Prevalence, Consequences and Data Management Unit

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Analysis of the data sources, numbers and characteristics of cocaine-related DRD cases reported in Special Mortality Registries, or eventually in General Mortality Registries (GMR) when necessary

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Glossary

ATS   Amphetamine-type stimulants
COD   Cause of death
DRD   Drug-related death
EMCDDA European Monitoring Centre for Drugs and Drug Addiction
GHB/GBL Gammahydroxybutyrate/Gammabutyrolactone
GMR   General Mortality Registry
ICD-10   International Classification of Diseases and Related Health Problems 10th Revision
'Legal highs' Licit drugs (chiefly stimulants such as cathinones, synthetic cannabinoids, etc. which may or may not have become regulated/controlled during the time-period examined by this project)
NFP   national focal point
PM   post mortem (autopsy)
SMR   Special Mortality Registry
UK   United Kingdom

Executive summary

Background

There have been increased numbers of cocaine-related deaths reported in some European countries since the early 1990s. There are indications that cocaine deaths are more difficult to define, detect and record as such in mortality registries, and more particularly in some countries' General Mortality Registries (GMRs) due to coding practices. Also, the characteristics of cocaine deaths are multi-factorial (socio-demographics, toxicology, circumstances and mechanism of death), and are often different from opiate deaths and may not be collected by GMRs. In many cases, it is difficult to ascertain if a death was primarily due to cocaine poisoning, a combination of substances, or the result of a pre-existing health condition precipitated by cocaine use. It remains unclear how cocaine deaths are identified in Europe. In particular, it is possible that deaths occurring shortly after, and induced by, cocaine use, but which are not poisonings in the strict sense, are not identified or reported as induced by cocaine. The EMCDDA decided to undertake a project aimed at providing better information on this phenomenon.

Aims

This project aimed to describe the trend in numbers reported to Special Mortality Registries (SMRs) (or GMRs) over 15 years in some European countries. In addition, it aimed to provide information on the demographic and drug-use characteristics of recent cases (the last five available years) in this instance, mainly drawing on information collected by SMRs. This element complements the current routine data collection on drug-induced deaths by the EMCDDA, which is mainly focused on opiate-related drug-induced deaths, and provides only limited information on cocaine-related deaths. The project also attempted to establish how cocaine deaths are identified and classified, and gauge the level of, and possible reasons for under-reporting.

Methods

Preliminary ideas were drawn up by the contractor and the EMCDDA and developed into a draft study protocol and survey questionnaire. The project was outlined at the DRD expert meeting in November 2011 and a parallel session discussed the documents, conceptual and methodological issues. This led to a Mini-survey being conducted in February and March 2012 to explore some of these issues including data availability, case identification and classification. A revised questionnaire and Microsoft Excel® dataset templates to collect aggregated data were circulated to selected countries for completion during April and May 2012.

Responses

The Mini-survey was sent to all 30 NFP experts/SMRs, of whom 19 (63 %) responded — comparable with a previous project on SMR information flows in 2010 (60 %). The protocol and data-table templates were sent to a total of 9 NFP experts/SMRs, all of whom submitted data: Denmark; France; Hamburg, Germany; Ireland; Italy; Netherlands; Portugal; Spain; and the UK.

Key findings

In the 19 responding countries, GMRs mostly use cause of death (i.e. the underlying and contributory causes mentioned on the death certificates and used to code the cases in the registries) and toxicology (i.e. the substances identified in the autopsy or post mortem (PM)) to identify cocaine-related DRDs. ICD codes or approaches based on them are the basis for categorising them. Four out of five GMRs stated they classify cocaine DRDs but did not provide details; a further three said it could be done. A wider range of factors is used by SMRs: toxicology, autopsy, evidence and cause of death. Most SMRs do not have ICD codes for case-identification.

The majority of respondents distinguish cocaine poisonings from other types of deaths. Apart from cocaine itself, the principal metabolites commonly identified or screened for are: benzoylecgonine, ecgonine methyl ester, cocaethylene and ecgonine. Most GMRs do not distinguish crack from powder cocaine.

There is a mixed picture in terms of trends in numbers of cocaine-related DRDs in the nine participating countries. During the 2000s, there was generally an increasing upward trend in such cases, followed by a decline in most countries. Peaks occurred in different years. Comparing 2009 against 2008, five countries show a fall or stabilisation, whilst the other four show an increase. Numbers of cocaine-related deaths

reported varied across countries. By far, most cases were in the UK (2 423 cases recorded by the SMR over the 1998–2009 period) and Spain (1 635 cases over the 2005–10 period).

Around 90 % of these deaths occurred in the 20–24 to 45–49 years age groups in 5 countries, and 84 % in a sixth country. The minimum age reported is 15 years and the maximum typically in their 60s. Mean age at death is typically in the late 20s or early 30s. Males accounted for 73 % to 93 % of cases.

Cocaine overdoses account typically for about two-thirds of all reported cases. In these, the role of cocaine alone being mentioned/implicated in cocaine-related DRDs varies considerably but typically lies in the 20+ % range. The clearest feature is that opioids are involved in most overdose cases (range 56 % to 92 %), often without other substances. This dominant presence of opioids in cocaine-related DRDs mirrors wider patterns evident in European DRDs, suggesting that many cocaine users are opioid users and that they are also polysubstance users — both factors increasing the risk of overdose/poisoning and of death.

Non-overdose cocaine-related deaths were less frequently reported. Cases ascribed to 'General medication condition' as their cause of death appear to play a large contribution to non-overdose cases; the category captures a whole range of underlying causes of death, particularly diseases of the circulatory system which merit closer examination. Deaths involving accidental injury and road traffic accidents also feature, as do suicides in most countries.

Further research

The analyses of non-overdose, cocaine-related fatalities undertaken by this project suggests that it would be valuable to examine in more detail those cases ascribed to 'general medical conditions', 'cardiovascular and other issues', etc. Scientific medical literature is increasingly featuring small-scale case-study or anecdotal reports of conditions associated with the acute and chronic use of cocaine. It is important to seek a more accurate picture of the numerical extent of such conditions (and its possible underestimation) and a fuller understanding of what conditions and diseases are caused, and how, by cocaine use. Other areas that could also be examined in the future include: the role of cocaine in deaths involving accidental injuries, road traffic accidents and suicides — especially by hanging.

Conclusions

Cocaine-related DRDs are not easy to monitor and are possibly an increasingly important feature of drug-related mortality in Europe. They are likely to continue to be so in the future, due to the large number of chronic and problematic users. It is necessary to understand the nature and extent of this phenomenon. Despite a number of practical and legal issues, the main objectives of this project have been achieved in describing trends in numbers of such deaths, and identifying some of the key characteristics of decedents, the substances involved in their deaths, and why/how they died. Some core commonalities have been observed; they confirm and quantify what was already known (those reported to have died of cocaine-related deaths in Europe in recent years are mostly males, young people, having often used cocaine with opioids and sometimes at least one or more additional drugs, and having died of an overdose). More information is needed though, in order to flesh out the skeleton presented here. The data and information presented provide major insights into the nature and possible extent of the phenomenon of cocaine-related DRDs in Europe.

1. Introduction and rationale

Aims of the project

Information for the Key indicator on drug-induced deaths (overdoses) and mortality among drug users (DRD indicator) of the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) can be based on data retrieved from General Mortality Registers (GMRs) or Special Mortality Registers (SMRs) for its component on overdoses. The EMCDDA recommends that both sources be used, if possible (EMCDDA, 2010).

Against a background of increasing prevalence of cocaine use in some countries, and indications of increased number of cocaine deaths in some countries (in excess of 1 000 in 2007–8) (EMCDDA, 2011), the EMCDDA decided to undertake a small project aimed at providing better information on this phenomenon of cocaine-related deaths in Europe. There are indications that cocaine deaths are more difficult to define, detect and record as such in mortality registries, and more particularly in some countries' GMRs due to coding practices. Also, the characteristics of cocaine deaths are multi-factorial (socio-demographics, toxicology, circumstances and mechanism of death), and are often different from opiate deaths and may not be collected by GMRs. In addition, there is evidence of a considerable burden of morbidity related to cocaine use in Europe (Mena et al., 2012).

In many cases, it is difficult to ascertain if a death was primarily due to cocaine poisoning, or whether it was due to a combination of substances, or the result of a pre-existing health condition precipitated by cocaine use. It remains unclear how cocaine deaths are identified in Europe. In particular, it is possible that deaths occurring shortly after, and induced by, cocaine use, but which are not poisonings in the strict sense, are not identified as induced by cocaine, and therefore are not reported (EMCDDA, 2007, pp. 19–20).

This project aimed to describe the trend in numbers reported to SMRs (or GMRs) over 15 years. In addition, it aimed to provide information on the demographic and drug-use characteristics of recent cases (the last five available years), in this instance, mainly drawing on information collected by SMRs. This element complements the current routine data collection on drug-induced deaths by the EMCDDA, which is mainly focused on opiate-related drug-induced deaths, and provides only limited information on cocaine-related deaths. The project also attempts to establish how cocaine deaths are identified and classified, and gauge the level of, and possible reasons, for under-reporting.

The project builds on work carried out in a previous contract that aimed to map DRD data available in SMRs in some EU countries (Wirl, 2010) ([1]). It is hoped the research will encourage interested countries to work on common study questions and data analysis to inform public health decisions, and to facilitate comparison.

