



Public Health  
England

Protecting and improving the nation's health

# **Response to consultation on proposed changes to the calculation of smoking attributable mortality and hospital admissions**

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## Summary

PHE conducted an online consultation from 23 September 2020 to 2 November 2020 proposing changes to the relative risks used in the calculation of indicators related to smoking attributable disease (1).

Having considered the responses received during the consultation, the main findings are:

- to use the relative risks listed in the Royal College of Physician's Report, 'Hiding in Plain Sight' (2) as proposed in the consultation document; this is to increase simplicity by using one data source for reference and minimising the complexity of the calculations used in the indicators and their updates
- that PHE will produce new indicators using the proposed relative risks, including a back-series from the period 2013 to 2015 (pooled) to present and will use this method, going forward
- that these new indicators or measures will be approved by PHE's Indicator Methodology Review Group prior to being published during 2021 to 2022
- that PHE will include mental health conditions as per the RCP report but also continue to work with colleagues on improving data sources and the relative risk of mental health conditions among smokers

## Background

Smoking remains the biggest single cause of preventable mortality and morbidity in the world and accounts for 1 in 6 of all deaths in England (3). There are well documented links between smoking and a number of diseases such as a several types of cancer, respiratory diseases, heart disease and mental ill health.

## The Local Tobacco Control Profiles

The Local Tobacco Control Profiles for England (4) provide a snapshot of the extent of tobacco use, tobacco related harm, and measures being taken to reduce this harm at a local level. These profiles have been designed to help local government and health services to assess the effect of tobacco use on their local populations. They inform commissioning and planning decisions to tackle tobacco use and improve the health of local communities.

## Reasons for review

The current relative risks used for the calculation of smoking attributable fractions are based on data from 'The Health Consequences of Smoking: A Report of the Surgeon General' using data from 1982 to 1988 (5). In our consultation we proposed to update the list of relative risks to a

subset of those in the report published by the Royal College of Physicians in 2018 (2) which used more up-to-date research from systematic reviews of the associations between smoking and various diseases along with meta-analyses of effect sizes. See consultation document for further details.

## What we did

PHE discussed with members of the Tobacco Control Implementation Board including colleagues in the Department of Health and Social Care (DHSC), Action on Smoking and Health (ASH), academic institutions and NHS Digital about the options for updating the relative risks used in the calculation of the smoking-attributable fractions due to the more recent evidence available. Those currently being used are based on data from 'The Health Consequences of Smoking: A Report of the Surgeon General' (5) using data from 1982 to 1988.

The proposal was to use the relative risks reported in Hiding in Plain Sight, a report published by the Royal College of Physicians in 2018 (2) (RCP report) which looked at systematic reviews of the associations between smoking and individual diseases with meta-analyses of effect sizes. The report states that:

“Where more than one recent review was available we took either the most recent or the review that identified the most individual studies; and where possible we selected reviews of longitudinal rather than cross-sectional studies. Where we have been unable to identify a recent or definitive review of a disease we consider too important to exclude, we have either carried out our own review or referred to substantive cohort study evidence.”

PHE produced tables assessing the impact of changing the relative risks on the smoking-attributable mortality and smoking-attributable hospital admissions indicators including by sex and disease type.

We proposed to update the back-series for the full list of indicators in the Local Tobacco Control Profiles that would be affected by this change:

- smoking-attributable mortality
- smoking-attributable deaths from heart disease
- smoking-attributable deaths from stroke
- potential years of life lost due to smoking related illness
- smoking-attributable hospital admissions

## Stakeholder survey

PHE conducted an online consultation from 23 September 2020 to 2 November 2020 (1). The survey was made available via the GOV.UK website and circulated via the PHE Local Knowledge and Intelligence Teams and the SPECTRUM Knowledge Broker to known stakeholders.

The survey asked 4 questions:

1. Do you agree with the proposal to update the relative risks in this way?
2. Do you agree with the rationale for inclusion and exclusion of particular conditions within our analysis aligned to the Royal College of Physicians report?
3. Which of the 3 options for mental health would you prefer:
  1. include these conditions as per the calculations in this document with clear caveats
  2. exclude mental health conditions from the calculations
  3. explore further data sources for mental health conditions to be included in the calculations, increasing the complexity of the calculations
4. Do you have any other comments or points that you would like us to consider?

## Who responded?

We received 8 responses to the consultation from a range of stakeholders including Cancer Research UK (CRUK), Action on Smoking and Health (ASH), Fresh and academic institutions (Kings College London, Sheffield University, University of Glasgow).

## What were the issues raised?

For each of the questions asked in the consultation document the following points were raised.

### 1. Do you agree with the proposal to update the relative risks in this way?

Two respondents of the 7 who answered this question said yes with no further comments and one respondent did not provide a response. Others gave detailed options for alternative data sources for relative risks to be considered as listed below.

