance of maintaining existing high standards in tobacco control moving forward.

11.4 Conclusion

The prevalence of smoking has reduced over the decades, although it is still estimated that globally, smoking will be responsible for eight to ten million deaths per year by 2030.[137] In contrast, e-cigarette use reaches an estimated 3.6 million people in the UK,[33] with the value of international sales estimated in 2015 to be around $3.5 billion.[138] If we are to further reduce prevalence of smoking, it is essential to understand the demographic and socioeconomic characteristics of those that continue to smoke, re-start, and quit, as well as those effective policy or legislative enactments that can support behaviour change. Our programme of work set out to explore the impact and consequences of a range of core policy changes implemented over the last decade to reduce tobacco smoking. In doing so, we first explored and provided detailed profile information on tobacco and e-cigarette users, taking forward the existing, somewhat fragmented, literature to provide an overall ‘holistic’ picture of smoking behaviours across communities and populations; in the UK as well as internationally.

We were able to confirm the centrality of demographic and socioeconomic factors (deprivation) in adult and child smoking behaviours, highlighting that those existing ‘levers’ to smoking (or non-smoking) had not changed substantially over the last decade. For example, men are still more likely to smoke, although the gap is narrowing, and women in Scotland smoke as ‘heavily’ as men in England. Those with lower educational qualifications are more likely to smoke, those individuals who are unemployed are less likely to quit smoking and those individuals neither married nor in a civil partnership are more likely to smoke.

However, we were also able to take the literature forward in a number of areas. A clarity was provided around the importance of family characteristics in tobacco smoking behaviours, particularly the impact of the *quality* of relationships between children and their parents that may lead to the former taking up (and continuing) smoking. In addition, it would seem that the diagnosis of new health conditions provides a ‘space’ where tobacco smoking can be appropriately tackled, with e.g., those diagnosed with a heart condition more than four times more likely to quit smoking. However, our analysis demonstrated that this window of change is time-limited and likely to require early and intensive exploitation.[139]

In exploring the profile of those who have adopted e-cigarette use, the normally accepted parameters of smoking behaviours (i.e., often linked to deprivation and lower socioeconomic status) on which legislation and policy has been focused were often reversed. While the literature was, at times contradictory, overall, it was found that those most likely to take up e-cigarette use were more likely to be employed, in professional (managerial) occupations, more likely to be married or in a civil partnership and report better health. While the narrative that e-cigarette use among children has reached an epidemic was not proven, it is of concern that over one-fifth of boys and just under one-fifth of girls aged 10–15 have used e-cigarettes at some point (albeit this may only be ‘a puff’).

There has been a plethora of legislation and regulation to tackle tobacco smoking behaviours in England as well those emerging from across the devolved governments. Where examined, we found cumulatively, these selected policies have supported a decline in smoking prevalence across the UK; however, due to the nature of tobacco control measures, and the combined effect of multiple policies, it seems that no single enacted policy had a statistically significant impact on smoking behaviours individually. Our models indicated that, while there has been a gradual decrease over time, there was no ‘step-change’ that reflected the implementation of legislation. This finding was reflected when exploring the impact of tobacco legislation in Europe, with changes to social inequality likely to have the most immediate impact on whether individuals take up, quit, or continue to smoke. It is argued that it is the cumulative effect of legislation that is likely to be having an impact on prevalence and consumption, rather than (one or other) single pieces of legislation. As noted above in the limitations section, it is also key to recognise that the lack of a statistical counterfactual prevents us from assessing whether the prevalence of cigarette smoking may have plateaued, or indeed risen, should these policies have not been enacted.

The picture around the effectiveness (or otherwise) of legislation on e-cigarette use behaviours would seem to be slightly different. In exploring the literature, the introduction of restrictive policies (i.e., all nicotine-containing vaping products banned, any use requiring a medical prescription, and regulations strongly enforced) would seem to result in lower social acceptability of the use of e-cigarettes as well as to negate the use of e-cigarettes among those who had never smoked. However, for those that were current smokers, the legislation seemed to have little effect, with restrictive policies being subverted by the simple expediency of purchasing liquids or e-cigarettes online. There were also indications in the literature that, to be truly effective, legislation needs to be supported by public health campaigns. In one study, while new legislation around e-cigarette use was found to have an impact, such implementation was accompanied by strong public health programmes. Again, it is likely to be the cumulative effect of policies and health campaigns that is changing behaviours.

Given the multifactorial nature of tobacco smoking, and its stubborn link with social deprivation, it is perhaps not surprising to have identified that specific pieces of legislation have little impact on smoking behaviours when viewed individually. Similarly, given that the known and generally accepted profile of smokers reverses when the demographics of e-cigarette users are explored, it is unlikely that the focus of policies suitable for tobacco smokers can be simply transferred to address the rise in e-cigarette use, should these be required to prevent non-smokers from taking-up e-cigarettes. However, these findings do not lead to the recommendation that restrictive policies should not be incorporated into any approach to mitigate or reduce tobacco use. Rather, policy and practice need to reflect the multifactorial nature of smoking.

Any future tobacco smoking legislation needs to be accompanied by high-profile and well-funded public health and primary care-based interventions (e.g., smoking cessation clinics, appropriate prescribing) that reflect the profile of the population highlighted in this study and are flexible enough to reflect and respond to the different patterns of smoking over the life-course (i.e., take up, quitting or re-starting). In addition, any tobacco smoking legislation needs to be undertaken in parallel with policies that reduce overarching social inequalities. Without such a holistic approach, while tobacco smoking is likely to continue to reduce (although our findings indicate that this pattern of reduction may be plateauing), health-related comorbidities and mortalities will continue to be seen. In addition, given the different profile of those who adopt e-cigarettes, we can no longer apply prior legislative responses to address this increase in use. Innovative and different approaches need to be applied in primary care to emerge the rationale behind e-cigarette use. Again, any legislation needs to be carried out in parallel with health and school-based education, and it may be necessary to even place limitations on what can (and cannot) be purchased through the internet. In summary, smoking will only be reduced or discouraged through implementing an integrated approach to legislation and public health alongside mechanisms to tackle social inequality.

12 Dissemination

To maximise research impact and effectively communicate findings to a wider audience, including academics, policymakers, stakeholders, and the general public, we have planned the following range of dissemination activities. Our original proposal included plans for a networking launch event for the report; due to the ongoing Covid-19 restrictions, this is no longer feasible.

Publication of reports online

With the permission of NIHR and the Department of Health and Social Care (DHSC), we will make a copy of this report (in full) and the executive summary available through the NatCen website and promote this through our social media channels. Advisory group members will be encouraged to support dissemination activities and promotion through their networks.

We will also produce a set of infographics that can be used on our social media platforms, particularly Twitter, where we have an audience of approximately 18,000 social scientists, academics and policymakers. Using infographics to promote the report increases the likelihood of engagement in our findings across each of these groups.

Journal publication

We intend to publish a paper in a high impact peer-reviewed journal. Suggested journals include *Tobacco Use Insights*, *Tobacco Control,* and *Tobacco Prevention and Cessation.* We anticipate that our secondary data analysis, which demonstrates the socio-economic characteristics affecting smoking take up, quitting and re-starting using longitudinal data, is likely to be the most relevant for publication. In addition, we perceive that the REA provides emerging insight into the use of e-cigarettes, adding to the literature, and we intend to submit a peer-reviewed paper, detailing this work strand.

Conference presentations

As our research includes findings relating to tobacco control on a global scale, we feel that it is vital to share this research with international academics and leaders. Recognising that a number of conferences have been postponed or cancelled as a result of the Covid-19 pandemic, we therefore plan to submit a conference presentation to the 18th World Congress on Tobacco or Health (WCTOH) which has been rescheduled from March 2021 to March 2022. Should this no longer be possible, we will endeavour to present at a similar event with a global reach.

Working with policymakers

With support from NIHR, we intend to share the executive summary and report with policymakers, particularly those in DHSC. We would be happy to arrange meetings, conference calls and presentations for colleagues who would like further insights into the report.

We are also aware of the concurrent NIHR research grant held by Professor Tessa Langley at the University of Nottingham, focusing on the impact of English tobacco control legislation on smoking prevalence. We would welcome opportunities from NIHR to work with Professor Langley in sharing our combined research findings to policymakers, including, for example, through an online shared dissemination presentation or meeting.

Appendix A. Legislative and policy measures

A selected list of relevant legislation covering the United Kingdom and the European Union is shown at Appendix table A:1 below:

Appendix table A:1 Legislative and policy measures: UK, EU, WHO

The full name of the legislation	*Year of approval*	*Date & month of implement ation*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
Television without Frontiers Directive (89/552/EEC)	Oct-89	Oct-91	EU	A directive to regulate audiovisual advertising of tobacco across the EU.	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al24101	1			
Tobacco Advertising and Promotion Act 2002	May-02	Feb-03	UK	The Tobacco Advertising and Promotion Act (2002) banned the advertisement, promotion and sponsorship of tobacco products, with limited exceptions. This included advertising of brandshare products, newspapers and electronic communications, and free distribution of coupons.	http://www.legislation.gov.uk/ukpga/2002/36/	1			
The Tobacco Products (Manufacture, Presentation and Sale) (Safety) Regulations (revoked)	Dec-02	Dec-02	UK	The Tobacco Products (Manufacture, Presentation and Sale) Regulations (2002) stipulated the maximum yields of tar, nicotine and carbon monoxide in cigarettes within the UK and available for export in the EEA. This also required further health warnings and banned the sale of tobacco which suggested the product is less harmful to health than others.	http://www.legislation.gov.uk/uksi/2002/3041/contents/made			1	
Tobacco Advertising Directive (2003/33/EC)	May-03	May-03	EU	The Tobacco Advertising Directive (2003/33/EC) introduced an EU wide ban on cross-border tobacco advertising and sponsorship in the media other than television. The ban covers print media, radio, internet and sponsorship of events involving several EU countries, such as the Olympic Games and Formula One races. Free distribution of tobacco is banned in such events. The ban covers advertising and sponsorship with the aim of direct or indirect effect of promoting a tobacco product.	https://ec.europa.eu/health/tobacco/advertising_en	1			
WHO Framework Convention on Tobacco Control	Jun-03	Feb-05	World-wide	A treaty to encourage countries to address the tobacco epidemic. MPOWER, a programme of regulation, has been developed to support countries to roll out legislation.	https://www.who.int/fctc/cop/about/en/	1	1	1	1

Appendix table A:1 Legislative and policy measures: UK, EU, WHO

The full name of the legislation	*Year of approval*	*Date & month of implementation*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
The Tobacco Advertising and Promotion (Point of Sale) Regulations	Mar-04	Dec-04	England, Wales and Northern Ireland	The Tobacco Advertising and Promotion (Point of Sale) regulations restrict the size, format and content of tobacco advertisements which may be published at a point of sale and on certain tobacco vending machines.	http://www.legislation.gov.uk/uksi/2004/765/contents/made	1			
The Tobacco Advertising and Promotion (Point of Sale) (Scotland) Regulations	Mar-04	Dec-04	Scotland	*See Tobacco Advertising and Promotion (Point of Sale) Regulations.*	https://www.legislation.gov.uk/ssi/2004/144/note/made	1			
Smoking, Health and Social Care (Scotland) Act	Jun-05	Mar-06	Scotland	The Act made it an offence to smoke in any partially or fully enclosed public space in Scotland, including workplaces and businesses, with a limited number of exemptions. It also gave powers to change the minimum age for purchasing tobacco, with a lower limit of 16 and an upper limit of 18.	http://www.legislation.gov.uk/asp/2005/13/contents/		1		1
The Health Act 2006	Jun-06	Jul-07	England and Wales	This Act legislated for a ban on smoking in places of work, in businesses open to the public, and in other places as required, which was laid out in regulations following the Health Act. It also allowed the Health Secretary to raise the minimum age for purchasing tobacco.	http://www.legislation.gov.uk/ukpga/2006/28/contents		1		1
The Smoke-free (Premises and Enforcement) Regulations	Dec-06	Jul-07	England	This regulation defined an enclosed or non-enclosed space for smoking, as required by the *Health Act 2006.*	http://www.legislation.gov.uk/uksi/2006/3368/introduction/made		1		
The Smoking (Northern Ireland) Order	Nov-06	Apr-07	Northern Ireland	This Order banned smoking in any public place or workplace. It also gave powers to change the minimum age for purchasing tobacco, with a lower limit of 16.	http://www.legislation.gov.uk/nisi/2006/2957/contents		1		1
The Children and Young Persons (Sale of Tobacco etc.) Order	Mar-07	Oct-07	England and Wales	This order raised the minimum age of purchase for tobacco products from 16 to 18 in England and Wales.	http://www .legislation.gov.uk/uksi/2007/767/contents/made				

Appendix table A:1 Legislative and policy measures: UK, EU, WHO

The full name of the legislation	*Year of approval*	*Date & month of implementation*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
The Tobacco Products (Manufacture, Presentation and Sale) (Safety) (Amendment) Regulations (revoked)	Aug-07	Oct-08	UK	This amendment to the Tobacco Products (Manufacture, Presentation and Sale) (Safety) (2002) required colour photos to be included as part of warning labels on tobacco packets.	http://www.legislation.gov.uk/uksi/2007/2473/made			1	
Variation of Age Limit for Sale of Tobacco etc. and Consequential Modifications Order	Sep-07	Sep-07	Scotland	This order raised the minimum age of purchase for tobacco products from 16 to 18 in Scotland. The Smoking, Health and Social Care (Scotland) Act 2005 (Variation of Age Limit for Sale of Tobacco etc. and Consequential Modifications) Order 2007	http://www.legislation.gov.uk/ssi/2007/437/contents/made				1
The Smoke-free (Penalties and Discounted Amounts) Regulations	Mar-07	Apr-07 (Wales); Jul-07 (England)	England and Wales	These regulations set out the penalties for smoking in a smokefree place as legislated in the *Health Act 2006.*	http://www.legislation.gov.uk/uksi/2007/764/contents/made		1		
The Smoke-free (Vehicle Operators and Penalty Notices) Regulations	Mar-07	Jul-07	England and Wales	These regulations set out the requirements for smokefree vehicles as legislated in the *Health Act 2006.*	http://www.legislation.gov.uk/uksi/2007/760/contents/made		1		
The Children and Young Persons (Sale of Tobacco etc.) Regulations (Northern Ireland)	Jul-08	Sep-08	Northern Ireland	This regulation raised the minimum age of purchase for tobacco products from 16 to 18 in Northern Ireland.	https://www.legislation.gov.uk/nisr/2008/306/contents/made				1
The Health Act 2009	Nov-09	Nov-11	England, Northern Ireland and Wales	This Act prohibited the open display of tobacco and smoking-related products in England, Northern Ireland and Wales. This included cigarette papers, filters, apparatus for making cigarette, cigarette holders and pipes for smoking tobacco products.	http://www.legislation.gov.uk/ukpga/2009/21/part/3/crossheading/tobacco	1			1
The Protection from Tobacco (Sales from Vending Machines) Regulations	Mar-10	Oct-11	England	These regulations banned the sale of tobacco products from vending machines, and was designed to prevent children and young people from accessing tobacco through machines.	http://www.legislation.gov.uk/uksi/2010/864/contents/made	1	1		1

Appendix table A:1 Legislative and policy measures: UK, EU, WHO

The full name of the legislation	*Year of approval*	*Date & month of implement ation*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
Audiovisual Media Services Directive (2010/13/EU)	Mar-10	Mar-10	EU	This updated the Television without Frontiers Directive to include product placement in media.	https://eur-lex.europa.eu/eli/dir/2018/1808/oj	1			
The Tobacco Advertising and Promotion (Display) (England) Regulations	Feb-10	Oct-11	England	These display regulations enable retailers to make temporary, limited-size displays when selling tobacco to customers over the age of 18. At all other times, businesses have to cover up their displays of tobacco products.	http://www.legislation.gov.uk/uksi/2010/445/note/made	1			
Tobacco and Primary Medical Services (Scotland) Act 2010	Mar-10	--	Scotland	This Act prohibited the open display of tobacco and smoking-related products in Scotland. This included cigarette papers, filters, apparatus for making cigarette, cigarette holders and pipes for smoking tobacco products. It also became an offence to sell cigarettes to anyone under the age of 18, or on behalf of anyone under the age of 18. This also prohibited the use of tobacco vending machines.	http://www.legislation.gov.uk/asp/2010/3/notes/division/3/1	1			1
The Protection from Tobacco (Sales from Vending Machines (Wales) Regulations	Oct-11	Feb-12	UK	*See Protection from Tobacco (Sales from Vending Machines) Regulations.*	http://www.legislation.gov.uk/wsi/2011/2498/contents/made	1	1		1
The Protection from Tobacco (Sales from Vending Machines) Regulations (Northern Ireland)	Jan-12	Mar-12	UK	*See Protection from Tobacco (Sales from Vending Machines) Regulations*	http://www.legislation.gov.uk/nisr/2012/15/contents/made	1			1
The Tobacco Advertising and Promotion (Display and Specialist Tobacconists) (England) (Amendment) Regulations	Mar-12	Large shops: Apr-12 Tobacco-nists: Apr-15	England	These regulations amended the *Tobacco Advertising and Promotion (Display) (England) Regulations (2010)* and ended the open display of tobacco products in shops, with exemptions made for a limited number of specialist tobacconists.	http://www.legislation.gov.uk/uksi/2012/677/contents/made	1			
Children and Families Act 2014	Mar-14	Apr-14	England and Wales	This Act makes it illegal to either smoke in a private vehicle with someone under age 18 present, or for drivers to fail to prevent smoking in a private vehicle with someone under age 18 present.	http://www.legislation.gov.uk/ukpga/2014/6/contents/enacted		1		1

Appendix table A:1 Legislative and policy measures: UK, EU, WHO									
The full name of the legislation	*Year of approval*	*Date & month of implement ation*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
European Tobacco Products Directive (2014/40/EU)	Apr-14	May-16	EU	This Directive was passed for member states of the EU to enforce tighter controls on the sale of tobacco and e-cigarettes. Actions as part of this Directive include:- A ban on flavoured cigarettes and roll-your-own tobacco (including menthol, vanilla, etc);- Minimum pack size: 30g for roll-your-own tobacco, 20 cigarettes for cigarettes; - A ban on any misleading labelling (such as “natural” or “organic”);- Increased size for combined health warnings and a requirement to place them on the front and back of the product;- Regulation of electronic cigarettes and refill containers;- Stricter rules on advertising/sponsorship for electronic cigarettes and refill containers;- Mandatory safety and quality requirements for electronic cigarettes and refill containers.	https://ec.europa.eu/health/tobacco/products_en	1		1	
The Standardised Packaging of Tobacco Products Regulations	Mar-15	May-16	UK	These regulations introduced plain packaging for tobacco sold in the UK, with all packaging produced in Pantone 448 C with a matt finish with only permitted specified text in a standard typeface.	http://www.legislation.gov.uk/uksi/2015/829/contents/made	1		1	
The Tobacco and Related Products Regulations	Apr-16	May-16	EU	These regulations updated and standardised the health warnings present on tobacco packaging across the EU. In addition, e-cigarettes are regulated including setting a maximum nicotine concentration, banning advertising in the press, and prohibiting sponsorship of cross-border events by e-cigarette companies. (This policy enacts the ETPD from 2014.)	http://www.legislation.gov.uk/uksi/2016/507/contents/made	1			
Health (Tobacco, Nicotine etc. and Care) (Scotland) Act 2016	Apr-16	Apr-16	Scotland	This Act introduced several new offences regarding the purchasing of e-cigarettes, such as selling e-cigarettes to under-18 and proxy-purchasing for under-18s. It also gave the Scottish government powers to regulate e-cigarette advertising and branding. In addition, it banned tobacco smoking on hospital grounds in Scotland.	https://www.legislation.gov.uk/asp/2016/14/introduction	1	1		1

A selected list of relevant legislation covering Australia, Canada and the United States is shown at Appendix table A:2 below:

Appendix table A:2 Legislative and policy measures: Australia, Canada, USA

The full name of the legislation	*Year of approval*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
Tobacco Advertising Prohibition Act 1992	1992	Australia	Prohibits any advertising that might 'encourage or persuade' smoking or use of tobacco products in Australia.	https://www.legislation.gov.au/Details/C2017C00302	1			
Tobacco Plain Packaging Act 2011	2011	Australia	Legislation to control the packaging of tobacco products in Australia. Bans the display of logos, brand images and controls the colour and display of brand names.	https://www.legislation.gov.au/Latest/C2018C00450			1	
Competition and Consumer (Tobacco) Information Standard 2011	2011	Australia	Provides for the display of health warnings on tobacco packaging in text and images.	https://www.legislation.gov.au/Latest/F2013C00598			1	
Non-smokers' Health Act	1988	Canada	This Act places restrictions on smoking in federal workplaces and in public places under federal jurisdiction. Administered by the Department of Human Resources and Skills Development.	https://laws-lois.justice.gc.ca/eng/acts/N-23.6/page-1.html		1		
Tobacco (Access) Regulations (SOR/99-93)	1999	Canada	Regulates the sale of tobacco to minors by requiring proof of age and the display of signs prohibiting sale to minors.	https://laws-lois.justice.gc.ca/eng/regulations/SOR-99-93/index.html				1
Tobacco Products Information Regulations (SOR/2000-272)	2000	Canada	These regulations required tobacco products to carry health messages in the form of text and graphic health warnings.	https://laws-lois.justice.gc.ca/eng/regulations/SOR-2000-272/index.html			1	
The Tobacco and Vaping Products Act (TVPA)	2018	Canada	Supersedes the Tobacco Act 1997 and regulates 'the manufacture, sale, labelling and promotion of tobacco products and vaping products sold in Canada'.	http://laws-lois.justice.gc.ca/eng/acts/T-11.5/	1		1	1
Tobacco Products Regulations (Plain and Standardized Appearance) (SOR/2019-107)	2019	Canada	Sets out the requirements for plain appearance of packaging, for the display of health warnings, and for the plain and standardised display of brand information on tobacco products.	https://laws-lois.justice.gc.ca/eng/regulations/SOR-2019-107/index.html			1	
Vaping Products Labelling and Packaging Regulations (SOR/2019-353)	2019	Canada	Sets out requirements for displaying health warnings about the dangers of vaping, nicotine concentration levels, and in the case of non-nicotine e-cigarettes, permitted statements about 'no nicotine'.	https://laws-lois.justice.gc.ca/eng/regulations/SOR-2019-353/index.html			1	
Family Smoking Prevention and Tobacco Control Act	2009	United States	Commonly known as the Tobacco Control Act. Responsibility for carrying out the provisions of the Act lie with the FDA Center for Tobacco Products (CTP) which has 'broad authority to regulate the manufacturing, distribution, and marketing of tobacco products'.	https://www.govinfo.gov/content/pkg/PLAW-111publ31/pdf/PLAW-111publ31.pdf	1		1	1

Appendix table A:2 Legislative and policy measures: Australia, Canada, USA

The full name of the legislation	*Year of approval*	*Country*	*Plain English summary*	*Link*	*Advert-ising*	*Public places*	*Pack-aging*	*Youth*
Regulations Restricting the Sale and Distribution of Cigarettes and Smokeless Tobacco To Protect Children and Adolescents (75 FR 13225)	2010	United States	Reissuing of a rule prohibiting the sale of cigarettes and smokeless tobacco to individuals under the age of 18. Also imposes specific marketing, labelling and advertising requirements.	https://www.federalregister.gov/documents/2010/03/19/2010-6087/regulations-restricting-the-sale-and-distribution-of-cigarettes-and-smokeless-tobacco-to-protect	1		1	1
Required Warnings for Cigarette Packages and Advertisements (76 FR 36627)	2011	United States	Regulations about the colour graphics required to accompany the nine new textual warning statements required on cigarette package and advertisements according to the Tobacco Control Act.	https://www.federalregister.gov/documents/2011/06/22/2011-15337/required-warnings-for-cigarette-packages-and-advertisements	1		1	
Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products (81 FR 28973)	2016	United States	Final Rule 'to deem products meeting the statutory definition of "tobacco product," except accessories of the newly deemed tobacco products, to be subject to the Federal Food, Drug, and Cosmetic Act (the FD&C Act), as amended by the Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act)'. This 'Deeming Rule' gave the FDA authority to regulate e-cigarettes and other new nicotine products in the way it regulates tobacco.	https://www.federalregister.gov/documents/2016/05/10/2016-10685/deeming-tobacco-products-to-be-subject-to-the-federal-food-drug-and-cosmetic-act-as-amended-by-the	1		1	1
Clarification of When Products Made or Derived from Tobacco Are Regulated as Drugs, Devices, or Combination Products; Amendments to Regulations Regarding "Intended Uses" (82 FR 2193)	2017	United States	Clarifies when a tobacco product is treated and regulated as a drug (for medical use) rather than as for recreational use.	https://www.federalregister.gov/documents/2017/01/09/2016-31950/clarification-of-when-products-made-or-derived-from-tobacco-are-regulated-as-drugs-devices-or				
Required Warnings for Cigarette Packages and Advertisements (85 FR 15638)	2020	United States	Establishes and outlines health warning messages and graphics to be used on cigarette packaging and advertising.	https://www.federalregister.gov/documents/2020/03/18/2020-05223/tobacco-products-required-warnings-for-cigarette-packages-and-advertisements	1		1	

Appendix B. Advisory Group

Name	Organisation	Role
Tahir Bockarie	NIHR	NIHR Representative
Martin Dockrell	Public Health England	Advisory Group Member
Professor Gerard Hastings	University of Stirling	Advisory Group Member
Dr Rosemary Hiscock	University of Bath	Advisory Group Member
Dr Nicholas S Hopkinson	National Heart and Lung Institute, Imperial College	Advisory Group Member
Dr Lion Shahab	UCL	Advisory Group Member
Martyn Willmore	Public Health England	Advisory Group Member

Appendix C. Technical note on ITSA modelling and trend testing

This section provides more information on the Interrupted Time Series Analysis (ITSA) and on trend testing.