Project objectives

The objectives of the project were to:
• analyse the characteristics (age, gender, simple 'substance' typology) of cocaine-related DRD cases reported in SMRs, in a limited number of countries over the last 5 available years (5–7 countries were *a priori* considered likely to provide sufficient cases);
• describe the trend in numbers over 15 years where possible; and
• compare the numbers and basic characteristics, if possible, of cocaine deaths in SMRs and GMRs in this small number of countries.

What this study covers

• This study mainly focuses on drug-induced deaths (i.e. overdose/poisoning). It was originally envisaged that other deaths (i.e. indirectly related to cocaine or for which cocaine is mentioned) might be explored, for some countries where data are available (see below).
• This study mainly focuses on SMRs.
• This study focuses on the 5 most recent years of reporting (i.e. commonly 2006 to 2010); or up to 10 or 15 years if data are available.
• This study is not looking at the deaths of cocaine users *per se* (i.e. not looking at cohort studies of cocaine users).

([1]) See reports on availability of the data in various national SMRs in the section on Special Mortality Registries in
http://www.emcdda.europa.eu/themes/key-indicators/drd

2. Methodology

The timeline of this project is given in Table 2.1 below.

Table 2.1: Project timeline

Period	Activity
October–November 2011	Development of draft protocol and survey questionnaire
November 2011	Presentation and parallel session at DRD Expert Meeting (available from DRD intranet)
February–March 2012	Mini-survey (detailed responses and summary table available in Annex 1)
April–May 2012	Completion of the protocol, questionnaire and MS Excel® workbook data templates (Annex 2 and 3)
June 2012	Analysis and writing up
June–July 2012	Submission of report and circulation to NFP experts for review

A draft protocol and survey questionnaire were developed during October and November 2011 by the contractor with input from EMCDDA colleagues, based on the areas of concern that emerged from the DRD Expert meeting in 2010, the presentations made on that occasion, and insights from a complementary study on cocaine-related hospital emergency admissions (Mena et al., 2012). The documents were circulated to national focal point (NFP) DRD experts at their annual meeting held at the EMCDDA on 16–17 November 2011.

The draft protocol set out the suggested case definition(s) and/or typologies of cases. The accompanying survey questionnaire asked for comments on these matters, and requested additional information to assist in drawing up a basic core dataset structure for collection of aggregated data for analysis, and in assessing the availability of data and feasibility of the project. Lastly, it asked whether national experts were interested in participating in the project, and whether they were able to do so.

There was a parallel session on this topic during the DRD expert meeting on 17 November 2011 aiming to discuss case identification. This led to the suggestion of a Mini-survey of the main and interested countries to ask how cocaine-related DRDs are identified and categorised, so as to refine the categories for the main study.

Discussions of and comments made on the questionnaire during the DRD expert meeting and parallel session were analysed and a number of revisions made to the draft protocol. There was a consensus that individual case data should not be requested at this stage, but potential study participants should be asked if they could supply data if approached to do so. Those contacts agreeing to participate were then contacted in respect of providing data and/or statistical tables. A Mini-survey of interested parties took place in February and March 2012, which led to better insights on the approach to identifying potential cases, and further revisions to the draft protocol (see Annex 1 for a copy of the Mini-survey questionnaire and the detailed responses). Following this, the work with interested experts was undertaken during April and May 2012, through use of the agreed protocol and tables in the form of Microsoft Excel® spreadsheet templates (see Annex 2 for a copy of the final protocol and Annex 3 for the Microsoft Excel® data-table templates). These materials focused on post-mortem toxicology 'mentions' of cocaine in overdoses, deaths related to cocaine, and the collection of core aggregated datasets on cocaine-related cases.

Information is presented separately, where available (e.g. the UK), for cases where cocaine was mentioned in the post-mortem (PM) toxicology and for cases where cocaine was mentioned in the cause of death (which can also be either underlying or contributory) ([2]). There can be an overlap between these categories in terms of the role which cocaine plays, e.g. PM toxicology reveals a lethal level of cocaine which causes death by poisoning. Many cases meet both criteria. However, cocaine may be detected through PM screening or analysis but at 'trace' levels without having contributed to the death, e.g. a car passenger who has consumed cocaine some time before being killed in a fatal road traffic accident. Another example, provided by the Danish expert, revealed that cocaine had been detected but the cause of death was tuberculosis. On the other hand, cocaine may be recorded in the medical cause of death as having caused or contributed to death, but no cocaine found at PM. There could be a variety of scenarios in this instance; the deceased was known to use cocaine regularly via injection but was also known to be HIV+ so no PM was undertaken, but eye-witnesses and other evidence pointed to cocaine use immediately prior to death; or, the deceased had been admitted to hospital, diagnosed as suffering from the consequences of cocaine use

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([2]) Part I of the Cause of Death on the death certificate should record the causal chain of morbid conditions that led to death, beginning with the condition most proximate to death on line (a) and working backwards to the initiating condition. The lines (a) to (c) in Part I are connected by the phrase 'due to, or as a consequence of'. Part I is designed to facilitate the selection of the underlying cause of death when two or more causes are recorded on the death certificate. Part II seeks other conditions that the certifier believed contributed to death, but were not in the causal chain.

(confirmed with ante-mortem blood analysis) and died several days later — after the cocaine had been eliminated from his system.

The selection of countries to which to send the final protocol and templates to report the number of cases reported annually was based on trying to achieve a balance between covering the majority of cocaine-related DRDs (by focusing on the countries with large numbers so as to improve the robustness of the findings) and a wide coverage of countries so as to improve representativeness (in respect of varying data collection methods, case-identification, trends, and characteristics) and, hence, enhance external validity. An initial minimum threshold of 100 cases per year was suggested; this would have meant that only 3 countries would probably be eligible — the UK, Spain and Germany. Setting the level at 100 in total over a 5-year period meant that the number of countries could be increased to 6 or 7 (e.g. the addition of Ireland, Italy, the Netherlands and France). It was decided to approach all of these countries, as well as Denmark, whose NFP DRD expert had previously expressed interest in taking part.

It was necessary to send several reminders to participants in order to achieve the desired level of responses to both the Mini-survey and data collection phases. All communications were undertaken via e-mail, supplemented when necessary by telephone conversations.

3 Results

This section firstly presents the key points emerging from the parallel session held at the EMCDDA DRD expert meeting on 17 November 2011 and the main findings from the Mini-survey, so as to provide a summary of the evolution of the project to the principal data collection stage. This demonstrates how developments were informed by the provision of information and expertise from NFP DRD experts and other informed data providers. The detailed responses from participating countries to each question are tabulated in Annex 1. Summary tables are also provided in this Annex. The second sub-section below presents the responses to the questionnaire on cocaine-related DRD numbers.

3.1 Main findings from the parallel session and Mini-survey

Parallel session

Recent data showed that cocaine DRDs are increasing again in some countries, such as Italy, but none have been recorded on others, such as Greece. Several countries, including Cyprus, Denmark and the UK, have reports of road traffic accident fatalities deaths where cocaine was present in PM toxicology and/or involved in the death.

Conceptual issues around methodology of case identification and classification systems were discussed. For the identification of cases, most SMRs do not have ICD codes, some do (e.g. UK), and others could undertake their own ICD coding. There was a consensus for this project that cases could be allocated to 14 suggested categories without the use of ICD codes, but those who have ICD codes could use this approach to help in the allocation process. ICD-10 code T40.5 should be in combination with F14.1 (harmful use).

Most SMRs do not have ICD codes, some do (e.g. UK), and others said they could undertake their own ICD coding for this project, if required. A by-product of doing the latter might be a step towards improving GMR coding. Some GMRs do not use T-codes; others do not use S or Z codes. For such countries, it might be possible to select a sample of all (poisoning) deaths and see what substances were recorded in the toxicology (if available).

There was a consensus after the parallel session in November 2011 that cases could be allocated to 14 suggested categories, based on ICD codes (WHO, 1992, 2010), without having to use this approach, but those who have ICD codes could use this approach to help in the allocation process. There was discussion of whether the case categories could be stratified in another way, rather than following the ICD approach.

The German expert thought that some papers had been published about using the products of combustion as a means of distinguishing smoked cocaine/crack from other modes of intake. Several papers were identified: Gostic et al. (2009); Myers et al. (2005); Ragoucy-Sengler and Kintz (2005); Liberty et al. (2003); Scheidweiler et al. (2003); Paul et al. (1999); Cone et al. (1998). However, toxicologists are not usually looking for such products. The use of crack immediately prior to death usually comes from police examination of the death scene and/or witness statements. Not all cocaine metabolites are screened for in all countries. Guidance was needed on interpretation of the post mortem (PM) toxicology levels to define overdoses/poisonings. There are wide variations in levels considered be toxic/fatal/lethal. These levels can

be affected by polysubstance use, metabolism in terms of blood levels. It is important to know levels for sole cocaine deaths. Bertol et al. (2008) suggest that it is not generally possible to correlate specific blood/tissue concentrations with toxicity. However, the German and Portuguese experts put together some guidance on PM toxicology levels, and provided relevant references/papers to help in the operationalisation of these aspects (Lahti et al, 2009; Stephens et al., 2004). There are some published levels available ([3]).