#### Specifically for cancers

- review the International Agency for Research on Cancer (IARC) monograph (6) for guidance on which cancer types to include in these calculations and reviewing the

wider current epidemiological literature to identify the best available evidence on relative risks

- consider including a lag in the relative risk calculations for cancer
- recommend treating oesophageal adenocarcinoma and oesophageal squamous cell carcinoma separately (the former has much lower relative risk but contributes a higher proportion of oesophageal cancer cases)
- calculating attributable deaths and hospital admissions for mucinous ovarian cancer only, rather than all ovarian cancer types combined

### Other diseases

- review the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) published in the Lancet (7), which provides a systematic scientific assessment of published, publicly available, and contributed data on incidence, prevalence, and mortality for a mutually exclusive and collectively exhaustive list of diseases and injuries

## 2. Do you agree with the rationale for inclusion and exclusion of particular conditions within our analysis aligned to the Royal College of Physicians report?

Two respondents answered yes to this question. One respondent did not provide a response to this question. Other respondents indicated that their answer would be based on the explanation given in their response to question 1.

## 3. Which of the 3 options for mental health would you prefer?

1. include these conditions as per the calculations in this document with clear caveats
2. exclude mental health conditions from the calculations
3. explore further data sources for mental health conditions to be included in the calculations, increasing the complexity of the calculations

There were 5 responses to this question and all agreed that in the short-term the first option was the most appropriate for moving these calculations forward, with some suggestions for the caveats including that relative risks may not be available for some mental health conditions due to lack of research.

Three respondents stated that Option 2 should not be followed as it would lead to lack of parity in national statistics between physical and mental health conditions, which may also disincentivise the recording of them, and vastly underestimate the number of smoking attributable hospital admissions or deaths.

In the longer term, 3 respondents strongly recommend looking into option 3 to ensure parity of esteem between mental and physical health conditions and exploring alternative relative risk data sources also saying that if such data do not exist, it provides incentive to conduct new primary research to calculate the relative risks.

Further comments were received related to a statement in the consultation which may need further clarification:

“We are aware that the Hospital Episode Statistics data will not fully capture all hospital admissions related to mental health illness” (page 18).

NHS Digital advised that some admissions related to mental health may not be recorded in HES where a patient was not admitted to an acute trust and that other data sources for example the Mental Health Services Data Set (MHSDS) may be an additional source of data that could be explored for inclusion in addition to HES. Please see next section for further details of how this will be taken forward.

Respondents also identified the need to take into account multi-morbidity in future research as people with a mental health condition often have more than one condition including other mental health disorders such as schizophrenia and/or depression, as well as co-occurring smoking related physical health conditions. They also asked for recognition of emerging research showing that tobacco smoking is implicated in the onset of psychosis.

#### 4. Do you have any other comments or points that you would like us to consider?

Numerous respondents asked for clarification on why a different methodology is used for estimating obesity and alcohol related hospital admissions compared to that for tobacco, noting that for smoking the population attributable fraction approach is used, but obesity and alcohol include any admissions where obesity/alcohol are recorded as a primary or secondary diagnosis in Hospital Episode Statistics.

Further clarification was also sought as to why the relative risks had seen such a large change for some conditions and we were asked to consider incorporating a time-lag between smoking and the onset of smoking attributable diseases in the calculations.

A further respondent asked for clear transparency when using this data to ensure that the change is not used to show any artificial reductions due to changes in smoking rates or to imply the success of interventions.

# Considerations based on responses

## Alternative data sources

### Cancers

Cancer Research UK (CRUK) provided an alternative table for cancer relative risks to be used in the calculations for smoking attributable fractions (see Table 1 for comparison of these with the RCP report relative risks used in the consultation). The table provides alternative ICD-10 codes in some cases and for others an alternative relative risk for the same ICD-10 code grouping.

**Table 1. Comparison of relative risks of smoking-related cancers**

Cancer type	RCP report	CRUK	RCP report				CRUK			
			Male		Female		Male		Female	
			current	ex	current	ex	current	ex	current	ex
Lung	C33-C34	C33-C34	10.92	3.85	10.92	3.85	7.33	3.13	6.99	3.14
Nasal synuses and nasopharynx	C11, C30-C31	C11	1.95	1.39	1.95	1.39	1.59	1.36	1.59	1.36
Oral cavity	C10	C00-C06	3.43	1.4	3.43	1.4	1.91	1	1.91	1
Pharynx	C14	C09-C10, C12-C14	6.76	2.28	6.76	2.28	3.43	1	3.43	1
Oral cavity	C10		3.43	1.4	3.43	1.4				
Larynx	C32	C32	6.98	4.65	6.98	4.65	7.01	2.37	7.01	2.37
Oesophagus	C15	AC	2.5	2.03	2.5	2.03	2.32	1.62	2.32	1.62
		SCC					4.21	2.18	4.21	2.18
Stomach	C16	C16	1.74	1.18	1.74	1.18	1.63	1.42	1.3	1