ITSA

Variables
Two outcome variables were used in the analysis:

- The weighted number of current smokers in each year and the mean number of cigarettes smoked each year; and
- The weighted number of cases was used as an offset, which scaled the number of current smokers.

For the HSE data, 'time' variable was derived to measure the year and quarter (e.g., January to April being the first quarter). Given that this was not possible with the SDD data, a time variable denoting the year was used for the analysis on young people. To account for the possibility that any trend observed was a function of time, the 'time variable' was transformed and examined in terms of the best fit to data.

Based on exploratory regression analyses using the overall rate of current smokers in HSE, it was observed that the square root of time had the best fit to the data on current smokers. Conversely, for the mean number of cigarettes, the untransformed time variable had the best fit to the data on mean number of cigarettes. For the SDD data, the untransformed time variable had the best fit to the data for both outcome variables.

The intervention variable was a dummy variable in which any data points before the legislation have a score of 0 while data points after the legislation was implemented was given a score of 1. The interaction variable was derived to be centered at the time of the intervention.

Analysis
Preliminary regression analyses were conducted to determine whether transformed time variables had the best fit to the outcome variable. The aim was to gain a better understanding of the shape of the trend; to identify whether the number of current smokers decreased uniformly over time, or whether it followed a curved trend where the number of current smokers fell faster during the earlier time periods and then slowed. A curved trend could be better replicated in the model using a transformed time variable. For the number of current smokers, the square root of time had the best fit while the untransformed linear time variable had the best fit to the data on mean number of cigarettes smoked. In each model, variables on the intervention and interaction were also included.

Given that legislation might impact different groups of people differently, each model was also examined across gender and age. However, none of the models were statistically significant.

To examine the impact of the legislations on the number of current smokers, Poisson modelling was used. Conversely, linear regression models with Newey-West standard errors were used to investigate the effect of legislations on the mean number of cigarettes smoked, given that this variable is a continuous variable. Weights were applied to data from the HSE and SDD to ensure that the results were nationally representative of adults and young people in England respectively.

A variable denoting time, intervention and interaction effects were included in each model. The models using HSE data were also examined by gender and age to explore any potential differences on the impact of the legislations across different groups of people. For the SDD data, given that there were fewer data points than the HSE, no sub-group analyses were undertaken.

Trend testing

Linear trends over time were tested using linear regression. Ordinary Least Squares regression was used to fit a straight line through the time points that best explained the trend. The model coefficient for the trend, plus its associated t-test and p-value are reported in Appendix table C:1 (adults) and Appendix table C:2 below.

The coefficient of the model summarises the direction and magnitude of the trend. It indicates whether the observed behaviour had increased significantly over time (a positive trend) or whether the observed behaviour had decreased significantly over time (a negative trend). This coefficient was tested using a t-test determine whether the slope was statistically different to zero. The trend is said to be statistically significant at the 90% level if the p-value of the t-test falls below 0.1, it is significant at the 95% if the p-value is smaller than 0.05, and significant at the 99% level if the p-value is smaller than 0.01.

Appendix table C:1 Summary of trend tests presented in Chapter 6 (adults)

Figure	Sub-group	Coefficient (slope)	T-test	P-value
6.1	England	-0.52	-6.37	0.00
	Scotland	-0.68	-6.87	0.00
6.2	Men in Scotland	-0.56	-6.06	0.00
	Women in Scotland	-0.80	-6.53	0.00
	Men in England	-0.50	-3.26	0.01
	Women in England	-0.55	-9.48	0.00
6.3	England			
	16–24 years	-0.64	-4.26	0.00
	25–34 years	-0.57	-2.21	0.05
	35–44 years	-0.73	-4.89	0.00
	45–54 years	-0.41	-1.60	0.11
	55–64 years	-0.30	-1.44	0.14
	65–74 years	-0.29	-3.49	0.01
	75+ years	-0.28	-1.82	0.08
6.4	Scotland			
	16–24 years	-1.10	-6.47	0.00

Appendix table C:1	Summary of trend tests presented in Chapter 6 (adults)			
Figure	**Sub-group**	**Coefficient (slope)**	**T-test**	**P-value**
	25–34 years	-0.99	-6.30	0.00
	35–44 years	-1.13	-4.51	0.00
	45–54 years	-0.25	-1.00	0.23
	55–64 years	-0.31	-1.22	0.18
	65-74 years	-0.35	-2.41	0.03
	75+ years	-0.27	-1.71	0.10
6.5	England			
	Light smoker, under 10 a day	1.26	7.29	0.00
	Moderate smoker, 10 to under 20 a day	-0.16	-1.00	0.23
	Heavy smoker, 20 or more a day	-1.10	-10.21	0.00
6.6	Scotland			
	Light smoker, under 10 a day	0.91	6.16	0.00
	Moderate smoker, 10 to under 20 a day	0.53	2.05	0.06
	Heavy smoker, 20 or more a day	-1.43	-8.45	0.00
6.7	Heavy smoker in Scotland			
	16–24 year olds	0.29	0.63	0.31
	25–34 year olds	-1.18	-4.35	0.00
	35–44 year olds	-2.90	-10.64	0.00
	45–54 year olds	-2.82	-4.32	0.00
	55–64 year olds	-0.67	-1.49	0.13
	65–74 year olds	-0.69	-0.91	0.25
	75+ year olds	-1.00	-2.97	0.01
6.8	Want to give up - England	-0.14	-0.72	0.29
	Want to give up - Scotland	0.17	0.56	0.32

Appendix table C:2	Summary of trend tests presented in Chapter 6 (children)			
Figure	**Sub-group**	**Coefficient (slope)**	**T-test**	**P-value**
6.9	England	0.84	4.27	0.01
	Scotland	0.84	2.60	0.04
6.10	England	-3.07	-13.81	0.00
	Scotland	-1.28	-5.63	0.01

Appendix table C:2 Summary of trend tests presented in Chapter 6 (children)				
Figure	**Sub-group**	**Coefficient (slope)**	**T-test**	**P-value**
6.11	Truant in England	-1.90	-2.08	0.06
	Not truant in England	-1.50	-1.83	0.08
	Truant in Scotland	-1.30	-5.00	0.01
	Not truant in Scotland	-0.49	-1.28	0.14
6.12	England			
	11 years or below	-1.84	-3.19	0.02
	12–13 years	-0.36	-0.92	0.22
	14–15 years	2.20	8.46	0.00
6.13	England			
	Truant	-2.58	-2.09	0.06
	Not truant	-2.29	-2.90	0.03
6.14	England			
	Given cigarettes	-0.90	-3.83	0.01
	Take cigarettes	0.22	1.41	0.14
	Buy from shops	-2.18	-2.62	0.03
	Buy from vending machines	-1.30	-6.27	0.00
	Buy from other people	-0.63	-1.08	0.20
6.15	Scotland			
	Given cigarettes	-0.43	-1.45	0.13
	Take cigarettes	0.62	3.85	0.01
	Buy from shops	-4.54	-6.66	0.00
	Buy from other people	-0.54	-0.83	0.24
6.16	England			
	Try to stop / persuade me to stop	-0.06	-0.23	0.36
	Do nothing / encourage me to smoke	-0.19	-1.07	0.20
	Don't know I smoke	0.20	0.55	0.31
6.17	Scotland			
	Try to stop / persuade me to stop	-0.76	-0.60	0.29
	Do nothing / encourage me to smoke	-0.07	-0.38	0.33
	Don't know I smoke	0.82	0.76	0.26

Appendix D. Results of the profile of starters and quitters

This Appendix provides details and tables to support the descriptive and multivariate analyses presented in Chapter 7.

Characteristics of starters and quitters (adults) – descriptive analysis

Appendix tables D:1–D:3 present the characteristics of adults who smoked, did not smoke, or had formerly smoked at USoc Wave 2 and whether they were smoking at Wave 5.

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5

Base: All respondents who smoked at Wave 2			*Data from Understanding Society*
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
Sex			
Male	49.5	49.3	49.5
Female	50.5	50.7	50.5
P-values	*P = 0.936*		
Age (at Wave 2)			
16-24	12.2	12.4	12.3
25-34	19.6	24.2	20.6
35-44	21.4	22.5	21.6
45-54	22	17.3	20.9
55-64	15.8	13.5	15.3
65+	9.1	10	9.3
P-values	*P = 0.044*		
Ethnicity			
White	94.5	94	94.4
Mixed / Other	1.7	2.4	1.8
Asian or Asian British	2.4	2.1	2.3
Black or Black British	1.4	1.5	1.4
P-values	*P = 0.621*		
Born in the UK			

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5

Base: All respondents who smoked at Wave 2	*Data from Understanding Society*		
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
Elsewhere	7.6	8.4	7.8
UK	92.4	91.6	92.2
P-values	*P = 0.552*		
In paid employment at Wave 2			
Employed	54.3	63.6	56.4
Unemployed / Student	45.7	36.4	43.6
P-values	*P = 0.000*		
Highest qualification at Wave 2			
Degree	11.8	22.4	14.2
Higher education below degree / A level or equivalent	12.8	18.3	14
O level or equivalent / CSE or equivalent / Foreign or other	41.2	35.8	40
No qualification	34.1	23.5	31.8
P-values	*P = 0.000*		
Current Job at Wave 2: permanent or temporary			
Not applicable	44.7	35.4	42.7
A permanent job	50.3	58.4	52.1
Not permanent job	5	6.3	5.3
P-values	*P = 0.001*		
Marital status at Wave 2			
Single	29.4	27.1	28.9
Married / Civil Partnership	35.3	42.8	37
Separated / Divorced	13.9	8.2	12.6
Widow	3.9	4.2	4
Cohabit	17.5	17.6	17.5
P-values	*P = 0.001*		
Current job at Wave 2: NS-SEC			

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5

Base: All respondents who smoked at Wave 2	*Data from Understanding Society*		
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
Not applicable	43.8	34.5	41.8
Management & professional	14.6	26.8	17.3
Intermediate	6.6	7.3	6.8
Small employers & own account	4.9	4.5	4.8
Lower supervisory & technical	6.2	6.2	6.2
Semi-routine & routine	23.9	20.7	23.2
P-values	*P = 0. 000*		
Government Office Region at Wave 2			
North East	4.7	4.7	4.7
North West	12.9	13.9	13.1
Yorkshire and the Humber	9	9.8	9.2
East Midlands	7.1	8.2	7.3
West Midlands	8.7	7	8.3
East of England	10.2	9.9	10.2
London	9.8	11.3	10.2
South East	13.9	13.7	13.8
South West	10.5	9.8	10.4
Wales	3.5	2.4	3.2
Scotland	7.8	7.4	7.7
Northern Ireland	2	1.8	1.9
P-values	*P = 0.867*		
Urban or rural area at Wave 2			
Urban area	80.5	80.7	80.6
Rural area	19.5	19.3	19.4
P-values	*P = 0.911*		
Whether had a long-standing illness or disability at Wave 2			
No	60.6	69	62.4
Yes	39.4	31	37.6
P-values	*P = 0.000*		

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5			
Base: All respondents who smoked at Wave 2	*Data from Understanding Society*		
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
Whether had a heart condition at Wave 2			
No	94.1	94.7	94.2
Yes	5.9	5.3	5.8
P-values	*P = 0.540*		
Whether had a lung condition at Wave 2			
No	82.7	83.9	83
Yes	17.3	16.1	17
P-values	*P = 0.498*		
Whether had high blood pressure at Wave 2			
No	85	84.6	84.9
Yes	15	15.4	15.1
P-values	*P = 0.796*		
Whether had clinical depression at Wave 2			
No	85.9	91.3	87.1
Yes	14.1	8.7	12.9
P-values	*P = 0.000*		
Whether had cancer at Wave 2			
No	96.8	98	97.1
Yes	3.2	2	2.9
P-values	*P = 0.106*		
General happiness at Wave 2			
More so than usual	8.4	10.8	8.9
About the same as usual	72.8	72.9	72.8
Less so than usual	14.8	13.8	14.6
Much less than usual	4	2.5	3.6
P-values	*P = 0.121*		

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5

Base: All respondents who smoked at Wave 2	*Data from Understanding Society*		
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
Changes in self-reported general health, from Wave 2 to Wave 5			
Fair / Poor -> Fair / Poor	20.1	13.6	18.7
Fair / Poor -> Excellent / Good	9.5	10.1	9.7
Excellent / Good -> Fair / Poor	10.8	9.8	10.6
Excellent / Good -> Excellent / Good	59.6	66.4	61.1
P-values	*P = 0.003*		
Been pregnant since Wave 2 interview			
Not applicable	70.7	68.2	70.1
No	23.5	22.9	23.4
Yes	5.8	8.9	6.5
P-values	*P = 0.025*		
Any new health condition diagnosed since Wave 2			
No	88.4	90.7	88.9
Yes	11.6	9.3	11.1
P-values	*P = 0.090*		
New heart condition diagnosed since Wave 2			
No	98.5	95.3	97.8
Yes	1.5	4.7	2.2
P-values	*P = 0.000*		
New lung condition diagnosed since Wave 2			
No	97.8	97.7	97.8
Yes	2.2	2.3	2.2
P-values	*P = 0.890*		
High Blood Pressure diagnosed since Wave 2			
No	96.1	94	95.7

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5			
Base: All respondents who smoked at Wave 2	*Data from Understanding Society*		
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
Yes	3.9	6	4.3
P-values	*P = 0.021*		
New cancer diagnosed since Wave 2			
No	98.7	97.3	98.4
Yes	1.3	2.7	1.6
P-values	*P = 0.008*		
Cigarettes smoked per day at Wave 2			
Up to 10	44.1	68	49.3
Between 10 and 20	47	28.4	42.9
Over 20	9	3.6	7.8
P-values	*P = 0.000*		
Age started smoking			
Missing	0	1.5	0.3
Less than 10 years	3.4	1.7	3
11–20 years	87	85.2	86.6
21–30 years	8.4	9.2	8.6
31–40 years	1.2	2.3	1.5
P-values	*P = 0.000*		
Number of smokers in household at Wave 2			
1	66.4	71.7	67.6
2+	33.6	28.3	32.4
P-values	*P = 0.032*		
Household smoking status at Wave 2			
Single person household - smoker	42.3	37.9	41.4
2 people, both smokers	22.3	21.6	22.1
2 people, one is a non-smoker	19.9	28.4	21.7
More than 2 people, all smokers	4.4	0.9	3.7

Appendix table D:1 Characteristics of adults who smoked at Wave 2 of the Understanding Society survey, by whether they continued to smoke at Wave 5			
Base: All respondents who smoked at Wave 2	*Data from Understanding Society*		
	Smoked at Wave 2 and Wave 5	**Smoked at Wave 2 but did not smoke at Wave 5**	**Total**
	%	%	%
More than 2 people, more non-smokers than smokers	4.4	5.5	4.6
More than 2 people, more / same number smoke than do not smoke	6.7	5.7	6.5
P-values	*P = 0.000*		
Unweighted base	*3865*	*1126*	*4991*

Appendix table D:2 Characteristics of adults who did not Smoke at Wave 2 of the Understanding Society survey, by whether they smoked at Wave 5			
Base: All respondents who did not smoke at Wave 2	*Data from Understanding Society*		
	Did not smoke at Wave 2 or Wave 5	**Smoked at Wave 5**	**Total**
	%	%	%
Sex			
Male	42.1	49.4	42.2
Female	57.9	50.6	57.8
P-values	*P = 0.302*		
Age (at Wave 2)			
16-24	15.7	70.4	16.3
25-34	14.8	10.3	14.7
35-44	18	8.5	17.9
45-54	19.5	4.2	19.3
55-64	15.1	1	15
65+	16.9	5.6	16.8
P-values	*P = 0.000*		
Ethnicity			
White	88.2	88.5	88.2
Mixed / Other	1.9	0.6	1.9

Appendix table D:2 Characteristics of adults who did not Smoke at Wave 2 of the Understanding Society survey, by whether they smoked at Wave 5

Base: All respondents who did not smoke at Wave 2	*Data from Understanding Society*		
	Did not smoke at Wave 2 or Wave 5	**Smoked at Wave 5**	**Total**
	%	%	%
Asian or Asian British	7.4	10.4	7.5
Black or Black British	2.5	0.5	2.4
P-values	*P = 0.349*		
Born in the UK			
Elsewhere	12.6	3.1	12.5
UK	87.4	96.9	87.5
P-values	*P = 0.013*		
In paid employment at Wave 2			
Employed	59.9	30.5	59.6
Unemployed / Student	40.1	69.5	40.4
P-values	*P = 0.000*		
Highest qualification at Wave 2			
Degree	30.9	6.8	30.6
Higher education below degree / A level or equivalent	18.6	8.3	18.5
O level or equivalent / CSE or equivalent / Foreign or other	29.9	37.1	30
No qualification	20.6	47.8	20.9
P-values	*P = 0.000*		
Current Job at Wave 2: permanent or temporary			
Not applicable	38.9	55.4	39.1
A permanent job	55.9	32.6	55.7
Not permanent job	5.2	12	5.3
P-values	*P = 0.002*		
Marital status at Wave 2			
Single	25.1	78.2	25.7
Married / Civil	53.4	3.6	52.8
Separated / Divorced	6.2	7.3	6.2
Widow	5.9	2.6	5.9
Cohabiting	9.4	8.2	9.3

Appendix table D:2 Characteristics of adults who did not Smoke at Wave 2 of the Understanding Society survey, by whether they smoked at Wave 5			
Base: All respondents who did not smoke at Wave 2	*Data from Understanding Society*		
	Did not smoke at Wave 2 or Wave 5	**Smoked at Wave 5**	**Total**
	%	%	%
P-values	*P = 0.000*		
Current job at Wave 2: NS-SEC			
Not applicable	38.2	55.4	38.4
Management & professional	27.3	4.1	27
Intermediate	9.8	7.1	9.7
Small employers & own account	4.9	2.8	4.9
Lower supervisory & technical	3.7	8.1	3.8
Semi-routine & routine	16.1	22.5	16.2
P-values	*P = 0.001*		
Government Office Region at Wave 2			
North East	5	13.5	5.1
North West	12	13.4	12.1
Yorkshire and the Humber	9.1	5.7	9
East Midlands	7.4	10	7.5
West Midlands	10.1	12.1	10.1
East of England	9.7	4.2	9.7
London	11.7	17.6	11.8
South East	14.5	7.9	14.4
South West	9.5	2.7	9.5
Wales	3.1	2.9	3.1
Scotland	6.5	7	6.5
Northern Ireland	1.4	3	1.4
P-values	*P = 0.088*		
Urban or rural area at Wave 2	77.6	86.4	77.7
Urban area	22.4	13.6	22.3
Rural area	100	100	100
P-values	*P = 0.085*		
Whether had a long-standing illness or disability at Wave 2			
No	69.6	85.7	69.8
Yes	30.4	14.3	30.2

Appendix table D:2 Characteristics of adults who did not Smoke at Wave 2 of the Understanding Society survey, by whether they smoked at Wave 5			
Base: All respondents who did not smoke at Wave 2	*Data from Understanding Society*		
	Did not smoke at Wave 2 or Wave 5	**Smoked at Wave 5**	**Total**
	%	%	%
P-values	*P = 0.019*		
Whether had a heart condition at Wave 2			
No	95.4	97.4	95.4
Yes	4.6	2.6	4.6
P-values	*P = 0.568*		
Whether had a lung condition at Wave 2			
No	86.8	84.5	86.7
Yes	13.2	15.5	13.3
P-values	*P = 0.696*		
Whether had high blood pressure at Wave 2			
No	82.4	93.5	82.5
Yes	17.6	6.5	17.5
P-values	*P = 0.033*		
Whether had clinical depression at Wave 2			
No	94.7	98.2	94.8
Yes	5.3	1.8	5.2
P-values	*P = 0.240*		
Whether had cancer at Wave 2			
No	96.6	100	96.7
Yes	3.4	0	3.3
P-values	*P = 0.166*		
General happiness at Wave 2			
More so than usual	11.2	25.8	11.3
About the same as usual	77.2	64.1	77.1
Less so than usual	10.4	8.5	10.3
Much less than usual	1.3	1.5	1.3
P-values	*P = 0.006*		

Appendix table D:2 Characteristics of adults who did not Smoke at Wave 2 of the Understanding Society survey, by whether they smoked at Wave 5			
Base: All respondents who did not smoke at Wave 2	*Data from Understanding Society*		
	Did not smoke at Wave 2 or Wave 5	**Smoked at Wave 5**	**Total**
	%	%	%
Changes in self-reported general health, from Wave 2 to Wave 5			
Fair / Poor -> Fair / Poor	9	6.5	9
Fair / Poor -> Excellent / Good	6.2	5.8	6.2
Excellent / Good -> Fair/Poor	6.7	6.9	6.7
Excellent / Good -> Excellent / Good	78.2	80.9	78.2
P-values	*P = 0.937*		
Been pregnant since Wave 2 interview			
Not applicable	71	55.4	70.8
No	24.4	39.9	24.5
Yes	4.7	4.7	4.7
P-values	*P = 0.017*		
Any new health condition diagnosed since Wave 2			
No	89.8	89.9	89.8
Yes	10.2	10.1	10.2
P-values	*P = 0.974*		
New heart condition diagnosed since Wave 2			
No	98.8	100	98.8
Yes	1.2	0	1.2
P-values	*P = 0.390*		
New lung condition diagnosed since Wave 2			
No	99	98.9	99
Yes	1	1.1	1
P-values	*P = 0.897*		
High Blood Pressure diagnosed since Wave 2			
No	96.6	97.3	96.7

Appendix table D:2 Characteristics of adults who did not Smoke at Wave 2 of the Understanding Society survey, by whether they smoked at Wave 5

Base: All respondents who did not smoke at Wave 2	*Data from Understanding Society*		
	Did not smoke at Wave 2 or Wave 5	**Smoked at Wave 5**	**Total**
	%	%	%
Yes	3.4	2.7	3.3
P-values	*P = 0.830*		
New cancer diagnosed since Wave 2			
No	98.3	98.8	98.4
Yes	1.7	1.2	1.6
P-values	*P = 0.778*		
Number of smokers in household at Wave 2			
None	91.3	78.2	91.2
1	7.3	16.7	7.4
2+	1.4	5	1.4
P-values	*P = 0.002*		
There was a smoker in the household at Wave 2			
No	91.3	78.2	91.2
Yes	8.7	21.8	8.8
P-values	*P = 0.001*		
Household smoking status at Wave 2			
Single person household - smoker	29.7	30.4	29.7
2 people, both smokers	45.2	26.9	45
2 people, one is a non-smoker	4.5	9.1	4.5
More than 2 people, all smokers	16.4	20.9	16.5
More than 2 people, more non-smokers than smoker	3	7.6	3
More than 2 people, more/same smoke than do not smoke	1.2	5	1.3
P-values	*P = 0.007*		
Unweighted base	*11397*	*140*	*11537*

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5

Base: All who did not smoke at Wave 2 but had smoked in the past	*Data from Understanding Society*		
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
Sex			
Male	51.6	52.6	51.7
Female	48.4	47.4	48.3
P-values	*P = 0.737*		
Age (at Wave 2)			
16-24	5.8	26.3	7.1
25-34	12.9	22.1	13.5
35-44	16.1	19.2	16.2
45-54	16.9	16.6	16.9
55-64	19.9	10.6	19.3
65+	28.4	5.3	27
P-values	*P = 0.000*		
Ethnicity			
White	95.8	87	95.3
Mixed / Other	1.4	4.2	1.6
Asian or Asian British	1.7	5.7	1.9
Black or Black British	1.1	3.1	1.2
P-values	*P = 0.000*		
Born in the UK			
Elsewhere	8.1	12.2	8.3
UK	91.9	87.8	91.7
P-values	*P = 0.019*		
In paid employment at Wave 2			
Employed	55.9	58.5	56.1
Unemployed / Student	44.1	41.5	43.9
P-values	*P = 0.417*		
Highest qualification at Wave 2			
Degree	29	18.5	28.4
Higher educ below degree / A level or equivalent	15.5	22	15.9

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5

Base: All who did not smoke at Wave 2 but had smoked in the past			*Data from Understanding Society*
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
O level or equivalent / CSE or equivalent / Foreign or other	28.8	36.5	29.3
No qualification	26.7	23	26.5
P-values	*P = 0.000*		
Current Job at Wave 2: permanent or temporary			
Not applicable	43.5	38.4	43.2
A permanent job	51.5	57.6	51.9
Not permanent job	4.9	4	4.9
P-values	*P = 0.128*		
Marital status at Wave 2			
Single	13.8	33.9	15
Married / Civil Partnership	59.5	36.9	58.1
Separated / Divorced	8.4	7.9	8.3
Widow	7.5	1.5	7.2
Cohabiting	10.8	19.8	11.3
P-values	*P = 0.000*		
Current job at Wave 2: NS-SEC			
Not applicable	42.7	38.4	42.4
Management & professional	26.5	20.9	26.2
Intermediate	7.8	10.6	8
Small employers & own account	5.4	3.8	5.3
Lower supervisory & technical	4.5	7.8	4.7
Semi-routine & routine	13	18.5	13.4
P-values	*P = 0.001*		
Government Office Region at Wave 2			
North East	4.4	4.8	4.4
North West	11.6	8.3	11.4
Yorkshire and the Humber	7.7	9.9	7.8
East Midlands	7.4	9.6	7.6
West Midlands	8.5	7.6	8.4