Poisonings and somatic deaths overlap; it can be difficult to distinguish between them. Germany, Spain and Luxembourg focus on the cardiovascular aspects of cocaine deaths. Fatal excited delirium cases have been noted in Germany, Netherlands and the UK.

Mini-Survey

The Mini-survey was sent to a total of 30 NFP experts/SMRs in the European Union and Croatia, Norway and Turkey. Twenty-three (77 %) expressed an interest in participating; responses were eventually received from 19 (63 % of all countries) of them (see Table 3.1).

For GMRs, it is mostly cause of death (i.e. the underlying and/or contributory cause of death, stated by the medical doctor on the death certificate and used to code the main cause of death in the mortality registries) and post mortem (PM) toxicology results which are used to identify cocaine-related DRDs. SMRs use a wider range of factors, the most important being toxicology, post mortem (PM, i.e. autopsy) and evidence as well as cause of death. There appears to have been some misunderstanding of what was requested in Q1 and Q2, thereby leading to reduced/limited information for Q1 and considerable overlap in the responses for the two questions.

Four out of five GMRs stated they classify cocaine DRDs but did not state how; a further three said it could be done. Similarly with SMRs, two out of four said they did classify such deaths but did not say how, and another three could carry out a classification exercise. For GMRs, 3/8 use specific ICD codes as the basis for categorising cocaine deaths, with 3 others appearing to be based on ICD coding; the criteria principally used relate to causality — probably based on cause of death. In the UK, for example, all three GMRs extract deaths related to poisonings by drugs, medicaments, etc. using ICD-10 codes for adding to special databases set up to monitor DRDs (Christophersen et al., 1998). Text searches of the wording of the medical cause(s) of death are then employed to assign deaths to specific classes of drugs or specific substances as listed in their annual publications on such fatalities (NRS, 2012; NISRA, 2012; ONS, 2012). For SMRs, there is more flexibility with 4/8 stating they could adopt any categorisation scheme; for the other three, there were several different ways of categorisation, again based primarily on toxicology or cause of death (see Annex 1).

The majority of GMRs and SMRs distinguish cocaine poisonings from other types of deaths. Apart from cocaine itself, the principal metabolites commonly identified or screened for are: benzoylecgonine, ecgonine methyl ester, cocaethylene and ecgonine. Most GMRs do not distinguish crack from powder cocaine, but 7/10 SMRs could provide some information — but this is probably not systematically provided. Any information provided from such sources would have to be regarded as minimum levels rather than as absolute measures. The overwhelming majority of GMRs and all SMRs can provide breakdowns by type of drug combinations.

In the majority of GMRs, the mode of use or route of administration of cocaine is not known/recorded. Half of SMRs do record such information (but this is dependent on the quality of data submitted); four other SMRs may have information, such as presence of injection marks.

3.2 Responses to the questionnaire on cocaine-related DRDs

The protocol and data-table templates were sent to a total of 9 NFP experts/SMRs who had expressed their interest: Denmark, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain and the United Kingdom. All countries responded, although limited data were available from Italy at the time of writing the report.

The following country overviews summarise the main patterns and key findings emerging from the data submitted. The full information for each country or SMR is presented in Annex 4. A more systematic overview then follows in which the commonalities and differences are explored, where this is possible.

([3]) For example, see the webpage of the Forensic Toxicology Service at St George's University of London (http://forensic-toxicology.org/normal_ranges.php?page=4&sort_by=&sort_order=Ascending)

Table 3.1: Return of Mini-survey questionnaire and provision of data

Country	Expressed interest in study	Returned questionnaire	Data submitted from		Expert(s)	Organisation(s)
			GMR	SMR		
Austria	X	X			Charlotte Wirl	Gesundheit Österreich GmbH Geschäftsbereich ÖBIG
Bulgaria	X	X			Sonia Chipeva	National Focal Point on Drugs and Drug Addictions
Croatia	X	X			Tanja Coric	Croatian National Institute of Public Health
Cyprus	X	X			Byron Gaist	Cyprus Monitoring Centre for Drugs & Drug Addiction
Czech Republic	X	X			Lucie Grolmusová	Czech National Focal Point for Drugs and Drug Addiction
Denmark	X	X	X		Claudia Ranneries	Sundhedsstyrelsen (National Board of Health)
Finland	X	X			Ilkka Ojanperä	Hjelt Institute
France	X	X	X	X	Eric Janssen	Observatoire Français des Drogues et Toxicomanies (OFDT)
Germany	X			X	Axel Heinemann	Institute for Legal Medicine, Hamburg
Greece	X				Chara Spilioupoulou	Medical School of Athens University
Hungary	X	X			Gergely Horváth	Hungarian National Focal Point
Ireland	X	X		X	Ena Lynn, Suzi Lyons	Health Research Board
Italy	X	X		X	Teodora Macchia	National Institute of Health
Luxembourg	X	X			Michel Yegles	Laboratoire National de Santé — Toxicologie
Malta	X	X			Roberto DeBono	NFP for Drugs & Drug Addiction
Netherlands	X	X		X	Guus Cruts/ Klaas Lusthof	Trimbos-instituut/National Forensic Institute
Portugal	X	X		X	Maria dos Anjos Campos/ Mário João Dias	Instituto Nacional de Estatística/Instituto Nacional de Medicina Legal
Romania	X	X			Andrei Botescu/ Gabriel Gorun	National Anti-drug Agency
Slovenia	X	X			Jozica Selb/ Darja Lavtar	Institute of Public Health of the Republic of Slovenia
Spain	X	X	X	X	Julia Alonso, Elena Álvarez, Begoña Brime, Noelia Llorens. Aurora Ruiz, Rosario Sendino	Observatorio Español sobre Drogas Spanish Observatory on Drugs. Government Delegation for the National Plan on Drugs. Ministry of Health, Social Services and Equality.
Sweden	X				Joakim Strandberg	Swedish National Institute of Public Health
Turkey	X				Bulent Sam	Ministry of Justice (The Council of Forensic Medicine)
UK	X	X	X	X	John Corkery	SMR (National Programme on Substance Abuse Deaths)

3.2.1 Denmark (*GMR)*

Data were supplied by Denmark for the GMR for the period 2002-10 in the form of individual anonymised records giving only the ICD codes for the underlying cause(s) of death and contributory cause(s). Due to time constraints, no other analyses or data were provided (age, and gender break down, or substances associated with cocaine). Two spreadsheets were submitted: (a) cases where F14.1 or T40.5 were mentioned, and (b) underlying cause of death ([4]) (F14X, X42, X62, Y12) in combination with T40.5 (Tables DK 1 and 2). This resulted in the second definition identifying more cases (46) than the first (32) — see Table 3.2 below.

Table 3.2: Cocaine-related deaths recorded on GMR based on cause(s) of death, Denmark, 2002–10

Case definition	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Any mention of F14.1, T40.5	2	4	1	5	8	15	5	4	2	46
F14X	0	0	0	0	0	1	0	1	0	2
X42	1	3	0	2	2	5	2	2	1	18
X62	0	0	0	0	1	2	0	0	0	3
Y12	0	0	1	0	3	3	0	0	0	7
Other	1	1	0	3	2	4	3	1	1	16
Underlying cause of death (F14X, X42, X62, Y12 + T40.5)	1	3	1	4	3	11	4	4	1	32
F14X	0	0	0	2	0	1	1	2	0	6
X42	1	3	0	2	1	4	2	2	1	16
X62	0	0	0	0	1	2	0	0	0	3
Y12	0	0	1	0	1	3	0	0	0	5
Other	0	0	0	0	0	1	1	0	0	2

The overall trend using both definitions is one of an increase from 2002 to 2007, followed by a decline by 2010 back to levels seen at the start of the period.

An examination of the underlying cause of death or cases with any mention of cocaine suggests that when using the broader definition the majority of cases fall within either X42 accidental poisoning (n=18) or 'other' (n=16), 6 of which come under ICD 10 Chapter IX — I codes (Diseases of the circulatory system I00-I99).

For the narrower definition (i.e. cocaine as underlying cause of death), a much clearer picture emerges; the majority of cases (16/32) are ascribed to X42, followed by F14X (n=6) and Y12 (n=5). No I codes appear in the underlying cause of death, and only occur twice in the contributory causes. For the wider definition, I codes appeared in 8 cases (6 as an underlying cause).

For both definitions, many of the codes for contributory causes are F14.1, F14.2 or F19.1, but also appear in the underlying cause fields although not necessarily as *the* underlying cause.

The key underlying cause of cocaine-related DRDs in Denmark during 2001-10 was accidental poisoning, and it appears to be the key factor for changes in the trends observed. For example, one case was coded as follows: 1a = X42, 1b = T40.5 and 2 = F19.1 (where 1a is the immediate cause, 1b is the proximal cause/underlying cause, and 2 is the contributory cause) ([5]).

3.2.2 France

GMR
Statistics from the French GMR (Cépi DC Inserm) have been provided for 2000-9 but suffer from a number of limitations, including the fact that deaths involving several substances are collectively coded to ICD 10 F19 without any further breakdowns. Therefore, the numbers presented under-report cocaine-related DRDs in France. The number of deaths involving only cocaine (all coded to F14X) rose from 2 in 2000 to 7 in 2004, fell to 3 in 2007 before rising to 10 in 2009 (Table FR A1). No data are available for any mention of cocaine. There are no further breakdowns available for GMR data.