Cancer type	RCP report	CRUK	RCP report				CRUK			
			Male		Female		Male		Female	
			current	ex	current	ex	current	ex	current	ex
Pancreas	C25	C25	1.9	1.13	1.9	1.13	1.9	1.2	1.9	1.2
Liver	C22	C22	1.51	1.12	1.51	1.12	1.66	1.51	1.66	1.51
Colorectal	C18-C20	C18	1.2	1.2	1.2	1.2	1.11	1.15	1.11	1.15
		C20					1.44	1.11	1.44	1.11
Kidney	C64	C64-C66, C68	1.52	1.25	1.52	1.25	1.57	1.29	1.27	1.2
Lower urinary tract	C65-C66		2.77	1.72	2.77	1.72				
Bladder	C67	C67	3.14	1.83	3.14	1.83	3.44	1.92	3.56	2.04
Breast	C50				1.07	1.08				
Cervix	C53	C53			1.83	1.26			2	1
Acute myeloid leukaemia	C92	C92.0, C92.4-C92.6, C92.8, C93.0, C94.0, C94.2	1.36	1.21	1.36	1.21	1.52	1.45	1.52	1.45
Malignant melanoma	C43-C44		1.7	1.4	0	0				
Ovary (mucinous)		C56-C57.4							1.44	1

These alternative risks were used to calculate an alternative estimate for smoking attributable mortality and smoking attributable hospital admissions as shown in Table 2 and Table 3. Note that the oesophageal cancers (C15) were apportioned to adenocarcinomas and squamous cell carcinomas as per morphology and topology of the diagnosed cancers in 2014, which, has recently been used by CRUK as these are unable to be defined by ICD-10 codes alone (see [Appendix A](#)). These are based on small numbers in some of the 5-year age bands at national level and including them in the calculation of attributable fractions would need careful consideration at local authority level due to uncertainty in using estimates based on small numbers.

Table 2 shows that using the CRUK proposed relative risks would reduce the number of estimated smoking related deaths by around 9,000 which equates to around 10 per 100,000 population compared to the proposed relative risks in the consultation document (Table 2). The majority of this difference is explained by the lower relative risk for lung cancer (7,500 fewer attributable deaths which is 8.2 per 100,000 population).

**Table 2. Smoking-attributable mortality, comparison of rates per 100,000 population age 35+ years (persons)**

Group	Relative risks applied	Number of attributable deaths	Mortality rate per 100,000 (age 35+)	LCL	UCL
All conditions	Current	232,859	250.20	249.20	251.20
	Proposed (as in consultation)	197,202	211.88	210.94	212.82
	Proposed (with alternative cancers)	188,122	202.10	201.18	203.02
Cancers only	Current	108,975	117.43	116.73	118.13
	Proposed (as in consultation)	85,996	92.68	92.06	93.30
	Proposed (with alternative cancers)	76,916	82.90	82.31	83.49

For hospital admissions, the CRUK proposed relative risks would reduce the estimated number by more than 34,000 and the rate by 109 per 100,000 population compared with the calculations using the relative risks in the RCP report. The majority of the difference here is due to the cancer sites which are not included in the CRUK list (breast cancer accounting for around 6,000 admissions and malignant melanoma in those age 50+ accounting for around 17,000 admissions) as well as the drop in the relative risk of lung cancer which accounts for a difference of around 9,500 admissions.

**Table 3. Smoking-attributable hospital admissions, comparison of rates per 100,000 population age 35+ years (persons)**

Group	Relative risks applied	Number of hospital admissions	Rate of hospital admissions per 100,000 (age 35+)	LCL	UCL
All conditions	Current	508,361	1612.46	1,608.02	1,616.90
	Proposed (as in consultation)	445,747	1414.82	1,410.66	1,418.99
	Proposed (with alternative cancers)	411,410	1305.96	1,301.96	1,309.96
Cancers only	Current	175,416	559.01	556.39	561.63
	Proposed (as in consultation)	167,383	533.04	530.48	535.60
	Proposed (with alternative cancers)	137,212	437.42	435.11	439.75

To keep the consideration of cancers consistent with the other disease types included and for simplicity in the calculation and understanding of the indicator, we will initially continue with the calculation using the relative risks as published following the meta-analysis in the RCP report and will continue to work with colleagues with more knowledge on cancers and the impacts of smoking in order to improve estimates as required.