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5			
Base: All who did not smoke at Wave 2 but had smoked in the past	*Data from Understanding Society*		
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
East of England	11.1	8.4	10.9
London	11	13.8	11.2
South East	17.4	16.1	17.4
South West	11.3	9	11.2
Wales	2.4	3.5	2.5
Scotland	6.2	8.2	6.3
Northern Ireland	1	0.9	1
P-values	*P = 0.166*		
Urban or rural area at Wave 2	75.9	84	76.3
Urban area	24.1	16	23.7
Rural area	100	100	100
P-values	*P = 0.002*		
Whether had a long-standing illness or disability at Wave 2			
No	59.2	68.9	59.8
Yes	40.8	31.1	40.2
P-values	*P = 0.001*		
Whether had a heart condition at Wave 2			
No	91.2	95.9	91.5
Yes	8.8	4.1	8.5
P-values	*P = 0.002*		
Whether had a lung condition at Wave 2			
No	84.4	82.8	84.3
Yes	15.6	17.2	15.7
P-values	*P = 0.509*		
Whether had high blood pressure at Wave 2			
No	75.9	87.9	76.6
Yes	24.1	12.1	23.4
P-values	*P = 0.000*		

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5			
Base: All who did not smoke at Wave 2 but had smoked in the past			*Data from Understanding Society*
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
Whether had clinical depression at Wave 2			
No	92.9	88.2	92.6
Yes	7.1	11.8	7.4
P-values	*P = 0.001*		
Whether had cancer at Wave 2			
No	94.9	99.3	95.1
Yes	5.1	0.7	4.9
P-values	*P = 0.000*		
General happiness at Wave 2			
More so than usual	9.1	11.1	9.3
About the same as usual	79.6	71.3	79.1
Less so than usual	9.4	14.4	9.7
Much less than usual	1.8	3.2	1.9
P-values	*P = 0.008*		
Changes in self-reported general health, from Wave 2 to Wave 5			
Fair / Poor -> Fair / Poor	12.8	14.7	12.9
Fair / Poor -> Excellent / Good	6.6	4.4	6.5
Excellent / Good -> Fair/Poor	7.6	8.2	7.6
Excellent / Good -> Excellent / Good	72.9	72.6	72.9
P-values	*P = 0.403*		
Been pregnant since Wave 2 interview			
Not applicable	80.3	66.4	79.4
No	15.3	24.4	15.8
Yes	4.4	9.1	4.7
P-values	*P = 0.000*		
Any new health condition diagnosed since Wave 2			
No	88.7	93.3	88.9

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5

Base: All who did not smoke at Wave 2 but had smoked in the past	*Data from Understanding Society*		
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
Yes	11.3	6.7	11.1
P-values	*P = 0.016*		
New heart condition diagnosed since Wave 2			
No	97.8	99.5	97.9
Yes	2.2	0.5	2.1
P-values	*P = 0.006*		
New lung condition diagnosed since Wave 2			
No	98.7	99.6	98.7
Yes	1.3	0.4	1.3
P-values	*P = 0.197*		
High Blood Pressure diagnosed since Wave 2			
No	96.6	97.6	96.6
Yes	3.4	2.4	3.4
P-values	*P = 0.243*		
New cancer diagnosed since Wave 2			
No	97.6	99.5	97.7
Yes	2.4	0.5	2.3
P-values	*P = 0.086*		
Age started smoking			
Missing	16	7.8	15.5
Less than 10 years	1.7	1.8	1.7
11–20 years	71.5	79.3	72
21–30 years	9.6	9.7	9.6
31–40 years	1.2	1.4	1.2
P-values	*P = 0.004*		
Ever smoked cigarettes regularly			

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5			
Base: All who did not smoke at Wave 2 but had smoked in the past	*Data from Understanding Society*		
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
Smoked regularly, at least one per day	67.6	79.1	68.3
Smoke them only occasionally	18.9	14.9	18.7
Spontaneous never really smoked cigarettes, just tried them once or twice	13.5	5.8	13
P-values	*P=0.000*		
Age at which respondent quit smoking regularly			
Under 30 years	26.2	34.7	26.7
31–50	29.6	31.2	29.7
51+	11.8	13.2	11.9
NA	32.4	20.9	31.7
P-values	*P=0.000*		
Cigarettes per day used to smoke			
Up to 10	28.6	37.2	29.1
Between 10 and 20	27.2	31.4	27.4
Over 20	11.9	10.6	11.8
Not applicable	32.4	20.9	31.7
P-values	*P=0.000*		
Number of smokers in household at Wave 2			
None	91	79.3	90.3
1	8.4	17	8.9
2+	0.6	3.7	0.8
P-values	*P = 0.000*		
There was a smoker in the household at Wave 2			
No	91	79.3	90.3
Yes	9	20.7	9.7
P-values	*P = 0.000*		
Household smoking status at Wave 2			

Appendix table D:3 Characteristics of adults who did not smoke at Wave 2 but had smoked in the past, by whether they were smoking at Wave 5

Base: All who did not smoke at Wave 2 but had smoked in the past			*Data from Understanding Society*
	Not smoking at Wave 5	**Smoking at Wave 5**	**Total**
	%	%	%
Single person household - smoker	34.4	33.7	34.4
2 people, both smokers	48.6	33.6	47.7
2 people, one is a non-smoker	5.9	10.6	6.2
More than 2 people, all smokers	8	12.1	8.2
More than 2 people, more non-smokers than smoker	2.5	7.2	2.8
More than 2 people, more / same smoke than do not smoke	0.6	2.9	0.7
P-values	*P = 0.000*		
Unweighted base	*8850*	*517*	*9367*

Multivariate output for analysis of changes in smoking among adults

The factors related to changes in smoking behaviour among people aged 16 years and over were examined in detail through the interrogation of data from *Understanding Society (USoc)* using multivariate analysis methods.

Detailed information about smoking was collected as part of the adult self-completion module in Waves 2 and 5 of *USoc*. These data were used to examine the relationship between demographic, socioeconomic and health characteristics of people aged 16 years and over on each of the **three smoking outcomes** investigated in Chapter 7. These were:

- **'Quitters'**; those who smoked at Wave 2 but did not smoke at Wave 5;
- **'New starters'**; those who have never smoked at Wave 2 but smoked at Wave 5; and
- **'Re-starters'**; those who were not current smokers at Wave 2 (but had previously smoked to some degree) and smoked at Wave 5.

Logistic regression models were used to investigate the relationship between each of these outcomes and a set of independent predictor variables. A separate model was run for each outcome. The three outcomes are mutually exclusive, meaning an individual cannot appear in more than one model. Each outcome was coded as a binary variable where 0=no change in smoking status between Wave 2 and Wave 5, and 1=a change in smoking status between Wave 2 and Wave 5.

The **predictor variables** were a set of individual and household variables that covered different demographic, socioeconomic and health characteristics (specifically, the characteristics covered in the descriptive analysis, see Appendix tables D:1–D:3 above). These predictors include a set of demographic characteristics, namely: age, gender, highest education qualification, ethnicity, country of birth, employment status, region, and an urban / rural indicator. Plus, a set of variables that exploited the longitudinal nature of the *USoc* data and flagged a number of events, such as pregnancy, that could potentially impact on smoking behaviour. These variables, the rationale for their inclusion, and our expectations are detailed here.

- **Whether the individual had had a pregnancy between Waves 2 and 5 (female only)**. Pregnant women are encouraged to stop smoking.[lx] The proportion of pregnant women who smoke has reduced over time, currently around 10% of women were known smokers at time of delivery.[lxi]
- **Whether the individual had had a change in their health status between Waves 2 and 5**. We expect a decline in general health status or the onset of new health conditions to lead to an uptake in healthier behaviours, such as attempts at weight loss, a move to eat healthier, and smoking cessation, since the diagnoses of such conditions are generally accompanied by advice from health professionals to make lifestyle changes.
- **Whether the individual had had a new health condition diagnosed between Waves 2 and 5** (five variables were created – any condition, new heart-related condition, new lung-related condition, cancer, and high blood pressure).
- A household-level variable that was created to summarise the **smoking status of the household at Wave 2.** The behaviour of individuals is known to be influenced by others in the household. There is evidence to suggest being around other smokers normalises smoking behaviour and reduces stigma, which can impact on the likelihood and success of cessation.[140] The variable is by necessity based on known smoking behaviour only, so excludes proxies.
- **A measure of mental health at Wave 2**. Those with poor mental health are more likely to be heavy smokers and less likely to quit.[141,142]
- **The individual's socio-economic group at Wave 2**. Socioeconomic group is linked to smoking status. Smokers in deprived socioeconomic groups are as likely to attempt to give up smoking as those in other groups but less likely to succeed.[143]

Only variables significantly related to the outcome were retained in the final models. Non-significant variables were removed. The models controlled for clustering of individuals within households, this was included as a nuisance factor in the model by using the 'SVY' commands and specifying household as a cluster. The models were weighted using the Wave 5 longitudinal weight for adults who had returned a self-completion questionnaire.

The output for each model is shown below in Appendix tables D:4 to D:6. The odds ratios show the direction and size of the relationship between the different characteristics and the outcome. If the value is greater than one it indicates that the characteristic is significantly related to a change in smoking behaviour, whereas a value less than one indicates the reverse. T-tests were used to formally test the relationship between the outcome and each characteristic. The p-values indicate whether this relationship is statistically significant; if the p-value is less than 0.05 then the outcome for that specific characteristic is significantly different from the reference category of that characteristic. The tables also present lower and upper confidence intervals.

[lx] NHS. Stop smoking in pregnancy: your pregnancy and baby guide. [Internet]. 2019 Nov 7 [cited 2020 Oct 22]. Available from: https://www.nhs.uk/conditions/pregnancy-and-baby/smoking-pregnant.
[lxi] NHS Digital. Statistics on Women's Smoking Status at Time of Delivery: England. [Internet]. [cited 2020 Oct 22]. Available from: https://digital.nhs.uk/data-and-information/publications/statistical/statistics-on-women-s-smoking-status-at-time-of-delivery-england

Appendix table D:4 Regression output for smoking cessation among adults								
							Observations = 4,991	
							95% confidence interval	
Variable	**Categories**	**Baseline**	**Odds Ratio**	**Std. Err.**	***t***	**P>*t***	**Lower**	**Upper**
Cigarettes per day (Wave 2)	Up to 10	Over 20	3.66	0.91	5.2	0.000	2.25	5.95
	Between 10 and 20		1.55	0.38	1.8	0.080	0.95	2.52
Household smoking status at Wave 2	2 people, all smokers	Single household, smoker	0.97	0.16	-0.2	0.871	0.71	1.34
	2 people, one non-smoker		1.30	0.18	1.9	0.063	0.99	1.71
	>2 people, all smokers		0.23	0.12	-2.9	0.003	0.09	0.61
	>2 people, more non-smokers than smokers		1.13	0.28	0.5	0.609	0.70	1.84
	>2 people, more / same smokers than non-smokers		0.86	0.22	-0.6	0.549	0.52	1.41
Had an existing limiting long-term illness (LLTI) at Wave 2			0.77	0.08	-2.4	0.015	0.62	0.95
Had clinical depression (existing diagnosis) at Wave 2			0.76	0.12	-1.7	0.095	0.55	1.05
New heart condition diagnosed between Wave 2 and Wave 5			4.32	1.26	5.0	0.000	2.44	7.66
High Blood Pressure diagnosed between Wave 2 and Wave 5			1.61	0.35	2.2	0.030	1.05	2.48
Cancer diagnosed between Wave 2 and Wave 5			2.47	0.78	2.9	0.004	1.33	4.57
Been pregnant between Wave 2 and Wave 5	No	NA	0.95	0.11	-0.4	0.671	0.75	1.20
	Yes		1.61	0.30	2.5	0.012	1.11	2.32
Marital status at Wave 2	Married / Civil Partnership	Single	1.31	0.20	1.8	0.073	0.98	1.77
	Separated / Divorced		0.73	0.13	-1.7	0.088	0.52	1.05
	Widowed		1.71	0.50	1.9	0.063	0.97	3.02
	Cohabiting		1.00	0.18	0.0	0.997	0.71	1.42
Highest qualification at Wave 2	Degree	No qualification	1.96	0.32	4.1	0.000	1.42	2.69
	Higher education below degree / A level or equivalent		1.75	0.28	3.5	0.000	1.28	2.39
	O level or equivalent / CSE or equivalent / Foreign or other		1.19	0.16	1.3	0.190	0.92	1.55
NS-SEC	Management & professional	Missing / Never worked	1.54	0.22	3.0	0.003	1.16	2.04
	Intermediate		1.09	0.21	0.4	0.662	0.75	1.59
	Small employers & own account		1.01	0.22	0.0	0.982	0.65	1.55

Appendix table D:4 Regression output for smoking cessation among adults

	Lower supervisory & technical		1.31	0.28	1.2	0.218	0.85	2.00
	Semi-routine & routine		1.10	0.15	0.7	0.478	0.84	1.45
Constant			0.50	0.10	-3.6	0.000	0.34	0.73

Appendix table D:5 Regression output for adults starting smoking for the first time

Observations = 11,537

							95% conf interval	
Variable	**Categories**	**Baseline**	**Odds Ratio**	**Std. Err.**	**t**	**P>t**	**Lower**	**Upper**
Household smoking status at Wave 2	2 people, all non-smokers	Single household, non-smoker	0.48	0.18	-1.9	0.053	0.23	1.01
	2 people, one non-smoker		0.69	0.37	-0.7	0.491	0.24	1.97
	>2 people, all non-smokers		0.19	0.09	-3.6	0.000	0.08	0.47
	>2 people, more non-smokers than smokers		0.33	0.22	-1.7	0.092	0.09	1.20
	>2 people, more / same smokers than non-smokers		0.35	0.25	-1.5	0.135	0.09	1.39
Age group at Wave 2	16-24	65+	24.90	25.99	3.1	0.002	3.22	192.67
	25-34		6.03	6.73	1.6	0.108	0.68	53.73
	35-44		4.29	3.96	1.6	0.114	0.70	26.16
	45-54		1.62	1.73	0.5	0.650	0.20	13.14
	55-64		0.35	0.43	-0.9	0.390	0.03	3.86
Marital status at Wave 2	Single	Married / Civil Partnership	8.50	5.13	3.5	0.000	2.60	27.78
	Separated / Divorced		12.59	8.82	3.6	0.000	3.19	49.73
	Widowed		4.38	5.26	1.2	0.218	0.42	45.99
	Cohabiting		6.29	4.25	2.7	0.007	1.67	23.68
Highest qualification at Wave 2	Higher education below degree / A level or equivalent	Degree	0.82	0.55	-0.3	0.772	0.22	3.06
	O level or equivalent / CSE or equivalent / Foreign or other		3.08	1.78	1.9	0.052	0.99	9.56
	No qualification		8.54	5.40	3.4	0.001	2.47	29.49
Constant			0.05	0.03	-5.1	0.000	0.01	0.15

Appendix table D:6 Regression output for adults re-starting smoking

Observations = 9,367

Variable	Categories	Baseline	Odds Ratio	Std. Err.	*t*	P>*t*	95% confidence interval Lower	Upper
Previous smoking behaviour	Occasional smoker, not regular	Only tried once or twice	2.08	0.69	2.2	0.027	1.09	4.00
	Regularly smoked <10 per day		6.47	1.97	6.1	0.000	3.56	11.75
	Regularly smoked 10-20 per day		7.83	2.48	6.5	0.000	4.21	14.58
	Regularly smoked >20 per day		6.34	2.32	5.0	0.000	3.09	13.01
Household smoking status at Wave 2	2 people, all non-smokers	Single household, non-smoker	0.82	0.16	-1.1	0.295	0.56	1.19
	2 people, one non-smoker		1.57	0.42	1.7	0.097	0.92	2.66
	>2 people, all non-smokers		0.99	0.25	0.0	0.978	0.61	1.63
	>2 people, more non-smokers than smokers		1.95	0.60	2.2	0.030	1.07	3.57
	>2 people, more / same smokers than non-smokers		2.51	1.14	2.0	0.043	1.03	6.11
Had clinical depression (existing diagnosis) at Wave 2			1.91	0.37	3.3	0.001	1.30	2.80
Had cancer (existing diagnosis) at Wave 2			0.28	0.18	-2.0	0.042	0.08	0.95
New heart condition diagnosed between Wave 2 and Wave 5			0.32	0.20	-1.8	0.072	0.09	1.11
Gender	Female	Male	0.79	0.11	-1.8	0.079	0.61	1.03
Age group at Wave 2	25-34	16-24	0.40	0.10	-3.7	0.000	0.25	0.65
	35-44		0.27	0.07	-5.2	0.000	0.17	0.44
	45-54		0.20	0.06	-5.7	0.000	0.12	0.35
	55-64		0.10	0.03	-7.2	0.000	0.06	0.19
	65+		0.04	0.01	-9.2	0.000	0.02	0.08
Ethnic group	Mixed / Other	White	2.47	0.91	2.5	0.014	1.21	5.08
	Asian or Asian British		3.39	1.23	3.4	0.001	1.67	6.89

Appendix table D:6 Regression output for adults re-starting smoking								
	Black or Black British		2.00	0.75	1.8	0.066	0.96	4.19
Marital status at Wave 2	Married / Civil Partnership	Single	0.55	0.12	-2.7	0.008	0.35	0.85
	Separated / Divorced		0.96	0.26	-0.2	0.875	0.57	1.62
	Widowed		0.47	0.22	-1.6	0.109	0.19	1.18
	Cohabiting		0.98	0.24	-0.1	0.940	0.60	1.59
Highest qualification at Wave 2	Higher education below degree / A level or equivalent	Degree	1.36	0.28	1.5	0.133	0.91	2.04
	O level or equivalent / CSE or equivalent / Foreign or other		1.50	0.27	2.2	0.027	1.05	2.13
	No qualification		2.32	0.51	3.9	0.000	1.51	3.56
Constant			0.06	0.02	-7.7	0.000	0.03	0.12

Smoking rates among children – descriptive analysis

Appendix tables D:7 and D:8 show overall smoking rates among children who smoked, by age and by gender respectively. Appendix tables D:9 and D:10 below present the characteristics by age group, of girls and boys respectively, who smoked.

Appendix table D:7 Overall smoking rates by age (in years), by wave

Base: All children aged 10–15 years who complete a Youth Questionnaire		*Data from Understanding Society*							
		Wave							
Gender	**Age (years)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		%	%	%	%	%	%	%	%
Male	10	0.6	1.4	2.2	1.5	3.7	2.3	0.0	1.2
	11	0.8	2.2	4.7	3.0	2.5	3.5	0.6	1.4
	12	2.8	4.0	6.8	3.1	6.6	4.6	0.1	2.3
	13	7.0	11.7	8.6	6.1	5.4	3.4	3.9	4.2
	14	10.7	17.1	15.7	13.6	13.6	9.8	6.4	8.4
	15	15.1	21.7	22.6	16.8	16.0	15.8	10.8	14.5
Female	10	1.2	0.6	0.7	0.2	0.0	1.9	0.0	0.9
	11	0.7	1.2	2.7	1.4	2.2	2.2	0.0	2.4
	12	2.8	3.7	4.8	1.2	2.5	3.1	0.0	1.4
	13	7.1	6.1	8.7	5.8	4.6	7.1	1.4	3.6
	14	13.3	17.2	15.5	9.7	14.2	11.6	9.5	9.1
	15	20.9	26.9	23.4	20.0	17.1	19.0	12.4	24.6
Unweighted bases - male	10	*402*	*375*	*355*	*286*	*301*	*232*	*285*	*273*
	11	*394*	*452*	*345*	*350*	*274*	*312*	*282*	*266*
	12	*416*	*419*	*399*	*335*	*325*	*257*	*330*	*237*
	13	*423*	*451*	*361*	*371*	*315*	*323*	*269*	*298*
	14	*377*	*399*	*391*	*339*	*341*	*301*	*330*	*230*
	15	*404*	*386*	*349*	*343*	*283*	*311*	*293*	*289*
Unweighted bases - female	10	*395*	*366*	*364*	*310*	*251*	*276*	*282*	*272*
	11	*429*	*391*	*332*	*340*	*282*	*257*	*340*	*242*
	12	*379*	*445*	*373*	*311*	*336*	*268*	*289*	*286*
	13	*418*	*412*	*366*	*350*	*305*	*326*	*276*	*273*
	14	*414*	*436*	*371*	*346*	*304*	*294*	*338*	*258*
	15	*413*	*413*	*385*	*334*	*310*	*279*	*291*	*300*

Appendix table D:8 Overall smoking rates by gender, by wave

Base: All children aged 10–15 years who complete a Youth Questionnaire		*Data from USoc*							
		Wave							
Gender	**Age (years)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		%	%	%	%	%	%	%	%
Male	All 10–15	6.3	9.5	10.0	7.4	8.0	6.7	3.7	5.5
Female	All 10–15	7.8	9.5	9.4	6.5	6.9	7.5	3.9	7.3
Male unweighted base		*2416*	*2482*	*2200*	*2025*	*1839*	*1736*	*1789*	*1598*
Female unweighted base		*2448*	*2463*	*2191*	*1991*	*1788*	*1700*	*1816*	*1635*

Appendix table D:9 Smoking rates among girls, by age group

Base: All children in the restructured data who complete a Youth Questionnaire.		*Data from Understanding Society*							
		Whether smoking:							
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**	
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Ethnicity										
White	%	98.5	1.5	100	96	4	100	87.8	12.2	100
Mixed	%	100	0	100	97.6	2.4	100	68.4	31.6	100
Asian	%	98.9	1.1	100	97.3	2.7	100	89.8	10.2	100
Black	%	94.9	5.1	100	94.4	5.6	100	97.1	2.9	100
Total	%	98.4	1.6	100	96	4	100	87.5	12.5	100
P-values		*P = 0.561*			*P = 0.893*			*P = 0.046*		
Ethnicity: grouped										
White	%	98.5	1.5	100	96	4	100	87.8	12.2	100
Non-white	%	98.2	1.8	100	96.7	3.3	100	85	15	100
Total	%	98.4	1.6	100	96	4	100	87.5	12.5	100
P-values		*P = 0.868*			*P = 0.748*			*P = 0.581*		
Religion										
None	%	99	1	100	93.5	6.5	100	84.1	15.9	100
Christian	%	98.2	1.8	100	96.9	3.1	100	88.2	11.8	100
Other	%	100	0	100	96.1	3.9	100	90	10	100
Missing	%	96.4	3.6	100	96.8	3.2	100	86.7	13.3	100

Appendix table D:9	Smoking rates among girls, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.510*			*P = 0.300*			*P = 0.554*		
Government Office Region										
North East	%	97.4	2.6	100	88.7	11.3	100	87.1	12.9	100
North West	%	100	0	100	94.8	5.2	100	88.2	11.8	100
Yorkshire and the Humber	%	97	3	100	100	0	100	88.8	11.2	100
East Midlands	%	100	0	100	97.9	2.1	100	77.9	22.1	100
West Midlands	%	96.5	3.5	100	94.5	5.5	100	83.2	16.8	100
East of England	%	99.5	0.5	100	92.6	7.4	100	86.3	13.7	100
London	%	100	0	100	97.8	2.2	100	81	19	100
South East	%	98.1	1.9	100	96.5	3.5	100	89.5	10.5	100
South West	%	97.9	2.1	100	95.9	4.1	100	90.6	9.4	100
Wales	%	100	0	100	95.2	4.8	100	95.2	4.8	100
Scotland	%	96	4	100	97.9	2.1	100	95.9	4.1	100
Northern Ireland	%	100	0	100	89.4	10.6	100	84.7	15.3	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.710*			*P = 0.433*			*P = 0.471*		
Urban-rural indicator										
Urban area	%	98.5	1.5	100	95.9	4.1	100	86.9	13.1	100
Rural area	%	98.3	1.7	100	95.2	4.8	100	86.6	13.4	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.849*			*P = 0.741*			*P = 0.929*		
Tenure										
Owner occupier	%	99	1	100	97	3	100	89.2	10.8	100
Local Authority / Housing Association rent	%	96.8	3.2	100	91.2	8.8	100	80.1	19.9	100
Privately rented / other	%	98.6	1.4	100	97.2	2.8	100	84.7	15.3	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.220*			*P = 0.040*			*P = 0.068*		
Cars in household										
None	%	98.6	1.4	100	89.4	10.6	100	82.2	17.8	100