([4]) All codes available from http://apps.who.int/classifications/icd10/browse/2010/en

([5]) F14: Mental and behavioural disorders due to use of cocaine. X42: Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified. X62: Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified. T40.5: Poisoning by narcotics and psychodysleptics — cocaine. F19.1: Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances — harmful use.

SMR
The SMR (DRAMES) has provided data based on PM toxicology for all deaths mentioning cocaine between 2006 and 2009, but for legal reasons prevent the provision of gender and age breakdowns. The number of cases with any mention of cocaine at PM varied from year to year with no overall pattern discernible, averaging about 48 deaths *per annum* (Table FR A2). Sole mentions show an increase from 13 in 2006 to 18 in 2007 followed by a slight fall (Table FR A2). The ratio of any: sole mention was 3.11:1 (193:62), with sole mentions accounting for 32.1 % (62/193) of all cases. Together with cocaine, the majority of cases (n=113; 58.5 %) involved only opioids, principally heroin/morphine (n=89; 46.8 %), methadone (n=17; 8.8 %), and buprenorphine (n=6; 3.1 %). (The finding for buprenorphine probably reflects the wider use of buprenorphine in France for opiate/opioid maintenance therapy.) There were 9 cases (4.7 %) involving opioids and other substances (all Amphetamine-type Stimulants - ATS), and 9 cases involving other substances but not opioids (7 ATS, 2 GHB/GBL).

Table 3.3: Cocaine-related deaths recorded by GMR and SMR, France, 2000–09

Case definition	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
GMR sole mention	2	2	3	2	7	5	5	3	7	10	46
SMR post mortem any mention							46	52	44	51	193
Of which as sole substance							13	18	16	15	62

3.2.3 Hamburg, Germany *(SMR)*

Data were provided based on PM toxicology for the period 1998–2010 for the Hamburg area, during the data-collection period. Although covering only part of Germany, the number of cases reported is as high as that reported by some entire countries.

Overdose cases

The number of overdose cases where any PM toxicology finding of cocaine was found fell from 40 in 1998 to 12 in 2003 before remaining at between 11 and 15 *per annum* until 2010 when it fell to 9. During this period there were only 4.6 % (11/240) cases where cocaine was the sole substance found; an any:sole ratio of 21.8:1 (Table DE A2).

Table 3.4: Cocaine-related deaths recorded in PM toxicology, Hamburg (Germany), 1998–2010

Case definition	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Overdose														
SMR post mortem any mention	40	31	24	25	20	12	14	15	11	12	12	15	9	240
Of which as sole substance	3	0	2	0	3	0	1	0	0	0	1	0	1	11
Non-overdose														
Any mention								7	0	3	4	3	2	19

A closer look at breakdowns by substance combinations for 2005–10 (Table DE B3) shows that only 2/74 cases involved cocaine alone, and only one case with alcohol alone. The majority of cases involved opioids. The number of opioid only cases was 33 (44.6 %), of which 28 (37.8 % of the overall total) was for heroin/morphine, 25 (33.8 %) codeine (a metabolite of morphine), and 9 (12.2 %) methadone. There were also 35 (47.3 %) cases involving opioids with other substances, mainly benzodiazepines (n=25; 33.6 %), followed by antidepressants (n=9; 12.2 %), antipsychotics (2), cannabis (2) and only one ATS. There were three other cases not involving opioids: 2 ATS and 1, cannabis. There appears to have been an overall fall in the number of cases involving combinations of opioids with other substances, especially benzodiazepines.

The overall proportion of males involved in cocaine-related overdoses during 2005–10 was 72.9 % (175/240), a ratio of 1.37:1; for deaths involving opioids it was 71.5 % (158/221) and 89.5 % (17/19) for non-opioid cases (Tables DE C7-C9).

The majority (n=220; 91.7 %) of all cases occurred in the 20–24 to 45–49 years age-groups; this is true for both genders. The proportions for the opioid (91.4 %) and non-opioid (89.5 %) groups were similarly high. The overall mean age for males was 34.6, compared to 32.0 years for females, with similar values for the opioid cases. However, the mean ages for non-opioid cases were higher for males (37.7 years; n=17) but lower for females (30.0 years; n=2).

Non-overdose cases
The cause of death, where known, for non-overdose cases was mostly ascribed to "general medical condition" (12/19; 63.2 %) for underlying cause, with 4 transport accidents, 2 suicides, and one event of undetermined intent (Table DE 1). No cases had a contributory cause recorded but 2 cases were noted to have cardiovascular problems caused/contributed to by the drug.

Gender and age breakdown distributions by year and drugs involved give relatively small numbers at this lower level of analysis, so the period as a whole was examined (Table DE 2). This shows that more than two thirds (13/19) of cases involved males. Most cases (n=15) occurred in the 25–44 years age-range. There was one case of cocaine on its own, 9 with opioids (5 male, 4 female), 5 with other stimulants, 4 with medications. Crack was identified in 7/19 cases.

3.2.4 Ireland (*SMR)*

The SMR (National Drug-Related Deaths Index) in Ireland has provided data on overdose deaths where cocaine was implicated, also where cocaine was implicated in the medical 'cause of death' and deaths among individuals who were cocaine users. The Register is based in a number of sources, chiefly coroners' records.

Table 3.5: Cocaine-related overdose deaths recorded on SMR, Ireland, 1998–2009

Case definition	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
SMR cause of death													
Any mention	5	5	5	8	14	10	19	36	49	56	61	52	320
Of which as sole substance	1	1	1	1	3	1	3	17	20	17	11	8	84

Data from the Irish SMR for the period 1998 to 2009 show that the overall number of any 'mentions' in the 'cause of death' rose from 5 in 1998 to 61 in 2008 before falling to 52 in 2009 (Table IE A2). A slightly different pattern was evident for sole 'mentions', rising from only one case in 1998 to a peak of 20 in 2006, followed by successive falls to 8 in 2009. During the period 1998–2009, the ratio of any to sole 'mentions' averaged 3.81:1 (range 2.12:1 to 10.00:1).

During the period 2005–9, there were 254 overdose cases (Table IE B2) where cocaine was mentioned, of which 73 cases (28.7 %) had only cocaine mentioned; 7 were with alcohol/cocaethylene only; 53 (20.9 %) were with opioids only (mainly heroin/morphine and/or methadone), 88 (34.6 %) were with opioids and other substances (mostly benzodiazepines but also ATS and prescribed medications); 33 (13.0 %) with other substances, but not opioids (mainly ATS drugs); and no unspecified substances or crack.

Tables IE C4 to C6 show that during the period 2005–9, 206/254 (81.1 %) cases involved males, with similar proportions for cocaine with opioids (110/141; 78.0 %) and for cocaine without opioids (96/113; 85.0 %). However, for cases involving cocaine, opioids and alcohol the proportion was much lower (37/53; 69.8 %).

The mean age was very similar for both males and females across all of these drug combinations, varying by less than 1.5 years. The overall mean age for all cases where cocaine was mentioned was 29.3 years for males and 30.0 for females. The age range for males was typically wider, the maximum being 65 years compared to 48 for females. Typically the youngest male death was at 17 years and at 18 for females.

Between 2005 and 2009 there were 44 non-overdose cocaine DRDs where the drug was described in the underlying cause (Table IE 1). Of these, 29 (65.9 %) were described as 'general medical condition', 4 as accidents, 2 suicides and 9 deaths of undetermined intent.

Table IE 2 gives information on the combinations of cocaine and other substances in non-overdose cases, when cocaine is mentioned in the underlying cause of death (n=44). Although the number of cases in the yearly breakdowns for 2005–9 is small for individual combinations, there appear to be similar patterns in these separate years. Eighteen of the 44 cases with any cocaine mention were for the drug on its own, 8 with alcohol only, 6 with opioids only and 2 with other stimulants only. The remaining 10 cases included either other prescription medication only or a combination of cocaine and 2 or more substances implicated. These findings reflect those seen in the overdose cases. The overall ratio of males to females was 4.5:1. The majority of cases (41/44) occurred in the 20–24 to 40–44 years age-groups, peaking for both genders in 25–29 years age-group.

3.2.5 Italy (*SMR)*

The Italian SMR (Ministry of the Interior, Central Directorate for Anti-Drug Services) has provided breakdowns by age-group and gender (as *per* ST5) for each year from 2001 to 2011 for cases linked only to direct examination, circumstances, marks, details that are ascribed to overdoses and on an evidential basis. Poisonings are not distinguished from somatic deaths. No information is provided on toxicology, so these deaths are largely reported, based on the cause(s) of death mentioned on the death certificate.

Table 3.6: Cocaine-related deaths recorded on SMR, Italy, 2001–11

Case definition	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
SMR cause of death												
Any mention	19	12	25	34	45	45	36	37	43	42	29	367

In Italy there appears to have been an increase in deaths to a peak in 2005–6 followed by a fall in 2007–8 and a further rise in 2009–10, and a further fall in 2011. Tables IT C1-C11 show that this pattern was mainly determined by male deaths. The overall male:female ratio during the period 2001–11 was 6.20:1 (range 2.17:1 to 41.00:1). Mean age at death (overall and for males) appears to have during over this time from 33.6 to 36.8 years, but there is considerable year on year variation, and the numbers are relatively small. Overall and for both genders, the mean and median ages are around 34 to 35 years. Typically, the minimum age at death is around 20 years overall and for males; there are wide variations for females due to the small annual numbers. Males (range 16–67 years) have a wider age range than females (17–55 years). The proportion of cases falling between the 20–24 and 45–49 years age-groups was 91.0 % overall (males 91.4 %, females 88.2 %).