## Global Burden of Disease (GBD)

The GBD cannot be considered for our calculation as it works with continuous risk models where appropriate, or to break down risks for maximum possible exposure levels in order to build a distribution. The data for smoking is broken by 'cigarettes per day' or 'pack years' for smokers or time since quit for ex-smokers (see [Smoking Pack Years](#) for a further explanation or [download a detailed breakdown used in the GBD](#)). Therefore, the distributions would need to be converted to average categories in order for them to be used in the calculation of smoking attributable fractions which is a complex task and considered outside of the scope of this project.

## Time lag

Whilst we understand that there is a time lag between smoking initiation and the onset of some smoking-attributable conditions, the datasets used for the calculation of these indicators do not contain details of each individual's smoking status or history of smoking behaviour and developing a method for estimating this is outside of the scope of this project.

Furthermore, data from the Health Survey for England has shown that the majority of smokers start smoking in their teenage years and therefore by only including adults aged 35 years and older some of the time lag has been accounted for. We recognise that we are not accounting for amount of time since quitting for ex-smokers and how this would affect the relative risk of disease, but again due to the lack of information available for individuals related to this, or other research into how this may affect the calculations, we consider this outside of the scope of this project.

Applying the smoking prevalence estimates for past years to the latest mortality and hospital admissions data would not be feasible for this project. This is due to different conditions having unique time-lags to onset from initiation of smoking that would need to be applied within the smoking attributable fraction calculation, it does not seem feasible to apply multiple years for one data point and there is no single agreed period currently that could be used. Also the calculation of the smoking attributable fractions requires smoking prevalence estimates (current smokers and ex-smokers) at local authority level, for each 5-year age band (from age 35+) by sex, and this data is only available from the Annual Population Survey 3-year pooled datasets, which are available from the period 2013 to 2015 and do not provide a long enough time-lag to account for the later onset of some conditions.

## Population Attributable Fraction Method

We recognise that a different method is used for the calculation of smoking attributable diseases compared with alcohol-attributable diseases. Reasons for this include:

- there are no wholly smoking-attributable conditions as there are for alcohol
- others affected by someone else's alcohol use, for example, alcohol-related harm, would be coded accordingly, which is not the case for smoking
- the same attributable fractions are applied to all geographical areas and age groups for alcohol but vary for smoking as we are able to calculate local attributable fractions for smoking because we have access to local smoking rates from the Annual Population Survey. This data is not available for alcohol consumption

We also acknowledge that obesity-attributable diseases were mentioned within consultation responses, however PHE do not produce any obesity-attributable fractions or indicators based on these, and we are unaware of any published work other than cancer-specific calculations.

## Conclusion

In conclusion, having considered all of the responses we have received, we plan to implement the new relative risks for data from the RCP report as proposed in the consultation document, working with colleagues to develop the data sources as described in the response.

The affected indicators (see [Appendix B](#)) will need to be reviewed by PHE's indicator methodology review group who will ensure that they are statistically robust. We will produce a new time series of data going back to 2013 to 2015.

Updated data will be made available in the Local Tobacco Control Profiles during 2021 to 2022.

## References

1. [Closed consultation: Proposed changes to how smoking attributable risk is calculated](#) (Accessed 21 January 2021)
2. Royal College of Physician's Report, [Hiding in Plain Sight](#) (Accessed 21 January 2021)
3. [NHS Digital Statistics on Smoking in England 2019](#) (Accessed 21 January 2021)
4. [Local Tobacco Control Profiles](#) (Accessed 21 January 2021)
5. [The Health Consequences of Smoking](#) (Accessed 21 January 2021)
6. [Personal Habits and Indoor Combustions: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 100E](#). 2012. (Accessed 21 January 2021)
7. [Smoking prevalence and attributable disease burden in 195 countries and territories, 1990 to 2015: a systematic analysis from the Global Burden of Disease Study 2015](#) (Accessed 21 January 2021)

# Appendices

## Appendix A

Oesophageal cancer type: ratio of adenocarcinomas (AC) to squamous cell carcinomas (SCC) for males and females. Provided by Cancer Research UK.

Age group	AC ratio		SCC ratio	
	Males	Females	Males	Females
35 to 39	0.73	0.29	0.27	0.43
40 to 44	0.72	0.44	0.23	0.33
45 to 49	0.73	0.50	0.22	0.50
50 to 54	0.79	0.37	0.20	0.52
55 to 59	0.68	0.38	0.20	0.57
60 to 64	0.69	0.45	0.21	0.55
65 to 69	0.66	0.39	0.18	0.48
70 to 74	0.64	0.34	0.19	0.51
75 to 79	0.66	0.40	0.21	0.47
80 to 84	0.72	0.38	0.20	0.46
85+	0.64	0.35	0.18	0.38

## Appendix B

List of indicators in the Local Tobacco Control Profiles affected by change to relative risks of smoking:

- smoking attributable mortality
- smoking attributable deaths from heart disease
- smoking attributable deaths from stroke
- potential years of life lost due to smoking related illness
- smoking attributable hospital admissions

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