Appendix table D:9	Smoking rates among girls, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
1	%	98.2	1.8	100	95.7	4.3	100	85	15	100
2+	%	98.7	1.3	100	97.5	2.5	100	89.6	10.4	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.912*			*P = 0.014*			*P = 0.225*		
Number in household not in paid employment										
None	%	98.8	1.2	100	97.3	2.7	100	88.2	11.8	100
1	%	97.4	2.6	100	93.9	6.1	100	86.6	13.4	100
2+	%	100	0	100	94.1	5.9	100	83.9	16.1	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.271*			*P = 0.150*			*P = 0.588*		
Age of youngest child										
Up to 4 years old	%	97.2	2.8	100	93.9	6.1	100	80.3	19.7	100
5 to 9	%	98.9	1.1	100	93.3	6.7	100	87.8	12.2	100
10 to 11	%	98.7	1.3	100	97	3	100	89	11	100
12 to 13	%	-	-	-	97	3	100	90.6	9.4	100
14 to 15	%	-	-	-	-	-	-	86.1	13.9	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.526*			*P = 0.287*			*P = 0.621*		
Net total monthly household income										
<£1000	%	100	0	100	100	0	100	69.2	30.8	100
£1000-£1499	%	95	5	100	93.6	6.4	100	92	8	100
£1500-£2499	%	99.5	0.5	100	94.2	5.8	100	85.8	14.2	100
£2500-£3499	%	99.1	0.9	100	94.8	5.2	100	84.7	15.3	100
£3500+	%	97.6	2.4	100	97.6	2.4	100	88.8	11.2	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.189*			*P = 0.524*			*P = 0.483*		
Household composition										
1 adult, 1 child	%	98.9	1.1	100	90.3	9.7	100	92.5	7.5	100

Appendix table D:9	Smoking rates among girls, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
1 adult, 2 or more children	%	97.5	2.5	100	91.4	8.6	100	83.6	16.4	100
Couple with 1 child	%	100	0	100	99.1	0.9	100	89.3	10.7	100
Couple with 2 children	%	99	1	100	97.2	2.8	100	88.1	11.9	100
Couple with 3 or more children	%	97.2	2.8	100	95.2	4.8	100	85.8	14.2	100
Large mixed household	%	100	0	100	96.1	3.9	100	85.8	14.2	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.413*			*P = 0.175*			*P = 0.868*		
How many times in the last 7 days has eaten evening meal with family										
None	%	100	0	100	90.5	9.5	100	74.3	25.7	100
1 - 2 times	%	95.8	4.2	100	93.5	6.5	100	86.7	13.3	100
3 - 5 times	%	100	0	100	96.6	3.4	100	89.5	10.5	100
6 - 7 times	%	98.4	1.6	100	96.7	3.3	100	88.1	11.9	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.119*			*P = 0.208*			*P = 0.059*		
Always feel support by family										
No	%	97.8	2.2	100	91.2	8.8	100	77.4	22.6	100
Yes	%	98.6	1.4	100	96.8	3.2	100	90.1	9.9	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.605*			*P = 0.010*			*P = 0.000*		
How often talk to mother about things that matter										
Most days	%	98.2	1.8	100	94.9	5.1	100	89.3	10.7	100
More than once a week	%	98.7	1.3	100	98.2	1.8	100	89.2	10.8	100
Less than once a week	%	99	1	100	96.9	3.1	100	82.5	17.5	100
Hardly ever	%	98.4	1.6	100	92.5	7.5	100	83	17	100
Don't have a mother	%	100	0	100	100	0	100	84.1	15.9	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.977*			*P = 0.254*			*P = 0.308*		

Appendix table D:9	Smoking rates among girls, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
	Girls aged 10–11				**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
How often talk to father about things that matter										
Most days	%	99.4	0.6	100	97.8	2.2	100	94.1	5.9	100
More than once a week	%	100	0	100	98.6	1.4	100	94.4	5.6	100
Less than once a week	%	97.5	2.5	100	95.6	4.4	100	86.7	13.3	100
Hardly ever	%	97.4	2.6	100	93.7	6.3	100	82.7	17.3	100
Don't have a father	%	100	0	100	92.4	7.6	100	74.1	25.9	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values	*P = 0.358*				*P = 0.203*			*P = 0.002*		
Expressed negative feelings about family										
No	%	98.6	1.4	100	97.1	2.9	100	89.4	10.6	100
Yes	%	97	3	100	87.3	12.7	100	79.6	20.4	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values	*P = 0.382*				*P = 0.000*			*P = 0.007*		
Importance of doing well in GCSEs or standard grades										
Missing	%	95.1	4.9	100	100	0	100	100	0	100
Very important	%	98.1	1.9	100	96.2	3.8	100	89.1	10.9	100
Important	%	100	0	100	93.2	6.8	100	78.2	21.8	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values	*P = 0.145*				*P = 0.334*			*P = 0.009*		
Parents always interested in how does at school										
No	%	96.9	3.1	100	92.1	7.9	100	78.1	21.9	100
Yes	%	98.7	1.3	100	96.5	3.5	100	89.6	10.4	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values	*P = 0.269*				*P = 0.065*			*P = 0.002*		
How often bully others in other ways										

Appendix table D:9	Smoking rates among girls, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Never	%	98.8	1.2	100	96.2	3.8	100	87.3	12.7	100
Not much (1-3 times in last 6 months)	%	96.7	3.3	100	87.4	12.6	100	75.5	24.5	100
Quite a lot / A lot	%	52.1	47.9	100	88.2	11.8	100	100	0	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.000*			*P = 0.044*			*P = 0.218*		
How often physically bullied at school										
Never	%	99.2	0.8	100	95.9	4.1	100	87.1	12.9	100
Not much (1-3 times in last 6 months)	%	94.9	5.1	100	94.9	5.1	100	80.6	19.4	100
Quite a lot / A lot	%	96.8	3.2	100	93.1	6.9	100	100	0	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.014*			*P = 0.771*			*P = 0.261*		
Frequency of eating fast food: days in a normal week										
Once a week or more	%	100	0	100	96.7	3.3	100	86.5	13.5	100
Every now and then	%	97.6	2.4	100	93.8	6.2	100	86.7	13.3	100
Never or hardly ever	%	99.5	0.5	100	98.1	1.9	100	87.3	12.7	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.126*			*P = 0.058*			*P = 0.982*		
Uses social media / website										
No	%	99.3	0.7	100	97.5	2.5	100	98.3	1.7	100
Yes	%	97.8	2.2	100	95.3	4.7	100	85.9	14.1	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.126*			*P = 0.289*			*P = 0.008*		
Has friends that drink regularly										
No	%	98.4	1.6	100	97.7	2.3	100	93.2	6.8	100
Yes	%	100	0	100	82.3	17.7	100	76.2	23.8	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.616*			*P = 0.000*			*P = 0.000*		

Appendix table D:9 Smoking rates among girls, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.		*Data from Understanding Society*								
		Whether smoking:								
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Drinks alcohol regularly										
No	%	98.7	1.3	100	96	4	100	87.9	12.1	100
Yes	%	89	11	100	61.4	38.6	100	49	51	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.018*			*P = 0.000*			*P = 0.000*		
Whether mum ever smoked										
Missing	%	100	0	100	100	0	100	73	27	100
Yes	%	98	2	100	94	6	100	83.5	16.5	100
No	%	98.9	1.1	100	97.1	2.9	100	91.7	8.3	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.593*			*P = 0.128*			*P = 0.009*		
Mum – smoking status										
Missing	%	100	0	100	100	0	100	73	27	100
Not applicable	%	98.9	1.1	100	97.1	2.9	100	91.7	8.3	100
Yes	%	96.4	3.6	100	95.8	4.2	100	81.9	18.1	100
No	%	99	1	100	92.8	7.2	100	84.6	15.4	100
P-values		*P = 0.269*			*P = 0.129*			*P = 0.020*		
Mum's Current job - grouped NSSEC										
No parent data	%	100	0	100	100	0	100	68.9	31.1	100
Professional	%	99.1	0.9	100	96.9	3.1	100	87.1	12.9	100
Intermediate / Small employer	%	98.7	1.3	100	98.9	1.1	100	90.3	9.7	100
Lower supervisory / semi routine & routine	%	98.1	1.9	100	97.1	2.9	100	90.1	9.9	100
Missing	%	98	2	100	91.9	8.1	100	84.5	15.5	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.888*			*P = 0.036*			*P = 0.206*		
Mum - Highest qualification										
No parent data	%	100	0	100	100	0	100	68.9	31.1	100

Appendix table D:9	Smoking rates among girls, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Degree / higher degree	%	98.9	1.1	100	95.3	4.7	100	86.4	13.6	100
A level / GCSE / Other	%	97.9	2.1	100	95.9	4.1	100	89.4	10.6	100
None	%	100	0	100	95	5	100	77.9	22.1	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.637*			*P = 0.850*			*P = 0.078*		
Whether dad has ever smoked										
Missing	%	97.7	2.3	100	93.9	6.1	100	83	17	100
Yes	%	99.1	0.9	100	95.1	4.9	100	87.2	12.8	100
No	%	98.8	1.2	100	98.9	1.1	100	91.7	8.3	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		P = 0.459			P = 0.042			P = 0.078		
Dad – smoking status										
Missing	%	97.7	2.3	100	93.9	6.1	100	83	17	100
Not applicable	%	98.8	1.2	100	98.9	1.1	100	91.7	8.3	100
Yes	%	100	0	100	91.2	8.8	100	86.1	13.9	100
No	%	98.6	1.4	100	97.5	2.5	100	88	12	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.551*			*P = 0.011*			*P = 0.150*		
Dad's Current job - grouped NSSEC										
No parent data	%	98.6	1.4	100	92.2	7.8	100	82.5	17.5	100
Professional	%	98.2	1.8	100	98.4	1.6	100	91.2	8.8	100
Intermediate / Small employer	%	97.5	2.5	100	96.6	3.4	100	83.9	16.1	100
Lower supervisory / semi routine & routine	%	100	0	100	97.1	2.9	100	91.5	8.5	100
Missing	%	97.3	2.7	100	91.5	8.5	100	78.1	21.9	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.691*			*P = 0.025*			*P = 0.049*		
Highest qualification of father										
No parent data	%	98.6	1.4	100	92.2	7.8	100	82.5	17.5	100
Degree / higher degree	%	98.6	1.4	100	97.6	2.4	100	89.9	10.1	100

Appendix table D:9	Smoking rates among girls, by age group								
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*								
	Whether smoking:								
		Girls aged 10–11			**Girls aged 12–13**			**Girls aged 14–15**	
		No	Yes	Total	No	Yes	Total	No	Yes	Total
A level / GCSE / Other	%	99.4	0.6	100	96.2	3.8	100	90.4	9.6	100
None	%	90.7	9.3	100	98.9	1.1	100	66.3	33.7	100
Total	%	98.5	1.5	100	95.7	4.3	100	86.9	13.1	100
P-values		*P = 0.010*			*P = 0.035*			*P = 0.003*		

Appendix table D:10	Smoking rates among boys, by age group									
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Tota l
Ethnicity										
White	%	98	2	100	93.8	6.2	100	89.9	10.1	100
Mixed	%	100	0	100	93	7	100	86.2	13.8	100
Asian	%	98.9	1.1	100	94.9	5.1	100	93.1	6.9	100
Black	%	100	0	100	93.8	6.2	100	95.9	4.1	100
Total	%	98.2	1.8	100	93.8	6.2	100	90.1	9.9	100
P-values		*P = 0.796*			*P = 0.982*			*P = 0.666*		
Ethnicity:										
White	%	98	2	100	93.8	6.2	100	89.9	10.1	100
Non-white	%	99.4	0.6	100	94.1	5.9	100	91.5	8.5	100
Total	%	98.2	1.8	100	93.8	6.2	100	90.1	9.9	100
P-values		*P = 0.194*			*P = 0.920*			*P= 0.676*		
Religion										
None	%	97.8	2.2	100	91.6	8.4	100	88.4	11.6	100
Christian	%	98.4	1.6	100	94.2	5.8	100	90.7	9.3	100
Other	%	99.4	0.6	100	95.2	4.8	100	88.1	11.9	100
Missing	%	90.7	9.3	100	90.8	9.2	100	87.6	12.4	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.019*			*P = 0.587*			*P = 0.838*		

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
	Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**			
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Government Office Region										
North east	%	89.4	10.6	100	100	0	100	100	0	100
North west	%	98	2	100	88.2	11.8	100	86.2	13.8	100
Yorkshire and the Humber	%	97.6	2.4	100	88.7	11.3	100	83.7	16.3	100
East midlands	%	100	0	100	87.4	12.6	100	81.5	18.5	100
West midlands	%	96.5	3.5	100	96.1	3.9	100	90.4	9.6	100
East of England	%	100	0	100	95.2	4.8	100	86.9	13.1	100
London	%	99.3	0.7	100	98	2	100	95.2	4.8	100
South east	%	97.1	2.9	100	91.7	8.3	100	90.3	9.7	100
South west	%	97.6	2.4	100	93.2	6.8	100	87.3	12.7	100
Wales	%	100	0	100	100	0	100	95.5	4.5	100
Scotland	%	97.6	2.4	100	92.9	7.1	100	98	2	100
Northern Ireland	%	94.9	5.1	100	100	0	100	81	19	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values	*P = 0.477*				*P = 0.283*			*P = 0.168*		
Urban-rural indicator										
Urban area	%	98.3	1.7	100	94	6	100	91.7	8.3	100
Rural area	%	96	4	100	90.3	9.7	100	82.4	17.6	100
P-values	*P = 0.159*				*P = 0.169*			*P = 0.04*		
Tenure										
Owner occupier	%	99	1	100	95.3	4.7	100	91.6	8.4	100
LA / HA rent	%	96.8	3.2	100	88.7	11.3	100	84.2	15.8	100
Private rent / other	%	91.9	8.1	100	87.7	12.3	100	86.1	13.9	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values	*P = 0.004*				*P = 0.024*			*P = 0.081*		
Number of cars in Household										
None	%	98.1	1.9	100	86.9	13.1	100	86.6	13.4	100
1	%	96.5	3.5	100	92	8	100	88.4	11.6	100
2+	%	99	1	100	95.8	4.2	100	90.8	9.2	100

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.222*			*P = 0.051*			*P = 0.573*		
Number not in paid employment										
None	%	97.6	2.4	100	93.5	6.5	100	91.7	8.3	100
1	%	98.4	1.6	100	94.1	5.9	100	84	16	100
2+	%	96.7	3.3	100	89.3	10.7	100	92.8	7.2	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.767*			*P = 0.414*			*P = 0.024*		
Age of youngest child										
Up to 4 years old	%	96.8	3.2	100	95.9	4.1	100	86.8	13.2	100
5 to 9	%	98.8	1.2	100	91.5	8.5	100	88.7	11.3	100
10 to 11	%	97.3	2.7	100	94.8	5.2	100	91.5	8.5	100
12 to 13	%	-	-	-	92.6	7.4	100	95.1	4.9	100
14 to 15	%	-	-	-	-	-	-	87.3	12.7	100
P-values		*P = 0.488*			*P = 0.618*			*P = 0.367*		
Net total monthly household income grouped (inc. Imputed)										
<£1000	%	100	0	100	53.3	46.7	100	70.8	29.2	100
£1000-£1499	%	94.2	5.8	100	97.8	2.2	100	90.2	9.8	100
£1500-£2499	%	99	1	100	89	11	100	86.2	13.8	100
£2500-£3499	%	97	3	100	92.1	7.9	100	91.4	8.6	100
£3500+	%	98	2	100	96.4	3.6	100	90.7	9.3	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.435*			*P = 0.001*			*P = 0.187*		
Household composition										
1 adult, 1 child	%	100	0	100	88.3	11.7	100	87.6	12.4	100
1 adult, 2 or more children	%	95.6	4.4	100	96.7	3.3	100	85	15	100
Couple with 1 child	%	99.2	0.8	100	89.9	10.1	100	93.3	6.7	100
Couple with 2 children	%	96.8	3.2	100	90.6	9.4	100	91.2	8.8	100

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
		Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Couple with 3 or more children	%	98.6	1.4	100	93.8	6.2	100	88.2	11.8	100
Large mixed household	%	99.5	0.5	100	95.6	4.4	100	89.2	10.8	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.316*			*P = 0.443*			*P = 0.786*		
How many times in the last 7 days has eaten evening meal with family										
None	%	100	0	100	90	10	100	75.1	24.9	100
1 - 2 times	%	97.7	2.3	100	93.7	6.3	100	89.7	10.3	100
3 - 5 times	%	98.7	1.3	100	92	8	100	87.4	12.6	100
6 - 7 times	%	97.1	2.9	100	93.8	6.2	100	93.9	6.1	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.623*			*P = 0.795*			*P = 0.001*		
Always feel support by family										
No	%	96.6	3.4	100	87.6	12.4	100	84	16	100
Yes	%	98	2	100	94.3	5.7	100	90.7	9.3	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.467*			*P = 0.024*			*P = 0.061*		
How often talk to mother about things that matter										
Most days	%	97.1	2.9	100	95.8	4.2	100	89.1	10.9	100
More than once a week	%	97.2	2.8	100	89.7	10.3	100	91.3	8.7	100
Less than once a week	%	100	0	100	92.6	7.4	100	93.6	6.4	100
Hardly ever	%	97.6	2.4	100	94.4	5.6	100	84.1	15.9	100
Don't have a mother	%	100	0	100	62.9	37.1	100	62.9	37.1	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.635*			*P = 0.064*			*P = 0.078*		
How often talk to father about things that matter										

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.										*Data from Understanding Society*
		Whether smoking:								
		Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Tota l
Most days	%	95.7	4.3	100	96.8	3.2	100	90.7	9.3	100
More than once a week	%	98.3	1.7	100	93.9	6.1	100	95.2	4.8	100
Less than once a week	%	97.7	2.3	100	90	10	100	95.6	4.4	100
Hardly ever	%	98.4	1.6	100	93.2	6.8	100	81.8	18.2	100
Don't have a father	%	100	0	100	87.6	12.4	100	80.9	19.1	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.508*			*P = 0.297*			*P = 0.000*		
Expressed negative feelings about family										
No	%	97.8	2.2	100	94.3	5.7	100	91.6	8.4	100
Yes	%	97.1	2.9	100	84.9	15.1	100	81.6	18.4	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.798*			*P = 0.005*			*P = 0.003*		
Importance of doing well in GCSEs or standard grades										
Missing	%	93.4	6.6	100	100	0	100	100	0	100
Very important	%	97.9	2.1	100	94.7	5.3	100	90.9	9.1	100
Important	%	97.9	2.1	100	85	15	100	83.4	16.6	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.482*			*P = 0.003*			*P = 0.165*		
Parents always interested in how does at school										
No	%	98	2	100	90.1	9.9	100	83.6	16.4	100
Yes	%	97.7	2.3	100	93.8	6.2	100	91.1	8.9	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.827*			*P = 0.199*			*P = 0.024*		
How often bully others in other ways										
Never	%	98	2	100	94.9	5.1	100	91.5	8.5	100
Not much (1-3 times in last 6 months)	%	98.2	1.8	100	81.6	18.4	100	72.1	27.9	100
Quite a lot / A lot	%	66.8	33.2	100	76.8	23.2	100	58.9	41.1	100

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
		Whether smoking:								
		Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.000*			*P = 0.000*			*P = 0.000*		
How often physically bullied at school										
Never	%	98.7	1.3	100	94.8	5.2	100	90.4	9.6	100
Not much (1-3 times in last 6 months)	%	97.4	2.6	100	86.3	13.7	100	87.7	12.3	100
Quite a lot / A lot	%	91	9	100	90	10	100	73.2	26.8	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.007*			*P = 0.023*			*P = 0.055*		
Frequency of eating fast food: days in a normal week										
Once a week or more	%	95.7	4.3	100	93.3	6.7	100	85	15	100
Every now and then	%	98.7	1.3	100	92.1	7.9	100	90.6	9.4	100
Never or hardly ever	%	97.3	2.7	100	94.9	5.1	100	90.7	9.3	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.269*			*P = 0.596*			*P = 0.236*		
Uses social media / website										
No	%	99.5	0.5	100	96.6	3.4	100	95.5	4.5	100
Yes	%	95.9	4.1	100	91.9	8.1	100	88.4	11.6	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.012*			*P = 0.100*			*P = 0.145*		
Has friends that drink regularly										
No	%	97.9	2.1	100	94.2	5.8	100	93.6	6.4	100
Yes	%	90.3	9.7	100	79.3	20.7	100	79.7	20.3	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.097*			*P = 0.001*			*P = 0.000*		
Drinks alcohol regularly										
No	%	97.9	2.1	100	93.3	6.7	100	90.1	9.9	100

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.										*Data from Understanding Society*
		Whether smoking:								
		Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Yes	%	93.5	6.5	100	75	25	100	66.7	33.3	100
Total		97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.258*			*P = 0.133*			*P = 0.003*		
Whether mum ever smoked cigarettes										
Missing	%	93.1	6.9	100	92.7	7.3	100	91.1	8.9	100
Yes	%	97.5	2.5	100	90.5	9.5	100	85.3	14.7	100
No	%	98.3	1.7	100	95.8	4.2	100	93.6	6.4	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.377*			*P = 0.098*			*P = 0.015*		
Whether mum currently smokes										
Missing	%	93.1	6.9	100	92.7	7.3	100	91.1	8.9	100
Not applicable	%	98.3	1.7	100	95.8	4.2	100	93.6	6.4	100
Yes	%	96.7	3.3	100	87.4	12.6	100	82	18	100
No	%	98.1	1.9	100	92.9	7.1	100	87.8	12.2	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.450*			*P = 0.065*			*P = 0.016*		
Mum - Current job - grouped NSSEC										
No parent data	%	90.5	9.5	100	90.5	9.5	100	88.2	11.8	100
Prof	%	98.1	1.9	100	92.8	7.2	100	93.2	6.8	100
Intermediate / Small employer	%	98.3	1.7	100	98.6	1.4	100	90.4	9.6	100
Lower supervisory / semi routine & routine	%	98.8	1.2	100	92.7	7.3	100	90.7	9.3	100
Missing	%	97	3	100	90.7	9.3	100	84.9	15.1	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.362*			*P = 0.290*			*P = 0.255*		
Mum's highest qualification										
No parent data	%	90.5	9.5	100	90.5	9.5	100	88.2	11.8	100
Degree / higher degree	%	98.5	1.5	100	94	6	100	90	10	100
A level / GCSE / Other	%	97.7	2.3	100	93.2	6.8	100	88.9	11.1	100

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
	Whether smoking:									
	Boys aged 10–11			**Boys aged 12–13**			**Boys aged 14–15**			
		No	Yes	Total	No	Yes	Total	No	Yes	Total
None	%	96.5	3.5	100	88	12	100	90	10	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values	*P = 0.317*				*P = 0.681*			*P = 0.983*		
Whether dad has ever smoked										
Missing	%	97.5	2.5	100	92.4	7.6	100	87	13	100
Yes	%	97.1	2.9	100	90.7	9.3	100	87.1	12.9	100
No	%	98.9	1.1	100	96.8	3.2	100	95.4	4.6	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values	*P = 0.525*				*P = 0.101*			*P = 0.027*		
Whether dad currently smokes										
Missing	%	97.5	2.5	100	92.4	7.6	100	87	13	100
Not applicable	%	98.9	1.1	100	96.8	3.2	100	95.4	4.6	100
Yes	%	98.8	1.2	100	87.6	12.4	100	85.4	14.6	100
No	%	95.9	4.1	100	92.9	7.1	100	88.3	11.7	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values	*P = 0.384*				*P = 0.101*			*P = 0.053*		
Dad - Current job - grouped NSSEC										
No parent data	%	97.2	2.8	100	94.1	5.9	100	87.4	12.6	100
Prof	%	98.8	1.2	100	94	6	100	92.8	7.2	100
Intermediate / Small employer	%	100	0	100	93.5	6.5	100	89.1	10.9	100
Lower supervisory / semi routine & routine	%	97.6	2.4	100	93.9	6.1	100	92	8	100
Missing	%	93.2	6.8	100	84.4	15.6	100	80.4	19.6	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values	*P = 0.163*				*P = 0.208*			*P = 0.142*		
Dad's highest qualification										
No parent data	%	97.2	2.8	100	94.1	5.9	100	87.4	12.6	100
Degree / higher degree	%	99.5	0.5	100	95.2	4.8	100	93	7	100
A level / GCSE / Other	%	96.8	3.2	100	91.8	8.2	100	89.2	10.8	100

Appendix table D:10 Smoking rates among boys, by age group										
Base: All children in the restructured data who complete a Youth Questionnaire.	*Data from Understanding Society*									
		Whether smoking:								
		Boys aged 10–11			Boys aged 12–13			Boys aged 14–15		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
None	%	98	2	100	76.5	23.5	100	77	23	100
Total	%	97.7	2.3	100	93.1	6.9	100	89.4	10.6	100
P-values		*P = 0.200*			*P = 0.050*			*P = 0.161*		

Multivariate output for analysis of smoking among children

The factors related to changes in smoking behaviour among children aged 10–15 years were examined further using multivariate analysis methods on data from USoc.

The aim of the multivariate analysis was to look at longitudinal patterns in smoking behaviour for children between the ages of 10 and 15 years. The youth self-completion survey includes questions on whether or not the child had smoked at every wave. However, owing to the modular nature of the questionnaire, the covariates that were of specific interest to this analysis were only collected every other wave (Waves 1, 3, 5, and 7). In addition, the number of young people who smoked at each age was low, meaning sample sizes for smoking per age, per wave, were low. This meant it was not practical to analyse the data by wave. For these reasons, the data were restructured and age groups combined to give three tranches of data for analysis; the first tranche contained children aged 10–11 years, the second children aged 12–13 years, and the third contained children aged 14–15 years. Each tranche combined children from more than one wave. Tranche 1 contained children aged 10–11 years in Wave 1 and 3, tranche 2 included children aged 12–13 from Wave 3 and 5, and tranche 3 incorporates those aged 14–15 from Wave 5 and 7.