3.2.6 Netherlands (*SMR)*

The National Forensic Institute has supplied information for 2006–10 derived from autopsies and forensic toxicology investigations. Not all relevant cocaine deaths are dealt with by the agency as many deaths are not investigated in such ways. This means there may be some under-recording of relevant cases.

Table NL A2 shows a decline in the number of deaths with any mention in the cause of death and/or finding of cocaine in PM toxicology from 40 in 2006 to 7 in 2008 before rising to 21 in 2009 and falling again in 2010 to 14. However, the number of deaths involving cocaine alone fell from 15 in 2006 to vary between 3 and 5 in subsequent years. The overall ratio of any: sole mention was 3.55:1 (110:31).

Table 3.7: Cocaine-related deaths recorded on SMR, the Netherlands, 2006–10

Case definition	2006	2007	2008	2009	2010	Total
Any death						
SMR post mortem/cause of death any mention	40	28	7	21	14	110
Of which as sole substance	15	3	4	5	4	31
Overdose PM						
Any mention	17	19	4	22	14	76
Of which as sole substance	5	2	0	3	3	9

The combinations of other substances found with cocaine in PM given in Table NL B3 are for a limited range of substances in overdose cases. The overall proportion of cases involving solely cocaine was 23.7 % (18/76). The largest number of deaths with another substance present was for heroin/morphine 49/65 (64.5 %), followed by opioids only (n=28; 36.8 %), codeine (n=22; 28.9 %), cannabis (n=19; 25.0 %), and GHB/GBL (n=9; 11.8 %). It is interesting to note that there were no deaths identified with methadone, buprenorphine or dihydrocodeine.

The overall proportion of males involved in deaths was 75.4 % (86/114) for any overdose death involving cocaine; for cases with opioids this proportion was 69.6 % (32/46), and without opioids 79.4 % (54/68) — Tables NL C7-C9. The majority of cocaine overdose deaths occurred in the 20–24 to 50–54 years age-groups, with peaks in the 30–34 and 45–49 years age-bands. There was a greater concentration of cases in the 30-34 to 45-49 years age-bands in respect of deaths with opioids than for non-opioid cases, where cases were more widely dispersed across the age-range.

Information provided on non-overdose deaths (Table NL 1) (n=50) suggests that nearly half of these cases (24/50; 48 %) were ascribed to assault (as an underlying cause) followed by 10 as accidental injury and 5 due to general medical condition, and 2 suicide by hanging. There were no cases described as having cocaine as a contributory cause, but 9 cases where cardiovascular problems caused/contributed to by the drug were recorded. No age or gender breakdowns for individual drug contributions were provided.

3.2.7 Portugal (*SMR*)

Data have been provided from the Portuguese NFP for the period 2008–10 and namely by the SMR (Portuguese National Institute of Legal Medicine). Any mentions of cocaine in the cause of death in overdose cases halved between 2008 (n=52) and 2010 (n=28). A slightly different pattern was exhibited for cases where cocaine was the sole substance mentioned, falling from 7 to 4 and then stabilising at 5 (Table PT A2). The overall ratio of any to sole mention was 7.06:1 (113:16).

Table 3.8: Cocaine-related deaths recorded on the SMR, Portugal, 2008–10

Case definition	2008	2009	2010	Total
SMR overdose cause of death				
Any mention	52	33	28	113
Of which as sole substance	7	4	5	16
SMR overdose PM				
Any mention	52	33	26	111
Of which as sole substance	7	4	3	14

About 40 % (41/102) of cocaine overdoses where the drug was implicated in the cause of death involved opioids only, almost all exclusively heroin/morphine and associated metabolites such as codeine; only 5 cases involved methadone (Table PT B2). Thirty-seven (36.3 %) of cases involved opioids and other substances, principally benzodiazepines (n=33); small numbers of antidepressants (n=5) and antipsychotics (n=5) were also implicated. There were only 7 cases that did not involve opioids; these mostly involved benzodiazepines, antidepressants, and antipsychotics (each 4 cases). The PM toxicology findings reveal an identical pattern. During the period 2008–10, there was a reduction in the number of cases involving cocaine on its own, and in the contribution played by other substances without opioids.

The gender and age distributions for cause of death and PM mentions are identical. The overall proportion of males is very high (92.5 %; 86/93) compared to other countries surveyed. The proportion is similar for cocaine mentions with opioids (95.8 %; 68/71) but lower for non-opioids (81.8 %; 18/22). The majority of deaths occurred in the 25–29 to 45–49 years age-groups for both genders, and for all drug combinations (Tables PT C4-C9).

The number of non-overdose cases fell from 51 in 2008 to 33 in 2009 before increasingly slightly in 2010 to 39 (Table PT 1). All the death cases reported on had cocaine recorded in the underlying cause of death rather than as a contributory cause. The largest proportion (26.8 %; 33/123) of underlying causes was attributed to general medical conditions, with almost equal proportions of transport injuries (17.9 %; 22/123) and accidental injuries (17.1 %; 21/123). An important proportion of suicides involving cocaine were recorded (17.9 %; 22/123), more than half by hanging. There were 16 (13.0 %) deaths of undetermined intent and 9 (7.3 %) assaults. The only discernible trend over this short period was a fall in the number of cases attributed to general medical conditions, from 15 in 2008 to 6 in 2010.

Table PT 2 presents gender and age breakdowns by year for the principal substance combinations. There are 11/123 cases for which the age was unavailable; therefore the totals are lower than those given in Table PT1. As the numbers in most of these tables are relatively small, the findings for the overall period are examined. As with overdose cases, the largest number of non-overdose cases involved opioids (n=48; 39.0 %), followed by medications (n=35; 28.5 %), alcohol (n=15; 12.2 %), and other substances (n=14; 11.4 %). There were only 2 cases involving other stimulants; this is perhaps surprising. No cocaethylene or crack mentions are given; this is because these substances are not screened for routinely. There were no cases involving 'legal highs'. The overall male:female ratio was 9.18:1 (101:11), ranging from 4.67:1 (14:3) for cocaine alone to 23:1 (46:2) for opioids. As with overdose cases, non-overdose cases were concentrated in the 25–29 to 45–49 years age-groups for both genders, and also for the main substance combinations.

3.2.8 Spain (*SMR*)

GMR data are not available for underlying cause of death as the Register does not use S, T or Z ICD-10 codes for this part of the data set. However, it is possible to provide limited data for contributory cause(s). This suggests a decline fall in numbers from 2008 (n=8) to 2010 (n=5).

It is not possible in respect of SMR data to distinguish between overdose and non-overdose cases. Information has, therefore, been provided that includes both types of cases. Data in Table ES 2 relate to SMR post mortem toxicology results for deaths between 2005 and 2010.

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Table 3.9: Cocaine related deaths recorded on the GMR and SMR, Spain, 2005–10

Case definition	2005	2006	2007	2008	2009	2010	Total
GMR non-overdose any mention (F14X)				8	7	5	20
SMR PM Any mention	303	242	301	247	247	295	1635
Of which as sole mention	26	17	35	27	23	30	158

There is no apparent pattern in respect of long term trends from the SMR data, the annual number of deaths ranging from 242 to 303.The overall proportion of males was 86.2 % (range 84.3 to 87.5 %). Deaths involving individuals aged less than 15 years only occurred in 2008. The oldest cases were aged 60–64 years and died in 2005 and 2006. The majority of deaths occurred in the 20–24 to 45–49 years age-groups; peaking in the 35–39 years age-group. These patterns apply to both genders and in all years for cases involving any mention of cocaine.

Of the total 1635 SMR cases, 158 (9.7 %) involved the drug on its own, 93 (5.7 %) with alcohol only, 1111 (68.00 %) with opioids, 173 (10.6 %) other stimulants, 81 (5.00 %) with non-specified substances, and 68 (4.2 %) hypnotics/sedatives. 'Crack' was mentioned in 244 (14.9 %) cases. Whilst the response to the Mini-survey suggests that cocaethylene can be distinguished, no cases were identified involving cocaethylene, 'legal highs' or medications for Table ES 2.

The male:female ratio was very stable for death overall — 6.23:1. When this is split by substance combinations, the ratio varied between 5.75:1 for cocaine with 'other substances' and 7.45:1 for cocaine with alcohol only.

Overall, during the period 2005–10, the majority of cocaine only cases occurred in the 25–29 to 40–44 years age-groups. A similar pattern applied for alcohol only, opioids, other stimulants, other substances, and hypnotics/sedatives. These patterns appear to apply across the individual years, although the peak age-group for individual substances can vary from year to year.

3.2.9 United Kingdom

GMR
Figures for the number of deaths published (NRS, 2012 for Scotland; NISRA, 2012 for Northern Ireland; ONS, 2012 for England & Wales) by the three GMRs covering the United Kingdom (UK) show that any 'mentions' of cocaine in the medical 'cause of death' on the death certificate generally rose year on year from 1998 (n=69) to 2008 (n=325), but subsequently fell in 2009 and again in 2010 (n=198) — see Table UK A1. This pattern was observed in England and Wales, Scotland and Northern Ireland.