Random effects regression models were run using the restructured data. The models were used to investigate the relationship between **smoking** (coded as a binary variable, where 0=the child does not smoke and 1=the child smokes) and a set of **independent predictor variables**. The predictor variables were a set of individual and household characteristics (namely, those presented in Appendix tables D:9 and D:10 above). The nature of secondary data analysis means the predictor factors are limited by data availability. While it was not possible to investigate all potential factors using USoc,[lxii] the following areas have been covered.

- **Parental smoking behaviour.** Research indicates that the uptake of smoking among children is associated with a wide range of individual, family, and environmental risk factors. Of these, parental behaviour appears particularly important.[23,144] Published research suggests children who live with parents or siblings who smoke are up to three times more likely to become smokers themselves than children of non-smoking households.[145] For this reason, it was

[lxii] Other factors highlighted in published research include the ease of obtaining cigarettes, smoking by friends and peer group members, exposure to tobacco marketing, and depictions of smoking in films, television and other media. These factors were not included in the analysis as they were not covered by Understanding Society.

important to include the smoking behaviour of both the mother and father (where the parent was present). The analysis also explored whether there was evidence of an interaction between the child's gender and which parent smokes (i.e., whether the father's smoking behaviour has greater impact on boys smoking).

- In line with above, a number of other parental characteristics, such as mental wellbeing, education, and socioeconomic status, were included in the analysis.
- As an extension to the importance of parental influence, the analysis includes information about wider **family ties**. *USoc* contains questions about whether the child eats meals with their parents, whether the child feels they can talk to parents, whether they feel their parents are interested in their schooling.
- Research indicates a link between truancy, anti-social behaviour, poor wellbeing and smoking uptake among children. The analysis includes information about other anti-social behaviour, specifically, questions about bullying, being bullied, the **child's drinking**, along with the reported drinking behaviour of their friends. This aims to build on evidence suggesting an association between smoking and other substance misuse. The links between truancy, bullying, and smoking,[146] and between victimisation and wider substance misuse[147] have been explored in the literature. As an extension to this, the analysis includes more general information about **the child's social and friendship networks**. *USoc* contains information about whether the child has close friends and the prosocial score from the Strengths and Difficulties Questionnaire.
- Both the *Smoking Drinking and Drug Use Among Young People in England (SDD)* survey[lxiii] and *What About Youth (WAY)*[lxiv] indicate that **deprivation** is linked to increased smoking. For this reason, local area deprivation (taken from the Index of Multiple Deprivation) and **household income** are both included in the analysis.
- Finally, both *SDD* and *WAY* show that smoking among children varies across a number of demographic characteristics, specifically, age, gender, ethnicity, region, and household type[lxv]. These were included in the modelling.

Boys and girls were modelled separately as the bivariate analysis indicated there were differences in the characteristics related to smoking take up by gender. Only variables significantly related to the outcome were retained in the final models. Non-significant variables were removed. The models were run in Stata 15 using the xtlogit commands. Random effects models were used to control for the longitudinal nature of the data, specifically, where information exists for each child at three different time points. For each child, the observations at each time point are likely to be correlated. This lack of independence violates the assumptions that underpin Ordinary Least Square regression models. Instead, random effects models take the longitudinal structure of the data into account and calculate correct standard errors for each of the regressors, providing reliable and robust estimates.

The model outputs show the odds ratios associated to each regressor, its standard error, P-value and 95% confidence intervals. The odds ratios are a measure of how likely or unlikely children are to smoke, with respect to the reference category of the

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[lxiii] NHS Digital. Smoking, drinking and drug use among young people in England – 2018. [Internet]. August 2019. [cited 2020 Oct 26]. Available from: https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england/2018.

[lxiv] Health and Wellbeing of 15 year olds in England: Findings from the What About YOUth? Survey 2014. [Internet]. December 2015. [cited 2020 Oct 22]. Available from: https://files.digital.nhs.uk/publicationimport/pub19xxx/pub19244/what-about-youth-eng-2014-rep.pdf

[lxv] *SDD* 2018, as above

characteristic. An odds ratio higher than 1 implies the chances of smoking are higher, an odds ratio less than one implies the opposite.

The models include a measure of the Intraclass Correlation Coefficient (ICC) also called *rho*. This represents the amount of variation in the smoking within each child. For girls this was 0.22, for boys the corresponding value was 0.5. This implies that there was more consistency in smoking over the three time points among boys than girls.

Appendix table D:11 Model output for girls aged 10–15 years

Variable	Category	Baseline	Odds Ratio	Std. Err.	*z*	P>*z*	[95% Conf.	Interval]
Age in years	11	10	1.87	1.17	1.0	0.318	0.55	6.36
	12		2.30	1.31	1.5	0.143	0.75	7.03
	13		3.43	1.91	2.2	0.027	1.15	10.19
	14		4.66	2.51	2.9	0.004	1.62	13.39
	15		6.35	3.43	3.4	0.001	2.21	18.30
How often talks to father about things that matter	Most days	Don't have a father	0.34	0.18	-2.0	0.044	0.12	0.97
	More than once a week		0.27	0.14	-2.6	0.010	0.10	0.73
	Less than once a week		0.83	0.37	-0.4	0.678	0.34	2.00
	Hardly ever		0.65	0.26	-1.1	0.294	0.30	1.44
Child expressed negative feelings about their family	Yes	No	1.86	0.50	2.3	0.020	1.10	3.15
Bullies other children, not physically	Yes	No	1.93	0.74	1.7	0.087	0.91	4.08
Has friends that drink regularly	Yes	No	4.72	1.26	5.8	0.000	2.80	7.96
Child drinks alcohol regularly	Yes	No	5.66	3.09	3.2	0.001	1.94	16.49
Mother's smoking status	Currently smokes	Does not smoke	1.76	0.51	2.0	0.051	1.00	3.09
	No mum in household		2.19	0.93	1.9	0.065	0.95	5.02
Father's highest qualification	Degree / higher degree	None	0.33	0.15	-2.5	0.012	0.14	0.79
	A level / GCSE / Other		0.22	0.10	-3.3	0.001	0.09	0.54
	Parent data not matched		0.20	0.09	-3.6	0.000	0.08	0.48
	Constant		0.03	0.02	-4.6	0.000	0.01	0.14
		/lnsig2u	-0.05	0.61			-1.24	1.14
		sigma_u	0.98	0.30			0.54	1.77
		rho	0.22	0.11			0.08	0.49

Note: balanced panel, observations for 555 girls at 3 time points.

Appendix table D:12 Model output for boys aged 10–15 years								
Variable	**Category**	**Baseline**	**Odds Ratio**	**Std. Err.**	***z***	**P>*z***	**[95% Conf.**	**Interval]**
Age in years	11	10	0.57	0.38	-0.9	0.396	0.16	2.07
	12		2.34	1.11	1.8	0.073	0.92	5.92
	13		1.26	0.68	0.4	0.670	0.44	3.61
	14		2.24	1.06	1.7	0.091	0.88	5.68
	15		1.73	0.91	1.1	0.292	0.62	4.84
Local Area	Rural	Urban	2.10	0.71	2.2	0.028	1.08	4.06
Bullies other children, not physically	Yes	No	2.22	0.74	2.4	0.017	1.16	4.25
Uses social media / website	Yes	No	5.79	2.63	3.9	0.000	2.38	14.10
Has friends that drink regularly	Yes	No	5.25	1.75	5.0	0.000	2.73	10.09
Child prosocial scale			0.81	0.06	-3.1	0.002	0.70	0.92
Father's smoking status	Currently smokes	Does not smoke	2.91	1.26	2.5	0.014	1.24	6.82
	No dad in household		1.25	0.78	0.4	0.719	0.37	4.26
Father's mental health	Very poor (SF12 >1 sd below average)	Above average (SF12>50)	5.16	2.81	3.0	0.003	1.78	14.98
	Poor (SF12<1 sd below average)		1.55	0.80	0.9	0.395	0.56	4.28
	Missing		2.45	1.57	1.4	0.163	0.70	8.59
	Constant		0.00	0.00	-6.6	0.000	0.00	0.02
		/lnsig2u	1.18	0.31			0.58	1.78
		sigma_u	1.80	0.28			1.34	2.44
		rho	0.50	0.08			0.35	0.64

Note: balanced panel, observations for 539 boys at 3 time points.

Characteristics of different types of smokers and e-cigarette users (adults)

Appendix table D:13 supports the findings in Section 7.3.3 and presents the characteristics of adults who were dual users (smoked cigarettes and used e-cigarettes), adults who smoked cigarettes, and adults who used e-cigarettes but did not smoke.

Appendix table D:13 Characteristics of different types of smoker

Base: all respondents aged 16+		Data from Understanding Society, waves 8 and 9				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
Sex						
Wave 8	Female	45.5	50.7	44.1	52.9	52.2
	Male	54.5	49.3	55.9	47.1	47.8
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Female	46.4	50.7	43.6	53.1	52.3
	Male	53.6	49.3	56.4	46.9	47.7
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	Wave 8	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
Age						
Wave 8	16-24	13.7	14.3	11.8	13.5	13.6
	25-34	16.4	19	22	11.7	13.1
	35-44	18.2	16.7	19.5	14.2	14.8
	45-54	20.5	19.3	22.4	17.2	17.7
	55-64	19.3	16.3	15.3	16.1	16.2
	65+	11.9	14.3	9.1	27.3	24.6
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	16-24	13.4	14	15.4	13.7	13.8
	25-34	15.1	17.7	20.3	11.5	12.6
	35-44	21.8	17.1	19.8	13.7	14.5
	45-54	17.4	19.4	20.7	16.8	17.3
	55-64	21.8	17.4	14.2	16.8	16.9
	65+	10.4	14.4	9.5	27.6	24.9
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
	Wave 8	*883*	*4622*	*1039*	*30984*	*37528*

Appendix table D:13 Characteristics of different types of smoker						
Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
Unweighted bases	*Wave 9*	*764*	*3929*	*1187*	*28988*	*34868*
Ethnicity						
Wave 8	White	96.4	94.7	95.3	91.6	92.2
	Mixed / Other	1.3	1.8	1.7	1.7	1.7
	Asian or Asian British	1.8	2	2.1	4.8	4.3
	Black or Black British	0.4	1.4	0.8	1.9	1.8
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	White	92.9	94.3	95.5	91.8	92.3
	Mixed / Other	3.4	2	1.8	1.6	1.7
	Asian or Asian British	2.1	2.4	1.9	4.7	4.2
	Black or Black British	1.6	1.3	0.8	1.9	1.8
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
In paid employment at Wave 2						
Wave 8	Employed	59.8	55.5	69.6	56.5	56.8
	Unemployed / Student	40.2	44.5	30.4	43.5	43.2
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Employed	57.3	55.3	70.8	56.2	56.6
	Unemployed / Student	42.7	44.7	29.2	43.8	43.4
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*

Appendix table D:13 Characteristics of different types of smoker						
Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
Current Job: five class NS-SEC		%	%	%	%	%
Wave 8	Not applicable	41.8	44.6	31.2	43.3	43.1
	Management & professional	14.9	14	23.9	25.8	23.9
	Intermediate	7.3	5.8	6.7	8	7.6
	Small employers & own account	6.3	6.2	8.7	5.3	5.6
	Lower supervisory & technical	5.7	5.4	8.3	3.5	4
	Semi-routine & routine	24	24	21.3	14.1	15.9
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Not applicable	43.2	46.7	31.8	44.8	44.5
	Management & professional	15.1	13.8	23.6	24.9	23.3
	Intermediate	6.9	5.8	7.3	7.8	7.5
	Small employers & own account	7.7	5.1	8	5.1	5.3
	Lower supervisory & technical	5.9	5.5	6.7	3.4	3.8
	Semi-routine & routine	21.3	23.2	22.6	14	15.6
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
Marital status grouped						
Wave 8	Single	43.6	48.5	42.8	30.6	33.7
	Married / Civil Partnership	36.3	32.2	42.1	53.7	50
	Separated / Divorced	15.4	14.5	11.2	8.5	9.6
	Widowed	4.7	4.8	3.9	7.2	6.7
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Single	49.3	47.1	42.4	31	33.8
	Married / Civil Partnership	32.3	33.4	45.7	53	49.8

Appendix table D:13 Characteristics of different types of smoker

Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
	Separated / Divorced	15.6	14.4	9.2	8.8	9.7
	Widowed	2.7	5.1	2.8	7.2	6.7
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
Long-standing illness or disability						
Wave 8	Yes	43.1	40.1	38	35.7	36.5
	No	56.9	59.9	62	64.3	63.5
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Yes	47.8	44.2	36.3	37	38.1
	No	52.2	55.8	63.7	63	61.9
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
General Health						
Wave 8	Excellent	5.7	7.1	6.6	14	12.7
	Very good	23.9	25.7	35.7	35.2	33.7
	Good	35	35.9	36.2	32	32.7
	Fair	23.2	20.8	13.8	13.9	15.1
	Poor	12.1	10.5	7.7	4.9	5.9
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Excellent	2.8	6	7.8	11.9	10.8
	Very good	23.3	23.7	32.7	34.9	33.2

Appendix table D:13 Characteristics of different types of smoker						
Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
	Good	36.3	36.3	36.5	33.7	34.2
	Fair	24.9	22.5	17.4	14.5	15.8
	Poor	12.7	11.5	5.7	4.9	6
	Total	100	100	100	100	100
	P-values	P = 0.000				
Unweighted bases	*Wave 8*	*862*	*4446*	*1025*	*29812*	*36145*
	Wave 9	*741*	*3760*	*1163*	*27849*	*33513*
General Health Questionnaire						
Wave 8	No issues	48.9	50.1	58.7	59.5	58
	Not optimal	24.9	23.4	19.9	23	23
	Likely problems	26.2	26.5	21.3	17.5	19
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	No issues	48.6	49.3	56.2	58.7	57.2
	Not optimal	22.5	22.8	23.1	23.3	23.2
	Likely problems	28.9	27.9	20.6	18	19.6
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*857*	*4425*	*1017*	*29610*	*35909*
	Wave 9	*736*	*3716*	*1152*	*27613*	*33217*
Government Office Region						
Wave 8	North East	5.7	4.2	7.1	4.3	4.4
	North West	11.9	12.5	12.4	10.7	11
	Yorkshire and the Humber	12	9.8	11	8.8	9.1
	East Midlands	7.5	7.6	12.2	7.5	7.6
	West Midlands	8.1	8.7	7.8	8.7	8.7
	East of England	10.5	8.9	8.8	9.7	9.6
	London	4.6	9.5	6.2	11.6	11
	South East	15.2	12.2	12.3	14.2	13.9

Appendix table D:13 Characteristics of different types of smoker						
Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
	South West	8.2	7.9	8.6	9.2	9
	Wales	4.6	6.4	4.6	4.4	4.7
	Scotland	9.8	8.8	7.1	8.2	8.3
	Northern Ireland	2	3.4	1.7	2.7	2.7
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	North East	5	4.1	7	4.3	4.4
	North West	11.7	11.4	15.1	10.9	11.2
	Yorkshire and the Humber	11.4	9.7	10	8.6	8.9
	East Midlands	6.7	7.9	10.2	7.5	7.6
	West Midlands	9.1	9.1	5.6	8.7	8.6
	East of England	9.5	9.3	9.4	9.7	9.7
	London	6.2	9	6	11.9	11.2
	South East	14.3	12.2	14	14.2	13.9
	South West	8.4	8.2	8	9.2	9
	Wales	6.1	6.4	5.2	4.4	4.7
	Scotland	8.9	9.4	7.3	8	8.2
	Northern Ireland	2.9	3.4	2.2	2.7	2.7
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
Urban or rural area						
Wave 8	Urban Area	80.8	79.3	81.2	74.8	75.8
	Rural Area	19.2	20.7	18.8	25.2	24.2
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Urban Area	77.7	78.9	79.1	75.1	75.7
	Rural Area	22.3	21.1	20.9	24.9	24.3
	Total	100	100	100	100	100

Appendix table D:13 Characteristics of different types of smoker

Base: all respondents aged 16+		Data from Understanding Society, waves 8 and 9				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
Household smoking status						
Wave 8	Single household, no smoker	0	0	25.9	26.1	21.9
	Single household, smoker	32.6	34.9	0	0	5.5
	2 person household, all non smokers	0	0	43.6	46.3	38.9
	2 person household, all smokers	21.1	20.7	0	0	3.3
	2 person household, one non smoker	23.8	21.2	6.8	3.9	6.8
	>2 person household, all non smokers	0	0	17	18.4	15.5
	>2 person household, all smokers	3.6	4.7	0	0	0.7
	>2 person household, more non smokers than smokers	9.9	10.2	5.8	4.1	5.1
	>2 person household, more / same smokers than non smokers	9	8.3	0.9	1.1	2.2
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Wave 9	Single household, no smoker	0	0	25.2	27	22.9
	Single household, smoker	34.6	35.9	0	0	5.3
	2 person household, all non smokers	0	0	45.3	45.2	38.5
	2 person household, all smokers	18.7	19	0	0	2.8
	2 person household, one non smoker	20.4	20.8	6.3	3.4	6.1
	>2 person household, all non smokers	0	0	15.8	19.4	16.4
	>2 person household, all smokers	1.9	3.9	0	0	0.5
	>2 person household, more non smokers than smokers	12.9	10.1	5.9	3.8	4.9

Appendix table D:13 Characteristics of different types of smoker						
Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
	>2 person household, more / same smokers than non smokers	11.5	10.2	1.5	1.2	2.6
	Total	100	100	100	100	100
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*884*	*884*	*884*	*884*
	Wave 9	*764*	*764*	*764*	*764*	*764*
Household smoking/vaping status		%	%	%	%	%
Wave 8	Single household, no smoker or vaper	0	0	25.9	25.8	21.7
	Single household, smoker or vaper	32.6	34.9	0	0.2	5.7
	2 person household, all non smokers or vaper	0	0	42.7	45.7	38.4
	2 person household, all smokers or vaper	21.2	21	0	0.1	3.4
	2 person household, one non smoker or vaper	23.7	20.9	7.8	4.5	7.3
	>2 person household, all non smokers or vaper	0	0	16.8	18	15.1
	>2 person household, all smokers or vaper	3.6	4.9	0	0	0.8
	>2 pp, more non smokers / vapers than smokers / vapers	9.9	10	6	4.5	5.4
	>2 pp, more / same smokers / vapers than non smokers / vapers	9	8.3	0.9	1.2	2.3
	P-values	*P = 0.000*				
Wave 9	Single household, no smoker or vaper	0	0	0	27	22
	Single household, smoker or vaper	34.6	35.9	25.2	0	6.2
	2 person household, all non smokers or vaper	0	0	0	43.9	35.8
	2 person household, all smokers or vaper	22	20.2	21.1	0	3.8
	2 person household, one non smoker or vaper	17.1	19.6	30.5	4.7	7.8

Appendix table D:13 Characteristics of different types of smoker						
Base: all respondents aged 16+		*Data from Understanding Society, waves 8 and 9*				
		Smoking behaviour				
		Used e-cigarettes and smoked cigarettes	**Smoked cigarettes only**	**Used e-cigarettes only**	**Neither**	**Total**
		%	%	%	%	%
	>2 person household, all non smokers or vaper	0	0	0	18.4	15
	>2 person household, all smokers or vaper	3.1	4.4	5.1	0	0.8
	>2 pp, more non smokers / vapers than smokers / vapers	11.5	9.1	9.6	4.6	5.5
	>2 pp, more / same smokers / vapers than non smokers / vapers	11.7	10.7	8.6	1.5	3.1
	P-values	*P = 0.000*				
Unweighted bases	*Wave 8*	*884*	*4625*	*1040*	*30993*	*37542*
	Wave 9	*764*	*3932*	*1187*	*28995*	*34878*
Usual number of cigarettes per day		%	%	%	%	%
Wave 8	<6	21.5	22.2	n/a	n/a	22.1
	6-10	31	33.1	n/a	n/a	32.7
	11-20	40.6	37.8	n/a	n/a	38.2
	>20	6.9	7	n/a	n/a	7
	Total	100	100	n/a	n/a	100
	P-values	*P = 0.657*				
Wave 9	<6	22.5	21.5	n/a	n/a	21.7
	6-10	33.5	33	n/a	n/a	33.1
	11-20	38.3	38.8	n/a	n/a	38.7
	>20	5.7	6.7	n/a	n/a	6.5
	Total	100	100	n/a	n/a	100
	P-values	*P = 0.863*				
Unweighted bases	*Wave 8*	*876*	*4582*	*n/a*	*n/a*	*5458*
	Wave 9	*760*	*3909*	*n/a*	*n/a*	*4669*

Appendix E. Tobacco control, social inequality and smoking in Europe: technical details

Appendix table E:1 Unweighted sample size by EU27 member states of Eurobarometer surveys used in analysis

Nation	Year				Total
	2006 (Wave 66.2)	2012 (Wave 77.1)	2014 (Wave 82.4)	2017 (Wave 87.1)	
France	1,022	1,059	1,009	1,004	4,094
Belgium	1,012	1,051	1,009	1,023	4,095
The Netherlands	1,069	1,014	1,019	1,015	4,117
Germany	1,551	1,552	1,572	1,537	6,212
Italy	1,005	1,036	1,010	1,022	4,073
Luxembourg	500	501	504	510	2,015
Denmark	1,060	1,019	1,024	1,000	4,103
Ireland	1,000	1,008	1,003	1,021	4,032
United Kingdom	1,375	1,331	1,312	1,346	5,364
Greece	1,000	999	1,008	1,010	4,017
Spain	1,026	1,004	1,011	1,024	4,065
Portugal	1,006	1,009	1,002	1,061	4,078
Finland	1,030	1,003	1,010	1,012	4,055
Sweden	1,006	1,016	1,029	1,007	4,058
Austria	1,013	1,031	1,044	1,001	4,089
Cyprus (Republic)	506	506	500	501	2,013
Czech Republic	1,072	1,003	1,044	1,058	4,177
Estonia	1,011	1,000	998	1,017	4,026
Hungary	1,001	1,021	1,057	1,053	4,132
Latvia	1,031	1,024	1,003	1,004	4,062
Lithuania	1,016	1,021	1,007	1,001	4,045
Malta	500	500	502	500	2,002
Poland	1,000	1,000	1,012	1,008	4,020
Slovakia	1,180	1,000	1,031	1,014	4,225
Slovenia	1,039	1,017	1,035	1,027	4,118
Bulgaria	1,027	1,006	1,003	1,044	4,080
Romania	1,026	1,020	1,034	1,033	4,113
Total	*27,084*	*26,751*	*26,792*	*26,853*	*107,480*

Appendix table E:2 Results of multivariate logistic regression predicting smoking behaviour in EU27 countries (continuous TCS scores and Gini coefficient)									
Variable	Categories	Coefficient	SE	t	p-value	Pr(>|t|)	OR	95% CI	
								2.50%	97.50%
(Intercept)		-0.64	0.30	-2.20	0.03	*	0.53	0.29	0.94
Wave	2005/06 (Ref)	**Wald test, P(> X2)**			**0.08**	.			
	2010/12	-0.65	0.44	-1.50	0.14		0.52	0.22	1.23
	2013/14	-1.04	0.46	-2.30	0.02	*	0.35	0.14	0.86
	2016/17	-0.96	0.47	-2.10	0.04	*	0.38	0.15	0.95
TCS Total Score		0.00	0.00	-0.80	**0.42**		1.00	0.99	1.00
Gini coefficient		0.01	0.01	1.50	**0.15**		1.01	1.00	1.03
Whether UK	Other countries (Ref)	**Wald test, P(> X2)**			**0.62**				
	UK	0.08	0.16	0.50	0.62		1.08	0.79	1.48
Gender	Male (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	Female	-0.47	0.05	-9.00	<0.01	***	0.63	0.57	0.69
Age grouped	15 - 24 (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	25 - 39	0.25	0.07	3.50	0.00	***	1.28	1.12	1.46
	40 - 54	0.12	0.08	1.50	0.13		1.12	0.97	1.31
	55+	-0.82	0.08	-10.90	<0.01	***	0.44	0.38	0.51
Wave*TCS Total Score	2005/06:TCS (Ref)	**Wald test, P(> X2)**			**0.02**	*			
	2010/12:TCS	-0.01	0.01	-1.60	0.12		0.99	0.98	1.00

	2013/14:TCS	0.00	0.01	0.70	0.50		1.00	0.99	1.01
	2016/17:TCS	0.01	0.01	2.00	0.05	*	1.01	1.00	1.02
Wave*Gini	2005/06:Gini (Ref)	**Wald test, P(> X2)**			**0.26**				
	2010/12:Gini	0.02	0.01	1.90	0.05	.	1.02	1.00	1.05
	2013/14:Gini	0.01	0.01	1.10	0.25		1.01	0.99	1.04
	2016/17:Gini	0.01	0.01	0.70	0.50		1.01	0.98	1.03
Wave*Whether UK	2005/06:Other countries (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	2010/12:UK	0.09	0.24	0.40	0.70		1.10	0.68	1.77
	2013/14:UK	-0.41	0.23	-1.70	0.08	.	0.67	0.42	1.05
	2016/17:UK	-0.96	0.24	-3.90	<0.01	***	0.38	0.24	0.62
Wave*Gender	2005/06:Male (Ref)	**Wald test, P(> X2)**			**0.75**				
	2010/12:Female	0.06	0.07	0.80	0.44		1.06	0.92	1.22
	2013/14:Female	0.04	0.07	0.50	0.59		1.04	0.90	1.21
	2016/17:Female	0.08	0.07	1.10	0.29		1.08	0.94	1.25
Wave*Age (grouped)	2005/06:15-24 (Ref)	**Wald test, P(> X2)**			**<0.01**	***			

	2010/12:25-39	0.12	0.10	1.20	0.23		1.13	0.93	1.38
	2013/14:25-39	0.12	0.10	1.10	0.26		1.12	0.92	1.37
	2016/17:25-39	-0.14	0.10	-1.30	0.18		0.87	0.71	1.07
	2010/12:40-54	0.16	0.11	1.40	0.15		1.18	0.94	1.47
	2013/14:40-54	0.28	0.11	2.60	0.01	**	1.33	1.07	1.64
	2016/17:40-54	-0.04	0.12	-0.40	0.72		0.96	0.76	1.21
	2010/12:55 +	0.15	0.11	1.40	0.17		1.16	0.94	1.43
	2013/14:55 +	0.35	0.11	3.10	<0.01	**	1.42	1.13	1.78
	2016/17:55 +	0.20	0.12	1.70	0.09	.	1.22	0.97	1.53
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1									

Appendix table E:3 Results of multivariate logistic regression predicting smoking behaviour in 27 EU countries (categorical TCS scores and Gini coefficient)

Variable	Categories	Coefficient	SE	t	p-value	Pr(>|t|)	OR	95%CI of OR	
								2.50%	97.50%
(Intercept)		-0.45	0.08	-5.40	<0.01	***	0.63	0.54	0.75
Wave	2005/06 (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	2010/12	-0.29	0.11	-2.70	0.01	**	0.75	0.61	0.93
	2013/14	-0.51	0.13	-3.80	<0.01	***	0.60	0.46	0.78
	2016/17	-0.17	0.14	-1.20	0.24		0.85	0.64	1.12
TCS Total Score	<44 (Ref)	**Wald test, P(> X2)**			**0.63**				
	44-53	0.01	0.07	0.10	0.89		1.01	0.88	1.15
	>54	-0.06	0.08	-0.80	0.45		0.94	0.81	1.10
Gini coefficient	>29.50 (Ref)	**Wald test, P(> X2)**			**0.16**				
	29.50-32.70	0.13	0.08	1.70	0.09	.	1.14	0.98	1.32
	>32.70	0.10	0.08	1.30	0.21		1.11	0.94	1.30
Whether UK	Other countries (Ref)	**Wald test, P(> X2)**			**0.72**				
	UK	0.06	0.16	0.40	0.72		1.06	0.77	1.45
Gender	Male (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	Female	-0.47	0.05	-9.00	<0.01	***	0.63	0.57	0.69
Age grouped	15 - 24 (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	25 - 39	0.24	0.07	3.50	<0.01	***	1.28	1.11	1.46
	40 - 54	0.12	0.08	1.50	0.14		1.12	0.96	1.31
	55+	-0.83	0.08	-10.90	<0.01	***	0.44	0.38	0.51

Wave*TCS Total Score	2005/06:TCS <44 (Ref)	**Wald test, P(> X2)**			**<0.01**	**			
	2010/12:TCS 44-53	-0.24	0.09	-2.50	0.01	*	0.79	0.65	0.95
	2013/14:TCS 44-53	-0.19	0.12	-1.60	0.11		0.83	0.66	1.04
	2016/17:TCS 44-53	-0.15	0.12	-1.30	0.19		0.86	0.68	1.08
	2010/12:TCS >54	-0.01	0.14	-0.10	0.95		0.99	0.75	1.30
	2013/14:TCS >54	0.16	0.11	1.40	0.16		1.17	0.94	1.45
	2016/17:TCS >54	0.23	0.12	1.90	0.06	.	1.26	0.99	1.61
Wave*Gini coefficient	2005/06:Gini >29.50 (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	2010/12:Gini 29.50-32.70	-0.02	0.11	-0.20	0.87		0.98	0.79	1.22
	2013/14:Gini 29.50-32.70	0.06	0.13	0.50	0.62		1.06	0.83	1.36
	2016/17:Gini 29.50-32.70	-0.11	0.12	-0.90	0.36		0.89	0.70	1.14
	2010/12:Gini >32.70	0.26	0.11	2.30	0.02	*	1.30	1.04	1.62
	2013/14:Gini >32.70	0.05	0.12	0.40	0.67		1.05	0.83	1.33
	2016/17:Gini >32.70	-0.08	0.11	-0.70	0.46		0.92	0.74	1.15
Wave*Whether UK	2005/06:Other countries (Ref)	**Wald test, P(> X2)**			**<0.01**	**			
	2010/12:UK	-0.40	0.23	-1.80	0.08	.	0.67	0.43	1.05
	2013/14:UK	-0.54	0.21	-2.60	0.01	*	0.58	0.39	0.88
	2016/17:UK	-0.85	0.23	-3.70	<0.01	***	0.43	0.27	0.67
Wave*Gender	2005/06:Male (Ref)	**Wald test, P(> X2)**			**0.76**				
	2010/12:Female	0.06	0.07	0.70	0.46		1.06	0.91	1.22
	2013/14:Female	0.04	0.07	0.50	0.60		1.04	0.90	1.20
	2016/17:Female	0.08	0.07	1.10	0.29		1.08	0.93	1.25

Wave*Age (grouped)	2005/06:15-24 (Ref)	**Wald test, P(> X2)**			**<0.01**	***			
	2010/12:25-39	0.13	0.10	1.30	0.21		1.14	0.93	1.38
	2013/14:25-39	0.12	0.10	1.20	0.23		1.13	0.93	1.38
	2016/17:25-39	-0.14	0.10	-1.30	0.19		0.87	0.71	1.07
	2010/12:40-54	0.17	0.11	1.50	0.12		1.19	0.95	1.49
	2013/14:40-54	0.29	0.11	2.70	0.01	**	1.34	1.08	1.65
	2016/17:40-54	-0.04	0.12	-0.40	0.72		0.96	0.76	1.21
	2010/12:55+	0.16	0.11	1.50	0.14		1.17	0.95	1.45
	2013/14:55+	0.36	0.12	3.10	<0.01	**	1.43	1.14	1.79
	2016/17:55+	0.20	0.12	1.70	0.08	.	1.22	0.97	1.54
Significance codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1									

Appendix F. REA: Search strategies

1. Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations and Daily <1946 to October 15, 2019> Searched 16th October 2019

1 Electronic Nicotine Delivery Systems/ (2682)
2 "tobacco use cessation devices"/ (1666)
3 Vaping/ (456)
4 ((electr* adj1 (cig* or nicotine)) or e-cig* or vaping or vape or vapes or juul or juuling).ti,ab,kw. (4578)
5 or/1-4 (6168)
6 austria/ or belgium/ or estonia/ or latvia/ or lithuania/ or bulgaria/ or croatia/ or czech republic/ or hungary/ or poland/ or romania/ or slovakia/ or slovenia/ or exp france/ or exp germany/ or exp united kingdom/ or greece/ or ireland/ or exp italy/ or luxembourg/ or malta/ or cyprus/ or netherlands/ or portugal/ or exp denmark/ or finland/ or sweden/ or norway/ or spain/ or switzerland/ or exp united states/ or exp canada/ or exp australia/ or new zealand/ (2732550)
7 ("great britain" or "united kingdom" or UK or "northern ireland" or scotland or "channel islands" or "isle of man" or wales or england or austria or belgium or estonia or latvia or lithuania or bulgaria or croatia or "czech republic" or hungary or poland or romania or slovakia or "slovak republic" or slovenia or france or germany or greece or ireland or eire or italy or luxembourg or malta or cyprus or netherlands or portugal or denmark or finland or sweden or norway or spain or switzerland or "united states" or usa or canada or australia or "new zealand").ti,ab,kw. (1143843)
8 6 or 7 (3217121)
9 5 and 8 (2134)
10 limit 9 to (english language and yr="2009 -Current") (**2011**)

2. Embase (Ovid) <1980 to 2019 Week 41>Searched 16th October 2019

1 electronic cigarette/ (5281)
2 vaping/ (1119)
3 ((electr* adj1 (cig* or nicotine)) or e-cig* or vaping or vape or vapes or juul or juuling).ti,ab,kw. (5779)
4 or/1-3 (6452)
5 austria/ or belgium/ or estonia/ or latvia/ or lithuania/ or bulgaria/ or croatia/ or czech republic/ or hungary/ or poland/ or romania/ or slovakia/ or slovenia/ or exp france/ or exp germany/ or exp united kingdom/ or greece/ or ireland/ or exp italy/ or luxembourg/ or malta/ or cyprus/ or netherlands/ or portugal/ or exp denmark/ or finland/ or sweden/ or norway/ or spain/ or switzerland/ or exp united states/ or exp canada/ or exp australia/ or new zealand/ (2649511)
6 ("great britain" or "united kingdom" or UK or "northern ireland" or scotland or "channel islands" or "isle of man" or wales or england or austria or belgium or estonia or latvia or lithuania or bulgaria or croatia or "czech republic" or hungary or poland or romania or slovakia or "slovak republic" or slovenia or france or germany or greece or ireland or eire or italy or luxembourg or malta or cyprus or netherlands or portugal or denmark or finland or sweden or norway or spain or switzerland or "united states" or usa or canada or australia or "new zealand").ti,ab,kw. (1775151)
7 5 or 6 (3414989)
8 4 and 7 (2174)
9 limit 8 to (english language and yr="2009 -Current") (2115)
10 limit 9 to embase (**1191**)

3. Cochrane Library – Searched 16th October 2019

#1	MeSH descriptor: [Electronic Nicotine Delivery Systems] this term only	84
#2	MeSH descriptor: [Tobacco Use Cessation Devices] this term only	449
#3	MeSH descriptor: [Vaping] this term only	16
#4	((electr* adj1 (cig* or nicotine)) or e-cig* or vaping or vape or juul or juuling):ti,ab,kw	406
#5	#1 or #2 or #3 or #4	858
#6	("great britain" or "united kingdom" or UK or "northern ireland" or scotland or "channel islands" or "isle of man" or wales or england or austria or belgium or estonia or latvia or lithuania or bulgaria or croatia or "czech republic" or hungary or poland or romania or slovakia or "slovak republic" or slovenia or france or germany or greece or ireland or eire or italy or luxembourg or malta or netherlands or portugal or denmark or finland or sweden or norway or spain or switzerland or "united states" or usa or canada or australia or "new zealand"):ti,ab,kw	145090
#7	[mh ^austria] or [mh ^belgium] or [mh ^estonia] or [mh ^latvia] or [mh ^lithuania] or [mh ^bulgaria] or [mh ^croatia] or [mh ^"czech republic"] or [mh ^hungary] or [mh ^poland] or [mh ^romania] or [mh ^slovakia] or [mh ^slovenia] or [mh france] or [mh germany] or [mh "united kingdom"] or [mh ^greece] or [mh ^ireland] or [mh italy] or [mh ^luxembourg] or [mh ^malta] or [mh ^netherlands] or [mh ^portugal] or [mh denmark] or [mh ^finland] or [mh ^sweden] or [mh ^norway] or [mh ^spain] or [mh ^switzerland] or [mh "united states"] or [mh canada] or [mh australia] or [mh ^"new zealand"]	49991
#8	#6 or #7	155194
#9	#5 and #8 with Cochrane Library publication date Between Jan 2009 and Oct 2019	**204**

4. Epistemonikos – Searched 16th October 2019

(title:((title:(((electr* W/1 (cig* OR nicotine)) OR e-cig* OR vaping OR vape OR juul OR juuling)) OR abstract:(((electr* W/1 (cig* OR nicotine)) OR e-cig* OR vaping OR vape OR juul OR juuling))) AND (title:(("great britain" OR "united kingdom" OR uk OR "northern ireland" OR scotland OR "channel islands" OR "isle of man" OR wales OR england OR austria OR belgium OR estonia OR latvia OR lithuania OR bulgaria OR croatia OR "czech republic" OR hungary OR poland OR romania OR slovakia OR "slovak republic" OR slovenia OR france OR germany OR greece OR ireland OR eire OR italy OR luxembourg OR malta OR Cyprus OR netherlands OR portugal OR denmark OR finland OR sweden OR norway OR spain OR Switzerland OR "united states" OR USA OR Canada OR Australia OR "New Zealand")) OR abstract:(("great britain" OR "united kingdom" OR uk OR "northern ireland" OR scotland OR "channel islands" OR "isle of man" OR wales OR england OR austria OR belgium OR estonia OR latvia OR lithuania OR bulgaria OR croatia OR "czech republic" OR hungary OR poland OR romania OR slovakia OR "slovak republic" OR slovenia OR france OR germany OR greece OR ireland OR eire OR italy OR luxembourg OR malta OR Cyprus OR netherlands OR portugal OR denmark OR finland OR sweden OR norway OR spain OR Switzerland OR "united states" OR USA OR Canada OR Australia OR "New Zealand")))) – **71**

5. Scopus – Searched 16th October 2019

(TITLE-ABS-KEY ((electr* W/1 (cig* OR nicotine)) OR e-cig* OR vaping OR vape OR vapes OR juul OR juuling)) AND (TITLE-ABS-KEY ("great britain" OR "united kingdom" OR uk OR "northern ireland" OR scotland OR "channel islands" OR "isle of man" OR wales OR england OR austria OR belgium OR estonia OR latvia OR lithuania OR bulgaria OR croatia OR "czech republic" OR hungary OR poland OR romania OR slovakia OR "slovak republic" OR slovenia OR france OR germany OR greece OR ireland OR eire OR italy OR luxembourg OR malta OR cyprus OR netherlands OR portugal OR denmark OR finland OR sweden OR norway OR spain OR switzerland OR "united states" OR usa OR canada OR australia OR "new zealand")) AND (LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009)) AND (LIMIT-TO (LANGUAGE , "English")) - **2130**

Appendix G. REA: Grey literature search record

Website	Search page URL(s)	Screening start date	Search terms	Number of returned hits	Number of included results
Name of website	*Add URLs of the actual pages in which searches were undertaken*	*In format dd/mm/yyyy*	*For example, "tobac", then separately "smok"*	*Total number of hits screened (record how many search results there were overall, only screen first 200)*	*Total number of studies included at title and abstract*
Open-Grey	http://www.opengrey.eu/	01/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "e-cigs" separately "vaping" separately "vape" separately "electronic nicotine delivery systems"	2	0
Action on smoking and health	https://ash.org.uk/home/	01/11/2019	"e-cigarettes" separately "elecetronic cigaretes" separately "vaping" separately "vape" sepraretly "electronic niccotine delivery systems"	1,100	2
Smoke free action coalition	http://smokefreeaction.org.uk/	01/11/2019	"e-cigarettes"	18	0
The office of Natiional statistics	https://www.ons.gov.uk/	01/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	15	5
The European Observatory	http://www.euro.who.int/en/about-us/partners/observatory	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	0	0
NICE	https://www.nice.org.uk	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	25	0
NHS Digital	https://digital.nhs.uk/	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	17	7
Gov.uk	https://www.gov.uk/	07/11/2019		19,271	
itc project	https://itcproject.org/	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	1,120	3
uk e-cigarette Research forum	https://www.cancerresearchuk.org/about-us/we-develop-policy/our-policy-on-preventing-cancer/our-policy-on-tobacco-control-and-cancer/uk-e-cigarette-research-forum	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	0	0
Centers for disease control and prevention	https://www.cdc.gov/	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	267	13
Society for research on nicotine and tobacco	https://www.srnt.org/default.aspx	07/11/2019		18	0
Smoking toolkit	https://www.ucl.ac.uk/pals/research/clinical-educational-and-health-psychology/research-groups/health-psychology-research-49	07/11/2019		3	0
WHO regional office for europe	https://www.who.int/about/regions/euro/en/	07/11/2019	"e-cigarettes" separately "electronic cigarettes" separately "Vaping" separately "vape" separately "electronic nicotine delivery system" separately "e-cigs"	141	0

Appendix H. REA: E-cigarettes title and abstract screening: inclusion and exclusion criteria

P11962 Title and Abstract Screening tool	
Must answer "Yes" to criteria from options 1, 2 and 3	
1. Study based in one or more of the following countries:	- Australia - Austria - Belgium - Bulgaria - Canada - Croatia - Cyprus - Czech Republic - Denmark - Estonia - Finland - France - Germany - Greece - Hungary - Ireland - Italy - Latvia - Lithuania - Luxembourg - Malta - Netherlands - New Zealand - Norway - Poland - Portugal - Romania - Slovakia - Slovenia - Spain - Sweden - Switzerland - United Kingdom - United States
2. Article describes or reports on the following products:	- E-cigarettes - Electronic Nicotine Delivery Systems - Vape devices / vapes - Juul **Studies should not *only* refer to tobacco products such as cigarettes. If tobacco products are included as comparison, the study can be included.**

3. Article includes one of the following study types:	- Systematic reviews - Randomised controlled trials in real-world settings that have explored e-cigarettes, electronic nicotine delivery systems, vape devices/ vapes and/ or Juul; **<u>or</u>** Randomised controlled trials that have **explored the impact of health campaigns to reduce consumption**. - Quasi-experimental studies (including cohort studies and pragmatic trials) - Case studies - Observational studies - Representative population surveys - Qualitative research
Must answer "Yes" to at least one option from options 3-8	
4. Article identifies the consumers of e-cigarettes with reference to following demographics:	- Age - Sex/gender - Level of deprivation/ inequality - Race or ethnicity - Nationality - Family status (married/unmarried, children/no children) - Socioeconomic - Sexual orientation - Location (urban/rural/suburban) - Faith - Immigration/citizenship status - Education status **If demographic characteristics not included above are referenced in the article, please flag as 'maybe' and we will review.**
5. Article discusses health campaigns in relation to consumption of e-cigarettes	This can include public health advertising campaigns, including social media/online campaigns, and campaigns via health professionals (GPs, at hospitals, etc). This should **not** include marketing campaigns or stop smoking cessations tested under lab-based RCT conditions. **If you are unsure of whether the campaign is a marketing campaign or an RCT, please flag as 'maybe' and we will review.**
6. Article discusses international or national policy in relation to consumption of e-cigarettes	National policy should be at a national or country-wide level. International policy includes political blocs such as the EU and North America. This should not include - State-wide policy - City-wide policy - Workplace, NHS trust or other local policy **If you are unsure, please flag as 'maybe' and we will review.**

7.	**Article discusses rates of consumption of e-cigarettes**	Key indicators of consumption include: - Financial: different rates of spend - Nicotine consumption by mg - Frequency of pick-up **If you are unsure of whether the measure included counts as a 'rate of consumption', please flag as 'maybe' and we will review.**
8.	**Article discussed rates of consumption by duration of use of e-cigarettes**	Duration of use by time (days/weeks/months/years) **If you are unsure, please flag as 'maybe' and we will review.**
9.	**Article discusses rates of consumption by type of smoker**	Key groups included: - Never tobacco cigarette smokers - Dual-users - Former tobacco cigarette smokers **If you are unsure, please flag as 'maybe' and we will review.**

Appendix I. REA: Substantive full text screening criteria

Criterion	Score
Article identifies the consumers of e-cigarettes with reference to age	Yes = 1; No = 0
Article identifies the consumers of e-cigarettes with reference to sex/gender and/or sexual orientation	Yes = 1; No = 0
Article identifies the consumers of e-cigarettes with reference to socioeconomic status (including level of deprivation/ inequality, class, income or education status)	Yes = 1; No = 0
Article identifies the consumers of e-cigarettes with reference to nationality, immigration/ citizenship status, race or ethnicity and/or faith	Yes = 1; No = 0
Article identifies the consumers of e-cigarettes with reference to factors related to the family (e.g. marital status, relationship status, living arrangements, smoking status of family members)	Yes = 1; No = 0
Article identifies the consumers of e-cigarettes with reference to area location (e.g. urban/rural/suburban)	Yes = 1; No = 0
Article identifies the consumers of e-cigarettes with reference to health status (including mental health and physical long term health conditions, and pregnancy)	Yes = 1; No = 0
Article considers whether specific health campaigns may have driven any changes in consumption patterns	Yes = 1; No = 0
Article considers whether specific national or international policies/policy changes may have driven any changes in consumption patterns	Yes to either = 1; No = 0
Article considers whether both national and international policies/policy changes may have driven any changes in consumption patterns	Yes = 1; No = 0
Article compares the potential impact of policies or health campaigns in multiple countries	Yes = 1; No = 0
Article considers consumption rates by type of e-cigarette used	Yes = 1; No = 0
Article compares consumption rates of e-cigarette users over time, including before they started using e-cigarettes if they were tobacco smokers (longitudinal)	Yes = 3; No = 0
Article compares consumption rates of users who have been consuming e-cigarettes for different durations (cross-section)	Yes = 1; No = 0
Article compares consumption rates of different smoker types (former tobacco smokers, never-tobacco smokers, dual users) (cross-section)	Yes = 1; No = 0
Article compares consumption rates of current consumers of e-cigarettes and consumers of tobacco cigarettes (cross-section)	Yes = 1; No = 0

Appendix J. REA: Weight of evidence screening tool

Weight of Evidence criterion	Score
Is there a clear statement of the aims and objectives and/or clear research questions?	Yes = 1; No = 0
Do the study authors justify their sampling strategy (or data selection strategy if not collecting primary data) as representative and/or appropriate for the research questions/aims?	Yes = 1; No = 0
Is the method of data collection clearly described and justified by the researchers as being appropriate to answer the aims/research questions?	Yes = 1; No = 0
Do the researchers identify ethical issues involved in the study design and explain steps to address these?	Yes = 1; No = 0
Is the paper or research team explicit about sources of funding for the project?	Yes and it's tobacco=1; Yes and non-tobacco=2; No=0
Are the methods for data analysis justified as being appropriate for the aims/objectives and/or research questions?	Yes = 1; No = 0
Are there any concerns regarding accuracy (e.g. discrepancies within the report)?	Yes = 0; No = 1
Is sufficient data/ evidence presented to support the conclusions?	Yes = 1; No = 0
Is there a critical discussion of the findings which makes caveats/ limitations clear?	Yes = 1; No = 0
Do the conclusions address the aims and objectives/ research questions (as stated)?	Yes = 1; No = 0
Is the intensity/frequency of vaping or e-cigarette smoking quantifiable?	Yes=1; No=0

Appendix K. REA: Data extraction template

Headings for data extraction
Short summary of key findings
Sample size and comment as to whether nationally representative
Age of e-cigarette consumers*
Sex/gender and/or sexual orientation of e-cigarette consumers*
Socioeconomic status of e-cigarette consumers*
Nationality, immigration or citizenship status of e-cigarette consumers*
Race, ethnicity or faith of e-cigarette consumers*
Family-related factors of e-cigarette consumers (e.g. relationship status, living arrangements, smoking status of family members)*
Location of e-cigarette consumers (e.g. rural or urban)*
Health status of e-cigarette consumers*
Health campaigns or policies (national or international) discussed in article
Article findings on the impact of the campaign(s)/policy/ies on consumption patterns**
Any further comments on drivers of consumption patterns (not already captured in U2:AD2)
How did consumption rates** compare between users of different types of e-cigarettes?
How did consumption rates** compare between users of e-cigarettes and users of tobacco cigarettes?
How did consumption rates** compare between different types of e-cigarette user (i.e., former tobacco smoker, never smoker & dual user)?
How did consumption rates** of e-cigarette users change over time (including before they started smoking e-cigarettes, if they were tobacco smokers)?
Any further findings about consumption rates** (not covered by AF2:AI2)
Any further comments/notes

Appendix L. List of papers included in the REA

Agaku IT, Davis K, Patel D, Shafer P, Cox S, Ridgeway W, et al. A longitudinal study of the relationship between receptivity to e-cigarette advertisements and e-cigarette use among baseline non-users of cigarettes and e-cigarettes, United States. Tob Induc Dis. 2017;15(1):42.

Aleyan S, Cole A, Qian W, Leatherdale ST. Risky business: a longitudinal study examining cigarette smoking initiation among susceptible and non-susceptible e-cigarette users in Canada. BMJ Open. 2018;8(5):e021080.

Aleyan S, East K, McNeill A, Cummings KM, Fong GT, Yong H, et al. Differences in norms towards the use of nicotine vaping products among adult smokers, former smokers and nicotine vaping product users: cross-sectional findings from the 2016 ITC Four Country Smoking and Vaping Survey. Addiction. 2019;114(S1):97–106.

Antwi GO, Lohrmann DK, Jayawardene W, Chow A, Obeng CS, Sayegh AM. Associations between e-cigarette and combustible cigarette use among U.S. cancer survivors: implications for research and practice. J Cancer Surviv. 2019;13(2):316–25.

Atuegwu NC, Perez MF, Oncken C, Thacker S, Mead EL, Mortensen EM. Association between regular electronic nicotine product use and self-reported periodontal disease status: Population Assessment of Tobacco and Health Survey. Int J Environ Res Public Health. 2019;16(7):e1263.

Auf R, Trepka MJ, Selim M, Ben Taleb Z, De La Rosa M, Bastida E, et al. E-cigarette use is associated with other tobacco use among US adolescents. Int J Public Health. 2019;64(1):125–34.

Azagba S, Wolfson M. E-cigarette use and quantity of cigarette smoking among adolescent cigarette smokers: a finite mixture model analysis. Drug Alcohol Depend. 2018;185:33–9.

Benmarhnia T, Pierce JP, Leas E, White MM, Strong DR, Noble ML, et al. Can e-cigarettes and pharmaceutical aids increase smoking cessation and reduce cigarette consumption? Findings from a nationally representative cohort of American smokers. Am J Epidemiol. 2018;187(11):2397–404.