Table 3.10: Cocaine-related deaths recorded on the GMR and SMR, UK, 1998–2011

Case definition	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
GMR Cause of death															
Any mention	69	100	88	117	161	161	192	221	224	246	325	264	198	152	2 518
Of which as sole substance	28	32	40	41	45	47	51	64	83	92	101	79	63	42	808
SMR cause of death															
Any mention	81	136	134	189	267	241	166	219	205	319	258	208			2 423
Of which as sole substance	0	0	0	1	3	3	5	48	52	61	66	39			278
SMR post mortem mentions															
Any mention	78	136	131	179	265	252	272	349	352	470	463	381			3 328
Of which as sole substance	7	19	14	16	25	21	27	37	36	36	32	19			289

In respect of sole 'mentions', this same pattern was obtained over the UK as whole, in England & Wales, and in Northern Ireland. However, Scotland showed a peak in 2006. At the UK level, the number of sole 'mentions' rose from 28 in 1998 to 101 in 2008, but fell to 42 by 2011. The ratio of any to sole 'mentions' of cocaine on UK death certificates during the period 1998–2011 averaged 3.12:1 (range 2.20:1 to 3.76:1).

SMR
This section is somewhat longer than the previous analysis sections as more material has been provided than for other registries. The UK SMR (National Programme on Substance Abuse Deaths — np-SAD) has comparable geographical coverage from 1998 onwards. Information is presented using two different approaches; (a) mentions of cocaine in the underlying and/or contributory causes of death; and (b) mentioned in the PM toxicology.

Cases reported based on cause of death
Table UK A2 shows that the number of cases in which cocaine was implicated in the cause of death (for any type of cocaine-related DRD) rose from 81 in 1998 to 267 in 2002, before falling in 2004 but then peaking at 319 in 2007, decreasing to 208 by 2009. In respect of sole mentions, this same pattern obtained: the number rose from 0 in 1998 to 66 in 2008, but fell to 39 by 2009.

The overall ratio during this period of any to sole mention was 8.72:1 (2423/278) for cause of death. However, the ratio of any to sole 'mentions' during the period 2005–09 (when sole mentions were systemically flagged as such) averaged 4.55:1 (1209/266) (range 3.91:1 to 5.33:1).

An examination of the combinations of substances mentioned in the cause of death fields during 2005-9 (Table UK B2) indicates that the largest proportion of cases were those with opioids and other substances (33.5 %; 405/1209) mostly benzodiazepines (14.8 %; n=179), antidepressants (5.9 %; n=71) and ATS (3.9 %; n=47). The second largest proportion was accounted for by opioids only (25.1 %; n=303), chiefly heroin/morphine (22.0 %; n=266) and methadone (5.5 %; n=66), some decedents had consumed both substances. The overall proportion of cases with some involvement of opioids was 58.6 % (n=708). The main substances found in the non-opioid group (11.9 %; n=144) were ATS (5.0 %; n=60), benzodiazepines (2.9 %; n=35), cannabis (2.2 %; n=26), and antidepressants (1.7 %; n=20). Cocaine alone accounted for 22.7 % (n=274) of cases, and with alcohol/cocaethylene for 6.9 % (n=83).

The fall in the overall number of cases where cocaine was implicated in the cause of death is paralleled by a fall in the number of cases involving opioids (with or without other substances) from 2007 and to a lesser extent for other substances from 2008. The number of deaths in which cocaine is found is far higher than the number of cases where it has caused/contributed to death: the number of cases where cocaine was found in PM toxicology was 66.7 % (n=2015) higher than the number where it was implicated in the cause of death (n=1209).

The proportion of males in cases where cocaine was mentioned in the cause of death between 2005 and 2009 was 84.3 % (1 019/1 209); this proportion was 81.8 % for cases involving opioids and 87.6 % for cases without opioids (Tables UK C4-C6). Overall, nine in ten cases are aged 20 to 49 years. The majority of cases (92.1 %; 1113/1209) fell in the 20–24 to 45–49 years age-groups for any mention; for combinations involving opioids this proportion was 92.9 % (658/708) compared to 91.0 % (447/491) for non-opioid cases. Tables UK C4-C6 show that the male:female ratio for any cocaine-related fatality where the drug was mentioned in the cause of death in the UK during 2005–9 was 5.36:1 (1 019:190), whereas for those deaths with opioids it was 4.49:1 (579:129) and 7.05:1 (430:61) for non-opioid cases.

Table UK 2 presents annual breakdowns by gender and age-group for all cases during 2005–9 with cocaine mentioned in (a) the cause of death and (b) PM toxicology, split into substance combinations. Since some of the frequencies in these individual tables are small, the discussion primarily focuses on the period as a whole. Overall, more than eight out of ten cases are males. In respect of cause of death, the overall proportion of male deaths was 84.3 % (1 019/1 209) (range 82.6 to 87.8 %). The majority of cases (92.1 %) overall occurred in the 20–24 to 45–49 years age-groups; this was true for both genders. The lowest proportion of males (80.3 %) was in cases involving medications, etc. and the highest for other stimulants (87.3 %). The peak age-group for opioid, medications, and other substance deaths was 30–34 years.

Cases reported based on PM toxicology
It can also be seen from Table UK A2 that for Post Mortem toxicology reports any mentions of cocaine generally rose year on year from 1998 (n=78) to 2007 (n=470), but subsequently fell to 381 in 2009. In respect of sole mentions, a similar pattern was present, rising from 7 in 1998 to plateau about 36–37 in 2005–7 but falling to 19 by 2009.

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Overall, there are 12 times more cases with cocaine and other substances than cases with only cocaine mentioned. The overall ratio in post-mortem toxicology reports of cases with any mention of cocaine over cases with cocaine as the sole drug during 1998–2009 averaged 11.70:1 (3 328/289) (range 9.43:1 to 20.05:1) but 12.59:1 (2 105/160) during 2005–9. The latter result probably reflects a trend towards polysubstance abuse.

The distribution of PM cases with cocaine (Table UK B3) during the period 2005–9 is substantially the same as that described above for cause of death, but the volumes are larger. The major groupings are: opioids and other substances 52.8 % (1 063/2 015); opioids alone 17.8 % (n=358); non-opioids 15.5 % (n=312); cocaine only 7.8 % (n=157), and cocaine with alcohol/cocaethylene 6.2 % (n=125). Overall, opioids were found in 70.5 % (1421/2015) of cases. Whilst these cases show an overall fall from 2007, a decline is noticeable for cocaine alone, cocaine with alcohol/cocaethylene, and non-opioid combinations from this year, but for cases involving opioids, the decline is from 2008.

A slightly different pattern in respect of the proportion of cases falling between the 20–24 and 44–49 years age-groups was evident for PM toxicology cases: all cases with cocaine, 94.9 %, cocaine with opioids, 95.4 %, and cocaine without opioids, 93.5 % (Tables UK C7-C9). The minor variations between the opioid and non-opioid deaths are also reflected in the mean age at death: mean age at death for cause of death involving opioids was 34.64 years compared to 33.6 years for non-opioid cases; and for the PM cases the figures were 35.2 and 33.1 years respectively. The above patterns were observed in both male and females in opioid and non-opioid cases. For cases in 2005–9 where cocaine was found in PM toxicology (Tables UK C7-C9) the male:female ratios were: all cases 5.56:1 (1 708:307), cocaine and opioids 5.07:1 (1 187:234), and non-opioid cases 7.14:1 (521:73).

For PM toxicology positive cases between 2005 and 2009 (Table UK2), the overall proportion of male deaths was 84.7 % (1 708/2 015) during this period (range 82.7 to 88.9 %). The majority of cases, both overall (91.7%) and for most substance sub-sets, were concentrated in the 20–24 to 45–49 years age-groups, exhibiting similar patterns to those for cause of death.

Non-overdose cases
An examination of a subset of the UK cases above, where the deaths during 2005–9 involved cocaine in the cause of death but were coded to non-overdose ICD 10 codes, is presented in Table UK1. The overall number is 128. This relatively small proportion of all deaths (10.7 %) is probably due to the historic coding practices used by np-SAD, where X and Y codes are given preference to F codes ([6]). Of the cases in this sub-set, 1 110 (86 %) were recorded in the underlying cause and 18 (14 %) as a contributory cause (all F14X). There were no cases ascribed to other causes. About one-third (n=43) of underlying cause cases were recorded as "general medical condition", 36 suicides (all by hanging), 22 with mental and behavioural disorders (F14X), together with 11 deaths described as accidental injuries, 5 traffic accidents, and 3 events of undetermined intent. There appears to have been a decline in the number of non-overdose cases since 2007, but this may be a reflection of the wider pattern described above for all cocaine-related DRDs.

Main features
As might be expected from the results in Tables UK B2, B3 and C4-C9, opioids (alone or in combination with other substances) are the main feature of cocaine-related DRDs in the UK: implicated in 58.6 % of cause of death cases and found in 70.5 % of PM toxicology reports in 2005–9. There was a number of cases where 'legal highs' including piperazines and methcathinones were both present at PM (n=28) and implicated in the cause of death (n=10); these featured in the period 2008-9. Other stimulants were found in 17.3 % (348/2 015) and implicated in 12.4 % (150/1 209) of cases.