Best C, Haseen F, van der Sluijs W, Ozakinci G, Currie D, Eadie D, et al. Relationship between e-cigarette point of sale recall and e-cigarette use in secondary school children: a cross-sectional study. BMC Public Health. 2016;16(1):310–8.

Bowler RP, Hansel NN, Jacobson S, Graham Barr R, Make BJ, Han MK, et al. Electronic cigarette use in US adults at risk for or with COPD: analysis from two observational cohorts. J Gen Intern Med. 2017;32(12):1315–22.

Brose LS, Hitchman SC, Brown J, West R, McNeill A. Is the use of electronic cigarettes while smoking associated with smoking cessation attempts, cessation and reduced cigarette consumption? A survey with a 1-year follow-up. Addiction. 2015;110(7):1160–8.

Chan G, Leung J, Gartner C, Yong H-H, Borland R, Hall W. Correlates of electronic cigarette use in the general population and among smokers in Australia – findings from a nationally representative survey. Addict Behav. 2019;95:6–10. (2019a)

Chan G, Morphett K, Gartner C, Leung J, Yong H, Hall W, et al. Predicting vaping uptake, vaping frequency and ongoing vaping among daily smokers using longitudinal data from the International Tobacco Control (ITC) Four Country Surveys. Addiction. 2019;114(S1):61–70. (2019b)

Cho B-Y, Seo D-C, Lin H-C, Lohrmann DK, Chomistek AK, Hendricks PS, et al. Adolescent weight and electronic vapor product use: comparing BMI-based with perceived weight status. Am J Prev Med. 2018;55(4):541–50.

Chou SP, Saha TD, Zhang H, Ruan WJ, Huang B, Grant BF, et al. Prevalence, correlates, comorbidity and treatment of electronic nicotine delivery system use in the United States. Drug Alcohol Depend. 2017;178:296–301.

Coleman BN, Rostron B, Johnson SE, Ambrose BK, Pearson J, Stanton CA, et al. Electronic cigarette use among US adults in the Population Assessment of Tobacco and Health (PATH) Study, 2013–2014. Tob Control. 2017;26(e2):e117–26.

Coleman B, Rostron B, Johnson SE, Persoskie A, Pearson J, Stanton C, et al. Transitions in electronic cigarette use among adults in the Population Assessment of Tobacco and Health (PATH) Study, Waves 1 and 2 (2013–2015). Tob Control. 2019;28(1):50–9.

Conner M, Grogan S, Simms-Ellis R, Flett K, Sykes-Muskett B, Cowap L, et al. Do electronic cigarettes increase cigarette smoking in UK adolescents? Evidence from a 12-month prospective study. Tob Control. 2018;27(4):365–72.

Conner M, Grogan S, Simms-Ellis R, Scholtens K, Sykes-Muskett B, Cowap L, et al. Patterns and predictors of e-cigarette, cigarette and dual use uptake in UK adolescents: evidence from a 24-month prospective study. Addiction. 2019;114:2048–55.

Deshpande M, Bromann S, Arnoldi J. Electronic cigarette use among adults with asthma: 2014-2017 National Health Interview Survey. Res Social Adm Pharm. 2020;16(2):202–7.

East K, Hitchman SC, Bakolis I, Williams S, Cheeseman H, Arnott D, et al. The association between smoking and electronic cigarette use in a cohort of young people. J Adolesc Health. 2018;62(5):539–47.

El-Khoury F, Bolze C, Gomajee R, White V, Melchior M. Lower smoking rates and increased perceived harm of cigarettes among French adults one year after comprehensive tobacco control measures. Drug Alcohol Depend. 2019;201:65–70.

Farsalinos K, Siakas G, Poulas K, Voudris V, Merakou K, Barbouni A. E-cigarette use is strongly associated with recent smoking cessation: an analysis of a representative population sample in Greece. Intern Emerg Med. 2019;14(6):835–42.

Friedman AS, Horn SJL. Socioeconomic disparities in electronic cigarette use and transitions from smoking. Nicotine Tob Res. 2019;21(10):1363–70.

Hanewinkel R, Isensee B. Risk factors for e-cigarette, conventional cigarette, and dual use in German adolescents: a cohort study. Prev Med. 2015;74:59–62.

Heckman BW, Fong GT, Borland R, Hitchman S, O'Connor RJ, Bickel WK, et al. The impact of vaping and regulatory environment on cigarette demand: behavioral economic perspective across four countries. Addiction. 2019;114(S1):123–33.

Hoffman L, Delahanty J, Johnson SE, Zhao X. Sexual and gender minority cigarette smoking disparities: an analysis of 2016 Behavioral Risk Factor Surveillance System data. Prev Med. 2018;113:109–15.

Jaber RM, Mirbolouk M, DeFilippis AP, Maziak W, Keith R, Payne T, et al. Electronic cigarette use prevalence, associated factors, and pattern by cigarette smoking status in the United States from NHANES (National Health and Nutrition Examination Survey) 2013-2014. J Am Heart Assoc. 2018;7(14):e008178.

Jackson SE, Hill E, Shahab L, Beard E, Michie S, Brown J. Prevalence and correlates of long-term e-cigarette and nicotine replacement therapy use: a prospective study in England. BMJ Open. 2019;9(10):e029252. (2019a)

Jackson SE, Shahab L, Kock L, West R, Brown J. Expenditure on smoking and alternative nicotine delivery products: a population survey in England. Addiction. 2019;114(11):2026–36. (2019b)

Johnson AL, Collins LK, Villanti AC, Pearson JL, Niaura RS. Patterns of nicotine and tobacco product use in youth and young adults in the United States, 2011–2015. Nicotine Tob Res. 2018;20(suppl_1):S48–54.

Kotz D, Böckmann M, Kastaun S. The use of tobacco, e-cigarettes, and methods to quit smoking in Germany: a representative study using 6 waves of data over 12 months (the DEBRA Study). Dtsch Arztebl Int. 2018;115(14):235–42.

Kyriakos CN, Filippidis FT, Hitchman S, Girvalaki C, Tzavara C, Demjén T, et al. Characteristics and correlates of electronic cigarette product attributes and undesirable events during e-cigarette use in six countries of the EUREST-PLUS ITC Europe Surveys. Tob Induc Dis. 2018;16(2):1.

Laverty AA, Filippidis FT, Vardavas CI. Patterns, trends and determinants of e-cigarette use in 28 European Union Member States 2014–2017. Prev Med. 2018;116:13–8.

Lee C, Yong H-H, Borland R, McNeill A, Hitchman SC. Acceptance and patterns of personal vaporizer use in Australia and the United Kingdom: results from the International Tobacco Control survey. Drug Alcohol Depend. 2018;185:142–8.

Levy DT, Yuan Z, Li Y, Yameng Li, David Levy, Zhe Yuan. The prevalence and characteristics of e-cigarette users in the U.S. Int J Environ Res Public Health. 2017;14(10):e1200.

Levy DT, Yuan Z, Luo Y, Abrams DB. The relationship of e-cigarette use to cigarette quit attempts and cessation: insights from a large, nationally representative U.S. survey. Nicotine Tob Res. 2018;20(8):931–9.

Lippert AM. Association between school-level prevalence of electronic cigarette use and student-level use behaviors, pre-use intentions, and risk perceptions: evidence from the 2014 US National Youth Tobacco Survey. Nicotine Tob Res. 2018;20(2):231–8.

Liu G, Wasserman E, Kong L, Foulds J. A comparison of nicotine dependence among exclusive e-cigarette and cigarette users in the PATH study. Prev Med. 2017;104:86–91.

Lopez AA, Redner R, Kurti AN, Keith DR, Villanti AC, Stanton CA, et al. Tobacco and nicotine delivery product use in a U.S. national sample of women of reproductive age. Prev Med. 2018;117:61–8.

Lucherini M, Rooke C, Amos A. 'They're thinking, well it's not as bad, I probably won't get addicted to that. But it's still got the nicotine in it, so…': maturity, control, and socializing: negotiating identities in relation to smoking and vaping - a qualitative study of young adults in Scotland. Nicotine Tob Res. 2019;21(1):81–7.

Mehra VM, Keethakumar A, Bohr YM, Abdullah P, Tamim H. The association between alcohol, marijuana, illegal drug use and current use of e-cigarette among youth and young adults in Canada: results from Canadian Tobacco, Alcohol and Drugs Survey 2017. BMC Public Health. 2019;19(1):1208–10.

Melka A, Chojenta C, Holliday E, Loxton D. Adverse childhood experiences and electronic cigarette use among young Australian women. Prev Med. 2019;126:1057-59.

Merianos AL, Jandarov RA, Klein JD, Mahabee-Gittens EM. Characteristics of daily e-cigarette use and acquisition means among a national sample of adolescents. Am J Health Promot. 2019;33(8):1115–22.

Merianos AL, Mancuso TF, Gordon JS, Wood KJ, Cimperman KA, Mahabee-Gittens EM. Dual- and polytobacco/nicotine product use trends in a national sample of high school students. Am J Health Promot. 2018;32(5):1280–90.

Miech R, Patrick ME, O'Malley PM, Johnston LD. What are kids vaping? Results from a national survey of US adolescents. Tob Control. 2017;26(4):386–91.
Mirbolouk M, Charkhchi P, Kianoush S, Uddin SMI, Orimoloye OA, Jaber R, et al. Prevalence and distribution of e-cigarette use among U.S. adults: Behavioral Risk Factor Surveillance System, 2016. Ann Intern Med. 2018;169(7):429–38.

Montreuil A, MacDonald M, Asbridge M, Wild TC, Hammond D, Manske S, et al. Prevalence and correlates of electronic cigarette use among Canadian students: cross-sectional findings from the 2014/15 Canadian Student Tobacco, Alcohol and Drugs Survey. CMAJ Open. 2017;5(2):E460–7.

Nayak P, Pechacek TF, Weaver SR, Eriksen MP. Electronic nicotine delivery system dual use and intention to quit smoking: will the socioeconomic gap in smoking get greater? Addict Behav. 2016;61:112–6.

Noland M, Rayens MK, Wiggins AT, Huntington-Moskos L, Rayens EA, Howard T, et al. Current use of e-cigarettes and conventional cigarettes among US high school students in urban and rural locations: 2014 National Youth Tobacco Survey. Am J Health Promot. 2018;32(5):1239–47.

O'Connor RJ, Fix BV, McNeill A, Goniewicz ML, Bansal-Travers M, Heckman BW, et al. Characteristics of nicotine vaping products used by participants in the 2016 ITC Four Country Smoking and Vaping Survey. Addiction. 2019;114(S1):15–23.

Owens VL, Ha T, Soulakova JN. Widespread use of flavored e-cigarettes and hookah tobacco in the United States. Prev Med Rep. 2019;14:1008-54.

Park SH, Lee L, Shearston JA, Weitzman M. Patterns of electronic cigarette use and level of psychological distress. PLoS One. 2017;12(3):e0173625.

Patel D MPH, Davis KC MA, Cox S MSPH, Bradfield B BA, King BA PhD, Shafer P MA, et al. Reasons for current E -cigarette use among US adults. Prev Med. 2016;93:14–20.

Pechacek TF, Nayak P, Gregory KR, Weaver SR, Eriksen MP. The potential that electronic nicotine delivery systems can be a disruptive technology: results from a national survey. Nicotine Tob Res. 2016;18(10):1989–97.

Persoskie A, O'Brien EK, Poonai K. Perceived relative harm of using e-cigarettes predicts future product switching among US adult cigarette and e-cigarette dual users. Addiction. 2019;114(12):2197–205.

Popova L, Owusu D, Weaver SR, Kemp CB, Mertz CK, Pechacek TF, et al. Affect, risk perception, and the use of cigarettes and e-cigarettes: a population study of U.S. adults. BMC Public Health. 2018;18(1):395.

Primack BA, Shensa A, Sidani JE, Hoffman BL, Soneji S, Sargent JD, et al. Initiation of traditional cigarette smoking after electronic cigarette use among tobacco-naïve U.S. young adults. Am J Med. 2018;131(4):443.e1-443.e9.
Primack BA, Soneji S, Stoolmiller M, Fine MJ, Sargent JD. Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults. JAMA Pediatr. 2015;169(11):1018–23.

Roberts W, Moore KE, Peltier MR, Verplaetse TL, Oberleitner L, Hacker R, et al. Electronic cigarette use and risk of harmful alcohol consumption in the U.S. population. Alcohol Clin Exp Res. 2018;42(12):2385–93.

Robertson L, Hoek J, Blank M-L, Richards R, Ling P, Popova L. Dual use of electronic nicotine delivery systems (ENDS) and smoked tobacco: a qualitative analysis. Tob Control. 2019;28(1):13–9.

Ruokolainen O, Ollila H, Karjalainen K. Determinants of electronic cigarette use among Finnish adults: results from a population-based survey. Nordic Studies on Alcohol and Drugs. 2017;34(6):471–80.

Rutten LJF, Blake KD, Agunwamba AA, Grana RA, Wilson PM, Ebbert JO, et al. Use of e-cigarettes among current smokers: associations among reasons for use, quit intentions, and current tobacco use. Nicotine Tob Res. 2015;17(10):1228–34.

Shahab L, Goniewicz ML, Blount BC, Brown J, McNeill A, Alwis KU, et al. Nicotine, carcinogen, and toxin exposure in long-term e-cigarette and nicotine replacement therapy users: a cross-sectional study. Ann Intern Med. 2017;166(6):390–400.

Sharapova SR, Singh T, Agaku IT, Kennedy SM, King BA. Patterns of e-cigarette use frequency—National Adult Tobacco Survey, 2012–2014. Am J Prev Med. 2018;54(2):284–8.

Sherratt FC, Marcus MW, Robinson J, Newson L, Field JK. Electronic cigarette use and risk perception in a Stop Smoking Service in England. Addict Res Theory. 2015;23(4):336–42.

Soule EK, Maloney SF, Guy MC, Eissenberg T, Fagan P. User-identified electronic cigarette behavioral strategies and device characteristics for cigarette smoking reduction. Addict Behav. 2018;79:93–101.

Spears CA, Jones DM, Weaver SR, Pechacek TF, Eriksen MP. Use of electronic nicotine delivery systems among adults with mental health conditions, 2015. Int J Environ Res Public Health. 2017;14(1):10.

Spears CA, Jones DM, Weaver SR, Yang B, Pechacek TF, Eriksen MP. Electronic nicotine delivery system (ENDS) use in relation to mental health conditions, past-month serious psychological distress and cigarette smoking status, 2017. Addiction. 2019;114(2):315–25.

Stokes A, Collins JM, Berry KM, Reynolds LM, Fetterman JL, Rodriguez CJ, et al. Electronic cigarette prevalence and patterns of use in adults with a history of cardiovascular disease in the United States. J Am Heart Assoc. 2018;7(9):e007602.

Sung H-Y, Wang Y, Yao T, Lightwood J, Max W. Polytobacco use and nicotine dependence symptoms among US adults, 2012–2014. Nicotine Tob Res. 2018;20(suppl_1):S88–98.

Syamlal G, King BA, Mazurek JM. Tobacco product use among workers in the construction industry, United States, 2014-2016. Am J Ind Med. 2018;61(11):939–51.

Vallone DM, Bennett M, Xiao H, Pitzer L, Hair EC. Prevalence and correlates of JUUL use among a national sample of youth and young adults. Tob Control. 2019;28(6):603–9.

Watkins SL, Glantz SA, Chaffee BW. Association of noncigarette tobacco product use with future cigarette smoking among youth in the Population Assessment of Tobacco and Health (PATH) Study, 2013-2015. JAMA Pediatr. 2018;172(2):181–7.

Weaver SR, Huang J, Pechacek TF, Heath JW, Ashley DL, Eriksen MP. Are electronic nicotine delivery systems helping cigarette smokers quit? Evidence from a prospective cohort study of U.S. adult smokers, 2015-2016. PLoS One. 2018;13(7):e0198047.

Weaver SR, Majeed BA, Pechacek TF, Nyman AL, Gregory KR, Eriksen MP. Use of electronic nicotine delivery systems and other tobacco products among USA adults, 2014: results from a national survey. Int J Public Health. 2016;61(2):177–88.

Yang Q, Liu J, Lochbuehler K, Hornik R. Does seeking e-cigarette information lead to vaping? Evidence from a national longitudinal survey of youth and young adults. Health Commun. 2019;34(3):298–305.

Yong H-H, Borland R, Balmford J, McNeill A, Hitchman S, Driezen P, et al. Trends in e-cigarette awareness, trial, and use under the different regulatory environments of Australia and the United Kingdom. Nicotine Tob Res. 2015;17(10):1203–11.

Zhu S-H, Zhuang Y-L, Wong S, Cummins SE, Tedeschi GJ. E-cigarette use and associated changes in population smoking cessation: evidence from US current population surveys. BMJ. 2017;358:j3262.

References

1. Office for National Statistics. Adult smoking habits in the UK: 2018 [Internet]. 2019 Jul [cited 2020 May 7]. (Statistical bulletin). Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/bulletins/adultsmokinghabitsingreatbritain/2018

2. Centers for Disease Control and Prevention. Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion. Tobacco-related mortality [Internet]. Centers for Disease Control and Prevention. 2018 [cited 2020 Apr 28]. Available from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/

3. Royal College of Physicians, UK Centre for Tobacco Control Studies. Fifty years since “Smoking and health”: Progress, lessons and priorities for a smoke-free UK [Internet]. Royal College of Physicians; 2012 [cited 2020 Oct 22] 54 p. Available from: https://www.rcplondon.ac.uk/projects/outputs/fifty-years-smoking-and-health

4. Cairney P. The transformation of UK tobacco control. In: Compton ME, ’t Hart P, editors. Great policy successes: Or, a tale about why it’s amazing that governments get so little credit for their many everyday and extraordinary achievements as told by sympathetic observers who seek to create space for a less relentlessly negative view of our pivotal public institutions [Internet]. Oxford: Oxford University Press; 2019 [cited 2020 Oct 22]. p. 84–103. Available from: https://oxford.universitypressscholarship.com/view/10.1093/oso/9780198843719.001.0001/oso-9780198843719-chapter-5

5. WHO Regional Office for Europe. European tobacco use: trends report 2019 [Internet]. Copenhagen: World Health Organization. WHO Regional Office for Europe; 2019 [cited 2020 Apr 22] iv, 61 p. Available from: http://www.euro.who.int/__data/assets/pdf_file/0009/402777/Tobacco-Trends-Report-ENG-WEB.pdf?ua=1

6. World Health Organization. WHO report on the global tobacco epidemic, 2008: the MPOWER package [Internet]. Geneva: World Health Organization; 2008 [cited 2020 Apr 29] 329 p. Available from: https://www.who.int/tobacco/mpower/2008/en/

7. Levy DT, Li Y, Yuan Z. Impact of nations meeting the MPOWER targets between 2014 and 2016: an update. Tob Control. 2020;29(2):231–3.

8. Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. Int J Epidemiol. 2017;46(1):348–55.

9. Tobacco Control Scale. Methods [Internet]. Tobacco Control Scale. [cited 2020 Oct 26]. Available from: https://www.tobaccocontrolscale.org/methods/

10. Joossens L, Raw M. The Tobacco Control Scale: a new scale to measure country activity. Tob Control. 2006;15(3):247.

11. Bauer JE, Hyland A, Li Q, Steger C, Cummings KM. A longitudinal assessment of the impact of smoke-free worksite policies on tobacco use. Am J Public Health. 2005;95(6):1024–9.

12. Trevallion L. How has the smoking ban changed our health? Heart Matters [British Heart Foundation] [Internet]. 2017 [cited 2020 Oct 26]; Available from: https://www.bhf.org.uk/informationsupport/heart-matters-magazine/news/smoking-ban

13. WHO Regional Office for Europe. Evidence brief: Tobacco point-of-sale display bans [Internet]. World Health Organization. WHO Regional Office for Europe; 2017 [cited 2020 Oct 26] 7 p. Available from: https://www.euro.who.int/__data/assets/pdf_file/0005/339233/who-evidence-brief-pos-ban-eng.pdf

14. Wagner AK, Soumerai SB, Zhang F, Ross-Degnan D. Segmented regression analysis of interrupted time series studies in medication use research. J Clin Pharm Ther. 2002;27(4):299–309.

15. Conway L. Prohibition of tobacco vending machines [Internet]. London: House of Commons; 2017 [cited 2020 Apr 1]. (Commons Research Briefing). Report No.: SN05536. Available from: https://commonslibrary.parliament.uk/research-briefings/sn05536/

16. Jha P, Peto R, Zatonski W, Boreham J, Jarvis MJ, Lopez AD. Social inequalities in male mortality, and in male mortality from smoking: indirect estimation from national death rates in England and Wales, Poland, and North America. Lancet. 2006 Jul 29;368(9533):367–70.

17. Marsh L, Gray A, McGee R, Newcombe R, Patterson R. Access to cigarettes by young New Zealand smokers: little change from 2000 to 2008. Aust N Z J Public Health. 2012;36(5):415–20.

18. Hagimoto A, Nakamura M, Morita T, Masui S, Oshima A. Smoking cessation patterns and predictors of quitting smoking among the Japanese general population: a 1-year follow-up study. Addiction. 2010;105(1):164–73.

19. Giordano GN, Lindström M. The impact of social capital on changes in smoking behaviour: a longitudinal cohort study. Eur J Public Health. 2011;21(3):347–54.

20. Maloney E, Hutchinson D, Burns L, Mattick RP. Prevalence of and characteristics associated with persistent smoking among Australian mothers and fathers: findings from the Longitudinal Study of Australian Children (LSAC). J Fam Stud. 2010;16(2):165–75.

21. Kalousova L, Burgard SA. Unemployment, measured and perceived decline of economic resources: contrasting three measures of recessionary hardships and their implications for adopting negative health behaviors. Soc Sci Med. 2014;106:28–34.

22. Hiscock R, Bauld L, Amos A, Platt S. Smoking and socioeconomic status in England: the rise of the never smoker and the disadvantaged smoker. J Public Health (Oxf). 2012;34(3):390–6.

23. Leonardi-Bee J, Jere ML, Britton J. Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: a systematic review and meta-analysis. Thorax. 2011;66(10):847–55.

24. Ali MM, Dean D. The influence of nonresident fathers on adolescent and young adult cigarette smoking. Fam Syst Health. 2015;33(3):314–23.

25. Huisman M, Kunst AE, Mackenbach JP. Inequalities in the prevalence of smoking in the European Union: comparing education and income. Prev Med. 2005;40(6):756–64.

26. Kuipers MAG, Monshouwer K, van Laar M, Kunst AE. Tobacco control and socioeconomic inequalities in adolescent smoking in Europe. Am J Prev Med. 2015;49(5):e64–72.

27. Feliu A, Filippidis FT, Joossens L, Fong GT, Vardavas CI, Baena A, et al. Impact of tobacco control policies on smoking prevalence and quit ratios in 27 European Union countries from 2006 to 2014. Tob Control. 2019;28(1):101–9.

28. Bosdriesz JR, Willemsen MC, Stronks K, Kunst AE. Tobacco control policy and socio-economic inequalities in smoking in 27 European countries. Drug Alcohol Depend. 2016;165:79–86.

29. Hill S, Amos A, Clifford D, Platt S. Impact of tobacco control interventions on socioeconomic inequalities in smoking: review of the evidence. Tob Control. 2014;23(e2):e89–97.

30. Eurostat. EU statistics on income and living conditions (EU-SILC) methodology: distribution of income [Internet]. Statistics explained: your guide to European statistics. 2020 [cited 2020 Apr 30]. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php/EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_-_distribution_of_income

31. Clarke E, Thompson K, Weaver S, Thompson J, O’Connell G. Snus: a compelling harm reduction alternative to cigarettes. Harm Reduction Journal. 2019;16(1):62.

32. McCoach DB, Kaniskan B. Using time-varying covariates in multilevel growth models. Frontiers in Psychology. 2010;1:17.

33. Action on Smoking and Health (ASH). Use of electronic cigarettes (vaporisers) among adults in Great Britain [Internet]. 2019 Sep [cited 2020 Apr 2] 18 p. Available from: https://ash.org.uk/wp-content/uploads/2019/09/Use-of-e-cigarettes-among-adults-2019.pdf

34. Dawkins L, Turner J, Hasna S, Soar K. The electronic-cigarette: effects on desire to smoke, withdrawal symptoms and cognition. Addict Behav. 2012;37(8):970–3.

35. Hughes K, Bellis MA, Hardcastle KA, McHale P, Bennett A, Ireland R, et al. Associations between e-cigarette access and smoking and drinking behaviours in teenagers. BMC Public Health. 2015;15:244.

36. Vansickel AR, Cobb CO, Weaver MF, Eissenberg TE. A clinical laboratory model for evaluating the acute effects of electronic “cigarettes”: nicotine delivery profile

and cardiovascular and subjective effects. Cancer Epidemiol Biomarkers Prev. 2010;19(8):1945–53.

37. Grana RA, Popova L, Ling PM. A longitudinal analysis of electronic cigarette use and smoking cessation. JAMA Intern Med. 2014;174(5):812–3.