3.3 General trends and key findings

Trends

There is a mixed picture in terms of trends in numbers of cocaine-related DRDs (i.e. overdose and no overdose related) in the participating countries. During the 2000s, there was generally an increasing upward trend in such cases, followed by a decline in most countries (Figures 3.1 and 3.2). However, the timing of the peak occurred in different years: Denmark and France — 2007; Ireland — 2008. Depending on the data source, the UK peak occurred in either 2007 (SMR) or 2008 (GMR) ([7]). Portugal shows a fall from 2008. Hamburg and the Netherlands show a secondary peak in 2009; Italy shows peaks in 2005–6 and 2009–10;

([6]) See footnote 3 on ICD codes.
([7]) Note that one difference is that ONS etc. look at deaths registered in a given year. And thus, deaths occurring in December are likely to be registered in the following January, whereas SMR (np-SAD) look at deaths occurring in a given year. Thus, the real peak probably occurred in 2007 in the UK.

and Spain shows peaks in 2007 and 2010. Comparing 2009 and against 2008, five countries show a fall or stabilisation, whilst the other four show an increase. A consistent pattern overall emerges from a comparison of the GMR and SMR trend figures for the UK.

Figure 3.1: Trends in cocaine-related DRDs (any mention) by country/region (excluding Spain, UK): actual numbers in 7 EU countries in 1998–2011 based on SMR and GMR and reported for cocaine mentioned in the cause of death (COD), or identified in post mortem (PM)
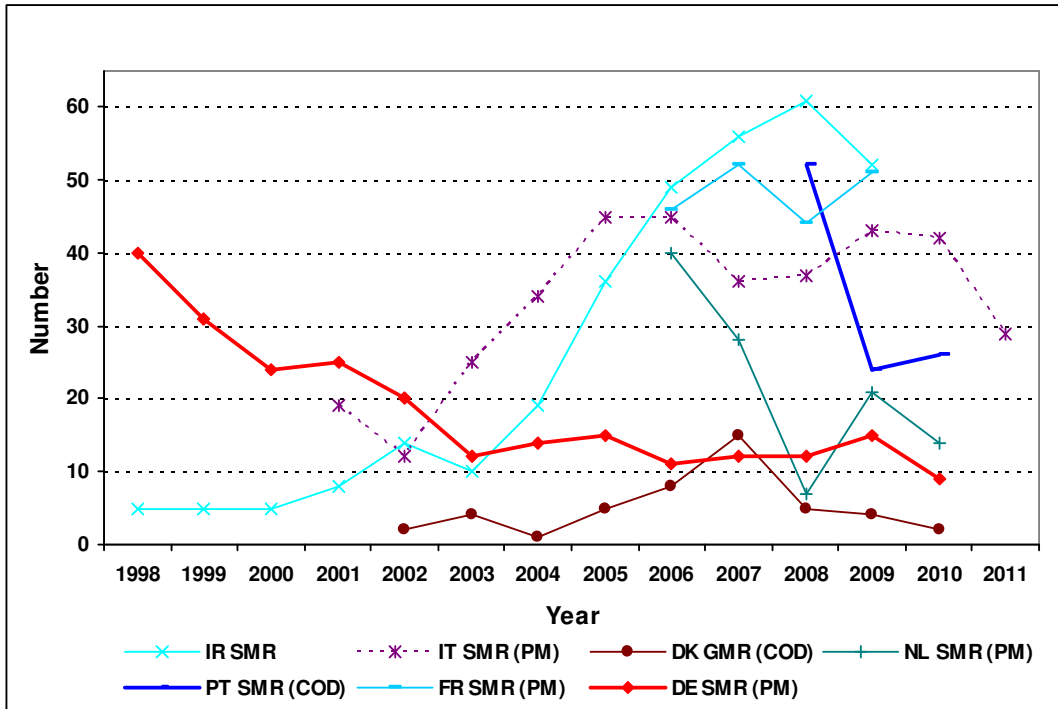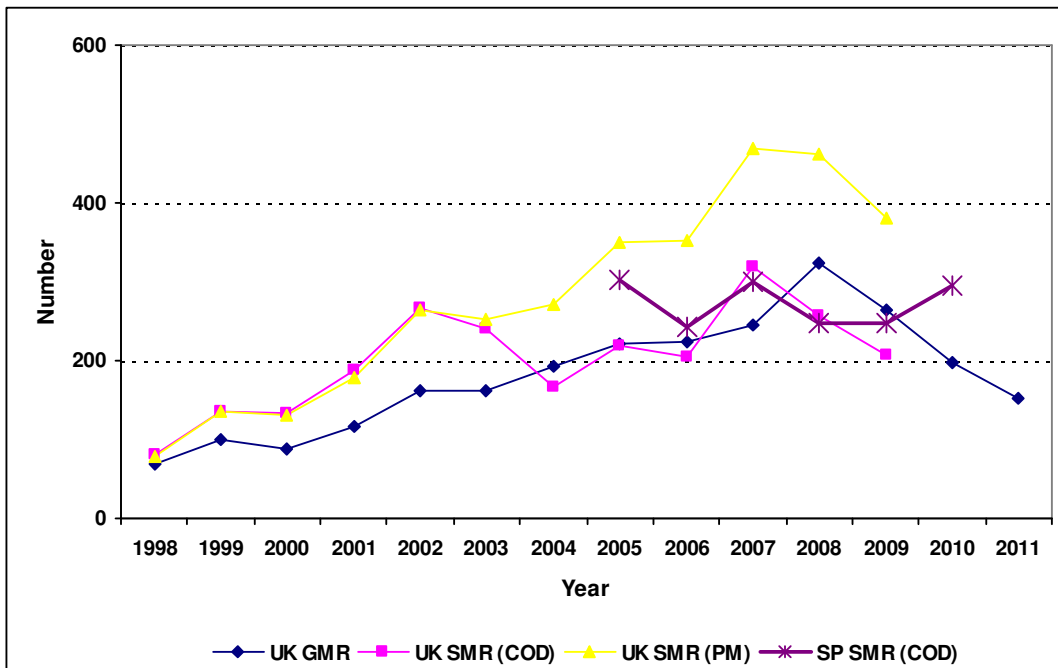

Figure 3.2: Trends in cocaine-related DRDs (any mention) Spain and UK: actual numbers in 1998–2010, based on SMR and GMR and reported for cocaine mentioned in the cause of death (COD), or identified in post mortem (PM)

Characteristics of the reported cases

The lack of detailed information on age and gender available for this project from GMRs means it is not possible to compare demographic characteristics within countries.

Table 3.11 provides an overview of the key characteristics for the data submitted; 'cause of death data' have been selected in preference to 'PM' data where available. Data provided using the ST5 ([8]) breakdown of age-groups shows that for five countries, the proportion of cases occurring in the 20–24 to 45–49 years age-groups is very close (range 90.2 to 92.1) but is lower in the Netherlands (84.2 %). Detailed information on age shows that the minimum age reported is 15 years; in two countries the oldest decedents were in their 60s but in the UK, there was an 81-year old. The mean age at death ranged from 29.4 to 34.3 years. The proportion of males ranged from 72.9 to 92.5 % for the seven countries for which the gender breakdown was available.

Table 3.11: Summary of main characteristics of cocaine-related DRDs by country/region, based on GMR or SMR and reported for cocaine mentioned in the cause of death (COD), or identified in post mortem (PM)

Characteristic	DK	FR	DE	IE	IT	NL	PT	ES	UK
GMR/SMR	GMR	SMR	SMR	SMR	SMR	SMR	SMR	SMR	SMR
COD/PM definition	COD	PM	COD	COD	COD	PM	COD	COD	COD
Period covered	2002–10	2006–9	1998–2010	2005–9	2001–11	2006–10	2008–10	2005–10	2005–9
Mean age (years)	-	-	33.9	29.4	34.9	-	-	-	34.3
Minimum age (years)	-	-	15	0	16	-	-	-	15.6
Maximum age (years)	-	-	62	65	67	-	-	-	81.3
Aged 20–49 (%)	-	-	91.7	90.2	91.0	84.2	90.3	91.7	92.1
Male (%)	-	-	72.9	81.1	86.1	75.4	92.5	86.2	84.3
Cocaine only (%)	-	32.1	2.7	28.7	-	23.7	16.5	9.7	22.7
Cocaine + alcohol only (%)	-	0.0	1.4	2.8	-	11.8	3.1	5.7	6.9
Any opioids (%)	-	63.2	91.9	55.5	-	64.5	80.4	67.9	58.6
Opioids only (%)	-	58.5	44.6	20.9	-	36.8	42.3	-	25.1
Opioids + others (%)	-	4.7	47.3	34.6	-	27.6	38.1	-	33.5
Non-opioids (%)	-	4.7	4.1	13.0	-	0.0	7.2	-	11.9
N for main sample	**46**	**193**	**74**	**254**	**367**	**76**	**97**	**1 635**	**1 209**
Underlying cause (%)	4.3	-	90.5	46.3	-	82.0	87.0	-	86.0
Mental & behavioural disorder (%)	4.3	-	0.0	0.0	-	0.0	0.0	-	17.2
General medical condition (%)	0.0	-	63.2	30.5	-	10.0	26.8	-	33.6
Transport accident (%)	0.0	-	19.0	3.2	-	0.0	17.9	-	3.9
Accidental injury (%)	0.0	-	0.0	1.1	-	20.0	17.1	-	8.6
Suicide — hanging (%)	0.0	-	4.8	1.1	-	4.0	10.6	-	20.3
Suicide — other (%)	0.0	-	4.8	1.1	-	0.0	7.3	-	0.0
Assault (%)	0.0	-	0.0	0.0	-	46.0	7.3	-	0.0
Undetermined intent (%)	-	-	4.8	9.5	-	0.0	13.0	-	2.3
Contributory cause (%)	-	-	0.0	46.3	-	0.0	0.0	-	14.0
Mental &	-	-	0.0	46.3	-	0.0	0.0	-	14.0

([8]) Standard table 5 — ST5 is the template for standard reporting of the annual number of all overdose deaths to the EMCDDA. Available in 'Data collection tools' section from http://www.emcdda.europa.eu/themes/key-indicators/drd

behavioural disorder									
Other cocaine toxicity (%)	-	-	0.0	0.0	-	0.0	0.0	-	0.0
Other causes (%)	95.7	-	9.5	7.4	-	18.0	0.0	-	0.0
*N for sub-set**	**46**	**-**	**21**	**95**	**-**	**50**	**123**	**-**	**128**

*The subsets include cases which are typically not coded as overdoses.