38. Action on Smoking and Health (ASH). Use of e-cigarettes among young people in Great Britain [Internet]. 2019 Jun [cited 2020 Apr 30] 14 p. Available from: https://ash.org.uk/wp-content/uploads/2019/06/ASH-Factsheet-Youth-E-cigarette-Use-2019.pdf

39. HM Treasury. Government Social Research Unit. The Magenta book: guidance notes for policy evaluation and analysis [Internet]. London: HM Treasury. Government Social Research Unit; 2003 Jul [cited 2020 Apr 29] p. [211]. (Magenta book background papers). Available from: http://dera.ioe.ac.uk/id/eprint/10521

40. Gough D. Weight of Evidence: a framework for the appraisal of the quality and relevance of evidence. Research Papers in Education. 2007;22(2):213–28.

41. Chou SP, Saha TD, Zhang H, Ruan WJ, Huang B, Grant BF, et al. Prevalence, correlates, comorbidity and treatment of electronic nicotine delivery system use in the United States. Drug Alcohol Depend. 2017;178:296–301.

42. Levy DT, Yuan Z, Li Y, Yameng Li. The prevalence and characteristics of e-cigarette users in the U.S. Int J Environ Res Public Health. 2017;14(10):e1200.

43. Park SH, Lee L, Shearston JA, Weitzman M. Patterns of electronic cigarette use and level of psychological distress. PLoS One. 2017;12(3):e0173625.

44. Zhu S-H, Zhuang Y-L, Wong S, Cummins SE, Tedeschi GJ. E-cigarette use and associated changes in population smoking cessation: evidence from US current population surveys. BMJ. 2017;358:j3262.

45. Hoffman L, Delahanty J, Johnson SE, Zhao X. Sexual and gender minority cigarette smoking disparities: an analysis of 2016 Behavioral Risk Factor Surveillance System data. Prev Med. 2018;113:109–15.

46. Laverty AA, Filippidis FT, Vardavas CI. Patterns, trends and determinants of e-cigarette use in 28 European Union Member States 2014–2017. Prev Med. 2018;116:13–8.

47. Ruokolainen O, Ollila H, Karjalainen K. Determinants of electronic cigarette use among Finnish adults: results from a population-based survey. Nordic Studies on Alcohol and Drugs. 2017;34(6):471–80.

48. Mehra VM, Keethakumar A, Bohr YM, Abdullah P, Tamim H. The association between alcohol, marijuana, illegal drug use and current use of e-cigarette among youth and young adults in Canada: results from Canadian Tobacco, Alcohol and Drugs Survey 2017. BMC Public Health. 2019;19(1):1208–10.

49. Vallone DM, Bennett M, Xiao H, Pitzer L, Hair EC. Prevalence and correlates of JUUL use among a national sample of youth and young adults. Tob Control. 2019;28(6):603–9.

50. Yong H-H, Borland R, Balmford J, McNeill A, Hitchman S, Driezen P, et al. Trends in e-cigarette awareness, trial, and use under the different regulatory environments of Australia and the United Kingdom. Nicotine Tob Res. 2015;17(10):1203–11.

51. Weaver SR, Majeed BA, Pechacek TF, Nyman AL, Gregory KR, Eriksen MP. Use of electronic nicotine delivery systems and other tobacco products among USA adults, 2014: results from a national survey. Int J Public Health. 2016;61(2):177–88.

52. Agaku IT, Davis K, Patel D, Shafer P, Cox S, Ridgeway W, et al. A longitudinal study of the relationship between receptivity to e-cigarette advertisements and e-cigarette use among baseline non-users of cigarettes and e-cigarettes, United States. Tob Induc Dis. 2017;15(1):42.

53. Patel D, Davis KC, Cox S, Bradfield B, King BA, Shafer P, et al. Reasons for current e-cigarette use among US adults. Prev Med. 2016;93:14–20.

54. Owens VL, Ha T, Soulakova JN. Widespread use of flavored e-cigarettes and hookah tobacco in the United States. Prev Med Rep. 2019;14:100854.

55. Lee C, Yong H-H, Borland R, McNeill A, Hitchman SC. Acceptance and patterns of personal vaporizer use in Australia and the United Kingdom: results from the International Tobacco Control survey. Drug Alcohol Depend. 2018;185:142–8.

56. Lucherini M, Rooke C, Amos A. “They’re thinking, well it’s not as bad, I probably won’t get addicted to that. But it’s still got the nicotine in it, so…”: maturity, control, and socializing: negotiating identities in relation to smoking and vaping - a qualitative study of young adults in Scotland. Nicotine Tob Res. 2019;21(1):81–7.

57. Miech R, Patrick ME, O’Malley PM, Johnston LD. What are kids vaping? Results from a national survey of US adolescents. Tob Control. 2017;26(4):386–91.

58. Best C, Haseen F, van der Sluijs W, Ozakinci G, Currie D, Eadie D, et al. Relationship between e-cigarette point of sale recall and e-cigarette use in secondary school children: a cross-sectional study. BMC Public Health. 2016;16(1):310–8.

59. Auf R, Trepka MJ, Selim M, Ben Taleb Z, De La Rosa M, Bastida E, et al. E-cigarette use is associated with other tobacco use among US adolescents. Int J Public Health. 2019;64(1):125–34.

60. Roberts W, Moore KE, Peltier MR, Verplaetse TL, Oberleitner L, Hacker R, et al. Electronic cigarette use and risk of harmful alcohol consumption in the U.S. population. Alcohol Clin Exp Res. 2018;42(12):2385–93.

61. Jaber RM, Mirbolouk M, DeFilippis AP, Maziak W, Keith R, Payne T, et al. Electronic cigarette use prevalence, associated factors, and pattern by cigarette smoking status in the United States from NHANES (National Health and Nutrition Examination Survey) 2013-2014. J Am Heart Assoc. 2018;7(14):e008178.

62. Montreuil A, MacDonald M, Asbridge M, Wild TC, Hammond D, Manske S, et al. Prevalence and correlates of electronic cigarette use among Canadian students: cross-sectional findings from the 2014/15 Canadian Student Tobacco, Alcohol and Drugs Survey. CMAJ Open. 2017;5(2):E460–7.

63. Azagba S, Wolfson M. E-cigarette use and quantity of cigarette smoking among adolescent cigarette smokers: a finite mixture model analysis. Drug Alcohol Depend. 2018;185:33–9.

64. Merianos AL, Mancuso TF, Gordon JS, Wood KJ, Cimperman KA, Mahabee-Gittens EM. Dual- and polytobacco/nicotine product use trends in a national sample of high school students. Am J Health Promot. 2018;32(5):1280–90.

65. Noland M, Rayens MK, Wiggins AT, Huntington-Moskos L, Rayens EA, Howard T, et al. Current use of e-cigarettes and conventional cigarettes among US high school students in urban and rural locations: 2014 National Youth Tobacco Survey. Am J Health Promot. 2018;32(5):1239–47.

66. Coleman B, Rostron B, Johnson SE, Persoskie A, Pearson J, Stanton C, et al. Transitions in electronic cigarette use among adults in the Population Assessment of Tobacco and Health (PATH) Study, Waves 1 and 2 (2013–2015). Tob Control. 2019;28(1):50–9.

67. Jackson SE, Hill E, Shahab L, Beard E, Michie S, Brown J. Prevalence and correlates of long-term e-cigarette and nicotine replacement therapy use: a prospective study in England. BMJ Open. 2019;9(10):e029252.

68. Atuegwu NC, Perez MF, Oncken C, Thacker S, Mead EL, Mortensen EM. Association between regular electronic nicotine product use and self-reported periodontal disease status: Population Assessment of Tobacco and Health Survey. Int J Environ Res Public Health. 2019;16(7):e1263.

69. Sung H-Y, Wang Y, Yao T, Lightwood J, Max W. Polytobacco use and nicotine dependence symptoms among US adults, 2012–2014. Nicotine Tob Res. 2018;20(suppl_1):S88–98.

70. Johnson AL, Collins LK, Villanti AC, Pearson JL, Niaura RS. Patterns of nicotine and tobacco product use in youth and young adults in the United States, 2011–2015. Nicotine Tob Res. 2018;20(suppl_1):S48–54.

71. Chan G, Leung J, Gartner C, Yong H-H, Borland R, Hall W. Correlates of electronic cigarette use in the general population and among smokers in Australia – findings from a nationally representative survey. Addict Behav. 2019;95:6–10.

72. Mirbolouk M, Charkhchi P, Kianoush S, Uddin SMI, Orimoloye OA, Jaber R, et al. Prevalence and distribution of e-cigarette use among U.S. adults: Behavioral Risk Factor Surveillance System, 2016. Ann Intern Med. 2018;169(7):429–38.

73. Rutten LJF, Blake KD, Agunwamba AA, Grana RA, Wilson PM, Ebbert JO, et al. Use of e-cigarettes among current smokers: associations among reasons for use, quit intentions, and current tobacco use. Nicotine Tob Res. 2015;17(10):1228–34.

74. Coleman BN, Rostron B, Johnson SE, Ambrose BK, Pearson J, Stanton CA, et al. Electronic cigarette use among US adults in the Population Assessment of Tobacco and Health (PATH) Study, 2013–2014. Tob Control. 2017;26(e2):e117–26.

75. Sharapova SR, Singh T, Agaku IT, Kennedy SM, King BA. Patterns of e-cigarette use frequency—National Adult Tobacco Survey, 2012–2014. Am J Prev Med. 2018;54(2):284–8.

76. Farsalinos K, Siakas G, Poulas K, Voudris V, Merakou K, Barbouni A. E-cigarette use is strongly associated with recent smoking cessation: an analysis of a representative population sample in Greece. Intern Emerg Med. 2019;14(6):835–42.

77. Chan G, Morphett K, Gartner C, Leung J, Yong H, Hall W, et al. Predicting vaping uptake, vaping frequency and ongoing vaping among daily smokers using longitudinal data from the International Tobacco Control (ITC) Four Country Surveys. Addiction. 2019;114(S1):61–70.

78. Merianos AL, Jandarov RA, Klein JD, Mahabee-Gittens EM. Characteristics of daily e-cigarette use and acquisition means among a national sample of adolescents. Am J Health Promot. 2019;33(8):1115–22.

79. Heckman BW, Fong GT, Borland R, Hitchman S, O'Connor RJ, Bickel WK, et al. The impact of vaping and regulatory environment on cigarette demand: behavioral economic perspective across four countries. Addiction. 2019;114(S1):123–33.

80. Weaver SR, Huang J, Pechacek TF, Heath JW, Ashley DL, Eriksen MP. Are electronic nicotine delivery systems helping cigarette smokers quit? Evidence from a prospective cohort study of U.S. adult smokers, 2015-2016. PLoS One. 2018;13(7):e0198047.

81. Benmarhnia T, Pierce JP, Leas E, White MM, Strong DR, Noble ML, et al. Can e-cigarettes and pharmaceutical aids increase smoking cessation and reduce cigarette consumption? Findings from a nationally representative cohort of American smokers. Am J Epidemiol. 2018;187(11):2397–404.

82. Nayak P, Pechacek TF, Weaver SR, Eriksen MP. Electronic nicotine delivery system dual use and intention to quit smoking: will the socioeconomic gap in smoking get greater? Addict Behav. 2016;61:112–6.

83. Liu G, Wasserman E, Kong L, Foulds J. A comparison of nicotine dependence among exclusive e-cigarette and cigarette users in the PATH study. Prev Med. 2017;104:86–91.

84. Aleyan S, Cole A, Qian W, Leatherdale ST. Risky business: a longitudinal study examining cigarette smoking initiation among susceptible and non-susceptible e-cigarette users in Canada. BMJ Open. 2018;8(5):e021080.

85. Cho B-Y, Seo D-C, Lin H-C, Lohrmann DK, Chomistek AK, Hendricks PS, et al. Adolescent weight and electronic vapor product use: comparing BMI-based with perceived weight status. Am J Prev Med. 2018;55(4):541–50.

86. Kotz D, Böckmann M, Kastaun S. The use of tobacco, e-cigarettes, and methods to quit smoking in Germany: a representative study using 6 waves of data over 12 months (the DEBRA Study). Dtsch Arztebl Int. 2018;115(14):235–42.

87. Lippert AM. Association between school-level prevalence of electronic cigarette use and student-level use behaviors, pre-use intentions, and risk perceptions:

evidence from the 2014 US National Youth Tobacco Survey. Nicotine Tob Res. 2018;20(2):231–8.

88. Deshpande M, Bromann S, Arnoldi J. Electronic cigarette use among adults with asthma: 2014-2017 National Health Interview Survey. Res Social Adm Pharm. 2020;16(2):202–7.

89. Jackson SE, Shahab L, Kock L, West R, Brown J. Expenditure on smoking and alternative nicotine delivery products: a population survey in England. Addiction. 2019;114(11):2026–36.

90. Friedman AS, Horn SJL. Socioeconomic disparities in electronic cigarette use and transitions from smoking. Nicotine Tob Res. 2019;21(10):1363–70.

91. Stokes A, Collins JM, Berry KM, Reynolds LM, Fetterman JL, Rodriguez CJ, et al. Electronic cigarette prevalence and patterns of use in adults with a history of cardiovascular disease in the United States. J Am Heart Assoc. 2018;7(9):e007602.

92. Antwi GO, Lohrmann DK, Jayawardene W, Chow A, Obeng CS, Sayegh AM. Associations between e-cigarette and combustible cigarette use among U.S. cancer survivors: implications for research and practice. J Cancer Surviv. 2019;13(2):316–25.

93. Bowler RP, Hansel NN, Jacobson S, Graham Barr R, Make BJ, Han MK, et al. Electronic cigarette use in US adults at risk for or with COPD: analysis from two observational cohorts. J Gen Intern Med. 2017;32(12):1315–22.

94. Lopez AA, Redner R, Kurti AN, Keith DR, Villanti AC, Stanton CA, et al. Tobacco and nicotine delivery product use in a U.S. national sample of women of reproductive age. Prev Med. 2018;117:61–8.

95. Primack BA, Shensa A, Sidani JE, Hoffman BL, Soneji S, Sargent JD, et al. Initiation of traditional cigarette smoking after electronic cigarette use among tobacco-naïve U.S. young adults. Am J Med. 2018;131(4):443.e1-443.e9.

96. Conner M, Grogan S, Simms-Ellis R, Scholtens K, Sykes-Muskett B, Cowap L, et al. Patterns and predictors of e-cigarette, cigarette and dual use uptake in UK adolescents: evidence from a 24-month prospective study. Addiction. 2019;114:2048–55.

97. Shahab L, Goniewicz ML, Blount BC, Brown J, McNeill A, Alwis KU, et al. Nicotine, carcinogen, and toxin exposure in long-term e-cigarette and nicotine replacement therapy users: a cross-sectional study. Ann Intern Med. 2017;166(6):390–400.

98. Pechacek TF, Nayak P, Gregory KR, Weaver SR, Eriksen MP. The potential that electronic nicotine delivery systems can be a disruptive technology: results from a national survey. Nicotine Tob Res. 2016;18(10):1989–97.

99. Syamlal G, King BA, Mazurek JM. Tobacco product use among workers in the construction industry, United States, 2014-2016. Am J Ind Med. 2018;61(11):939–51.

100. Spears CA, Jones DM, Weaver SR, Yang B, Pechacek TF, Eriksen MP. Electronic nicotine delivery system (ENDS) use in relation to mental health

conditions, past-month serious psychological distress and cigarette smoking status, 2017. Addiction. 2019;114(2):315–25.

101. Spears CA, Jones DM, Weaver SR, Pechacek TF, Eriksen MP. Use of electronic nicotine delivery systems among adults with mental health conditions, 2015. Int J Environ Res Public Health. 2017;14(1):10.

102. Melka A, Chojenta C, Holliday E, Loxton D. Adverse childhood experiences and electronic cigarette use among young Australian women. Prev Med. 2019;126:105759.

103. Hanewinkel R, Isensee B. Risk factors for e-cigarette, conventional cigarette, and dual use in German adolescents: a cohort study. Prev Med. 2015;74:59–62.

104. Primack BA, Soneji S, Stoolmiller M, Fine MJ, Sargent JD. Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults. JAMA Pediatr. 2015;169(11):1018–23.

105. Kyriakos CN, Filippidis FT, Hitchman S, Girvalaki C, Tzavara C, Demjén T, et al. Characteristics and correlates of electronic cigarette product attributes and undesirable events during e-cigarette use in six countries of the EUREST-PLUS ITC Europe Surveys. Tob Induc Dis. 2018;16(2):1.

106. Robertson L, Hoek J, Blank M-L, Richards R, Ling P, Popova L. Dual use of electronic nicotine delivery systems (ENDS) and smoked tobacco: a qualitative analysis. Tob Control. 2019;28(1):13–9.

107. Conner M, Grogan S, Simms-Ellis R, Flett K, Sykes-Muskett B, Cowap L, et al. Do electronic cigarettes increase cigarette smoking in UK adolescents? Evidence from a 12-month prospective study. Tob Control. 2018;27(4):365–72.

108. East K, Hitchman SC, Bakolis I, Williams S, Cheeseman H, Arnott D, et al. The association between smoking and electronic cigarette use in a cohort of young people. J Adolesc Health. 2018;62(5):539–47.

109. European Parliament. Directive 2014/40/EU of the European Parliament and of the Council of 3 April 2014 on the Approximation of the Laws, Regulations and Administrative Provisions of the Member States Concerning the Manufacture, Presentation and Sale of Tobacco and Related Products and Repealing Directive 2001/37/EC [Internet]. 2014. Available from: https://ec.europa.eu/health/sites/health/files/tobacco/docs/dir_201440_en.pdf

110. Aleyan S, East K, McNeill A, Cummings KM, Fong GT, Yong H, et al. Differences in norms towards the use of nicotine vaping products among adult smokers, former smokers and nicotine vaping product users: cross-sectional findings from the 2016 ITC Four Country Smoking and Vaping Survey. Addiction. 2019;114(S1):97–106.

111. O’Connor RJ, Fix BV, McNeill A, Goniewicz ML, Bansal-Travers M, Heckman BW, et al. Characteristics of nicotine vaping products used by participants in the 2016 ITC Four Country Smoking and Vaping Survey. Addiction. 2019;114(S1):15–23.

112. Adkison SE, O’Connor RJ, Bansal-Travers M, Hyland A, Borland R, Yong H-H, et al. Electronic nicotine delivery systems: international tobacco control four-country survey. Am J Prev Med. 2013;44(3):207–15.

113. Sherratt FC, Marcus MW, Robinson J, Newson L, Field JK. Electronic cigarette use and risk perception in a Stop Smoking Service in England. Addict Res Theory. 2015;23(4):336–42.

114. El-Khoury F, Bolze C, Gomajee R, White V, Melchior M. Lower smoking rates and increased perceived harm of cigarettes among French adults one year after comprehensive tobacco control measures. Drug Alcohol Depend. 2019;201:65–70.

115. Popova L, Owusu D, Weaver SR, Kemp CB, Mertz CK, Pechacek TF, et al. Affect, risk perception, and the use of cigarettes and e-cigarettes: a population study of U.S. adults. BMC Public Health. 2018;18(1):395.

116. Yang Q, Liu J, Lochbuehler K, Hornik R. Does seeking e-cigarette information lead to vaping? Evidence from a national longitudinal survey of youth and young adults. Health Commun. 2019;34(3):298–305.

117. Persoskie A, O'Brien EK, Poonai K. Perceived relative harm of using e-cigarettes predicts future product switching among US adult cigarette and e-cigarette dual users. Addiction. 2019;114(12):2197–205.

118. Tonkin-Crine S, Anthierens S, Hood K, Yardley L, Cals JWL, Francis NA, et al. Discrepancies between qualitative and quantitative evaluation of randomised controlled trial results: achieving clarity through mixed methods triangulation. Implement Sci. 2016;11(1):66.

119. O'Cathain A, Knowles E, Bishop-Edwards L, Coster J, Crum A, Jacques R, et al. Understanding variation in ambulance service non-conveyance rates: a mixed methods study. Health Serv Deliv Res. 2018;6(19).

120. Denzin NK. The research act: a theoretical introduction to sociological methods. New Jersey: Transaction Publishers; 1973.

121. Yin RK. Validity and generalization in future case study evaluations. Evaluation. 2013;19(3):321–32.

122. Centers for Disease Control and Prevention. Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion. Diseases and death: fast facts [Internet]. Smoking & Tobacco Use. 2019 [cited 2020 May 13]. Available from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/index.htm#diseases

123. Peters SAE, Huxley RR, Woodward M. Do smoking habits differ between women and men in contemporary Western populations? Evidence from half a million people in the UK Biobank study. BMJ Open. 2014 Dec 1;4(12):e005663.

124. Partos TR, Hiscock R, Gilmore AB, Branston JR, Hitchman S, McNeill A. Impact of tobacco tax increases and industry pricing on smoking behaviours and inequalities: a mixed-methods study [Internet]. Southampton (UK): NIHR Journals Library; 2020 [cited 2020 Apr 29]. (Public health research). Available from: https://www.ncbi.nlm.nih.gov/books/NBK555628/

125. Keenan PS. Smoking and weight change after new health diagnoses in older adults. Arch Intern Med. 2009;169(3):237–42.

126. Hiscock R, Judge K, Bauld L. Social inequalities in quitting smoking: what factors mediate the relationship between socioeconomic position and smoking cessation? J Public Health (Oxf). 2011;33(1):39–47.

127. Barth J, Jacob T, Daha I, Critchley JA. Psychosocial interventions for smoking cessation in patients with coronary heart disease. Cochrane Database Syst Rev. 2015;(7):Art. no. CD006886.

128. Hopkinson NS, Lester-George A, Ormiston-Smith N, Cox A, Arnott D. Child uptake of smoking by area across the UK. Thorax. 2014;69(9):873.

129. Levin KA, Dundas R, Miller M, McCartney G. Socioeconomic and geographic inequalities in adolescent smoking: A multilevel cross-sectional study of 15 year olds in Scotland. Soc Sci Med. 2014;107:162–70.

130. Blosnich J, Lee JGL, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. Tob Control. 2013;22(2):66–73.

131. Jackson SE, Brown J, Grabovac I, Cheeseman H, Osborne C, Shahab L. Smoking and Quitting Behavior by Sexual Orientation: A Cross-Sectional Survey of Adults in England. Nicotine Tob Res. 2020 Mar 2;(ntaa042).

132. Zhuang Y-L, Cummins SE, Y Sun J, Zhu S-H. Long-term e-cigarette use and smoking cessation: a longitudinal study with US population. Tob Control. 2016;25(Suppl 1):i90–5.

133. Hartwell G, Thomas S, Egan M, Gilmore A, Petticrew M. E-cigarettes and equity: a systematic review of differences in awareness and use between sociodemographic groups. Tob Control. 2017;26(e2):e85–91.

134. Centers for Disease Control and Prevention. Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion. Surgeon General's Advisory on e-cigarette use among youth [Internet]. Smoking & Tobacco Use. 2019 [cited 2020 May 8]. Available from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/surgeon-general-advisory/index.html

135. Chalmers V, Pickles K. Number of children and young people who are vaping DOUBLES in four years, official figures reveal. Daily Mail [Internet]. 2019 Feb 27 [cited 2020 May 8]; Available from: https://www.dailymail.co.uk/health/article-6747813/Number-children-young-people-vaping-DOUBLES-four-years.html

136. Jones AM, Laporte A, Rice N, Zucchelli E. Do public smoking bans have an impact on active smoking? Evidence from the UK. Health Econ. 2015;24(2):175–92.

137. Clare P, Bradford D, Courtney RJ, Martire K, Mattick RP. The relationship between socioeconomic status and 'hardcore' smoking over time: greater accumulation of hardened smokers in low-SES than high-SES smokers. Tob Control. 2014;23(e2):e133–8.

138. Kennedy RD, Awopegba A, De León E, Cohen JE. Global approaches to regulating electronic cigarettes. Tob Control. 2017;26(4):440–5.

139. Zbikowski SM, Magnusson B, Pockey JR, Tindle HA, Weaver KE. A review of smoking cessation interventions for smokers aged 50 and older. Maturitas. 2012;71(2):131–41.

140. Hiscock R, Dobbie F, Bauld L. Smoking cessation and socioeconomic status: An update of existing evidence from a national evaluation of English Stop Smoking Services. BioMed Research International. 2015;2015:274056.

141. Ross, L. Smoking cessation 3: supporting people with mental health conditions. Nurs Times. 2020;116(5):46–8.

142. Richardson S, McNeill A, Brose LS. Smoking and quitting behaviours by mental health conditions in Great Britain (1993-2014). Addict Behav. 2019 Mar;90:14–9. Erratum in: Addict Behav. 2019 Jun;93:274.

143. Kotz D, West R. Explaining the social gradient in smoking cessation: It's not in the trying, but in the succeeding. Tobacco Control. 2009;18(1):43–6.

144. Gilman SE, Rende R, Boergers J, Abrams DB, Buka SL, Clark MA, et al. Parental smoking and adolescent smoking initiation: an intergenerational perspective on tobacco control. Pediatrics. 2009 Feb;123(2):e274–81.

145. Turner-Warwick M. Smoking and the young: A report of a working party of the Royal College of Physicians. Tobacco Control. 1992;1(3):231–5.

146. Lasher S, Baker C. Bullying: evidence from the longitudinal study of young people in England 2, wave 2 [Internet]. Department for Education; 2015 Nov [cited 2020 Oct 26] 24p. Available from: http://dera.ioe.ac.uk/id/eprint/24730

147. Hong JS, Davis JP, Sterzing PR, Yoon J, Choi S, Smith DC. A conceptual framework for understanding the association between school bullying victimization and substance misuse. Am J Orthopsychiatry. 2014;84(6):696–710.

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