The role of cocaine alone being mentioned/implicated in cocaine-related DRDs (mostly described here as overdose cases) varies considerably from about 3 % in Hamburg (PM) cases to 32 % in France, but more typically lies in the 20+ % range. There is a similar variation in the cocaine + alcohol proportion, ranging from 0 to nearly 12 %. The clearest feature is that opioids are involved in most cases (range 56 to 92 %), often without other substances. Between 0 and 13 % of cases involve non-opioids alone with cocaine.

The data sub-sets, based on ICD codes, examined for cause of death were mostly non-overdose cases; because of differences in approach/definition and data-source there is some variation in the findings. For 4 countries (Denmark, the Netherlands, Portugal and the UK) the majority of cases were ascribed to underlying cause (range 82 to 91 %); for Ireland the cases were divided evenly between underlying and contributory causes (both 46 %), but in Hamburg the overwhelming majority (96 %) was 'other causes'. 'General medication condition' appears to play a significant role in such cases, ranging in 5 countries from 10 to 63 %. Deaths involving accidental injury and road traffic accidents also feature as do suicides (often by hanging) in most countries. Mental and behavioural disorders coded cases play a role in deaths in 2 countries. 'Other causes' of deaths are mentioned in 4 countries.

Remarks on the identification and classification of the reported cases

Cause of death and toxicology are mostly used by GMRs to identify cocaine-related DRDs. SMRs use a wider range of factors, the most important being toxicology, autopsy and evidence, as well as cause of death. Four out of five GMRs classify cocaine DRDs but did not give examples of this is done; three others could do it, if required for the project. Some GMRs do not use T-codes, and one GMR additionally does not S, T or Z for underlying cause. Two out of four SMRS classify such deaths but did not say how; three others could carry out a classification exercise. ICD codes are the basis for categorising cocaine deaths by 3/8 GMRs; 3 others appear to be based on ICD coding, their criteria principally related to causality. SMRs have more flexibility; they have different ways of categorisation, based primarily on toxicology or cause of death. For the identification of cases, most SMRs do not have ICD codes for the identification of cases, some do and others could undertake their own ICD coding.

Guidance is needed on the PM toxicology levels to define overdoses/poisonings as there are wide variations in levels considered toxic/fatal/lethal. These levels can be affected by polysubstance use, metabolism in terms of blood levels.

The majority of GMRs and SMRs distinguish cocaine poisonings from other types of deaths. Poisonings and somatic deaths overlap; it can be difficult to distinguish between them. Germany, Spain and Luxembourg focus on the cardiovascular aspects of cocaine deaths. Fatal excited delirium cases have been noted in Germany, Netherlands and the UK.

Apart from cocaine itself, the principal metabolites commonly identified or screened for are: benzoylecgonine, ecgonine methyl ester, cocaethylene and ecgonine. Most GMRs do not distinguish crack from powder cocaine, but 7/10 SMRs could provide information. The products of combustion can be a means of distinguishing smoked cocaine/crack from other modes of intake. However, toxicologists are not usually looking for such products. The use of crack immediately prior to death usually comes from police examination of the death scene and/or witness statements. The majority of GMRs and all SMRs can provide breakdowns of drug combinations.

Mode of use or route of administration of cocaine is not known/recorded by most GMRs. Half of SMRs do record such information; others may have information on injection marks. It is not possible to gauge the level of under-reporting without undertaking further investigations to establish in detail the full range of reasons for under-reporting and their extent.

4 Discussion

Participation

The Mini-survey was sent to a total of 30 NFP experts/SMRs, of whom 19 (63 %) responded — comparable with the project on SMR information flows carried out in 2010 (60 %). The protocol and data-table templates were sent to a total of 9 NFP experts/SMRs, all of whom submitted data.

Main findings

Data sources

For GMRs, it is mostly cause of death and toxicology which are used to identify cocaine-related DRDs. Three out of 8 GMRs use ICD codes as the basis for categorising cocaine deaths, with 3 others appearing to be based on ICD coding; the criteria principally used relate to causality — probably based on cause of death. Some GMRs do not use T-codes; one does not use S, T or Z codes for underlying cause of death. For such countries it might be possible to select a sample of all (poisoning?) deaths and see what substances were recorded in the toxicology (if available).

A wider range of factors is used by SMRs: toxicology, autopsy, evidence and cause of death. For them there is more flexibility with 4/8 stating they could adopt any categorisation scheme; for the other three there were several different ways of categorisation, again based primarily on toxicology or cause of death. Most SMRs do not have ICD codes for case-identification of cases; some could undertake their own ICD coding. A by-product of doing the latter might be a step towards improving GMR coding.

The majority of respondents (both GMRs and SMRs) distinguish cocaine poisonings from other types of deaths. Apart from cocaine itself, the principal metabolites commonly identified or screened for are: benzoylecgonine, ecgonine methyl ester, cocaethylene and ecgonine. Most GMRs do not distinguish crack from powder cocaine, but most SMRs could provide some information — but this is not collected systematically. Any information provided from such sources would have to be regarded as minimum levels rather than as absolute measures.

Trends

There is a mixed picture in terms of trends in numbers of cocaine-related DRDs in the participating countries. During the 2000s there was generally an increasing upward trend in such cases, followed by a decline in most countries. Peaks occurred in different years. Comparing 2009 and against 2008, 5 countries show a fall or stabilisation whilst the other 4 show an increase; the available data cannot provide an indication of whether these patterns will be sustained. It is not possible to aggregate these figures to derive overall trends due to the differences in definitions and data sources. A clearer picture might emerge if these figures were used in conjunction with figures based on those presented at the 2010 expert meeting, when data for longer periods were presented for some countries. Additional or supplementary information may be contained in NFP annual reports.

The patterns in cocaine-related DRDs need to be set in a wider context. Part of the recent decline apparent in some countries (EMCDDA, 2012), may be related to a decline in cocaine purity and/or a shift to using alternative stimulants, including 'legal highs'. For example, the mean purity of powder cocaine seized by the police in England & Wales fell from 33 % in 2007 to 24 % in 2010; the purity of 'Crack' cocaine is reported to have fallen during the same period from 52 % to 31% (UK NFP, 2012). Last year use of powder cocaine amongst 16–59 year-olds in England & Wales fell from 3 % in 2008/9 to 2 % in 2010/11 (Smith and Flatley, 2011). It has been proposed that the fall in ecstasy and cocaine-related deaths in the United Kingdom since 2008 may be as a result of users switching to 'legal highs' with the suggestion that this may have had an unintended harm reduction effect (Bird, 2010). There is now emerging evidence of a large problem of cocaine-related morbidity leading to hospitalisation and emergency visits (Mena et al., 2012). Cocaine-related mortality could also be related to a wider set of indicators, as was done a number of years ago for the UK (Schifano and Corkery, 2006, 2008).

Characteristics of the reported cocaine-related cases

Around 90 % of deaths occurred in the 20–24 to 45–49 years age-groups in 6 countries, and 84 % in a sixth country. Where detailed information is available on age, the minimum age reported is 15 years and the maximum typically in their 60s. Mean age at death is typically in the late 20s or early 30s, much younger than the mean commonly reported using the EMCDDA Standard (i.e. all overdose deaths, accounted for

mainly by opioid related cases). Males accounted for 73 to 93 % of cases, broadly in line with the general findings for deaths reported to the EMCDDA.

The role of cocaine alone being mentioned/implicated in cocaine-related DRDs varies considerably but typically lies in the 20+ % range. There is a similar variation in the cocaine + alcohol proportion. The clearest feature is that opioids are involved in most cases (range 56 to 92 %), often without other substances. This dominant presence of opioids in cocaine-related DRDs (mostly defined here as overdoses) mirrors wider patterns evident in European DRDs. The finding suggests that many cocaine users are problematic users, and that they are also polysubstance users; both factors increasing the risk of overdose/poisoning and of death.

The minimum and maximum ages in the non-opioid group in Hamburg were lower than in the opioid group. In the Netherlands, there was a greater concentration of cases in the 30–34 to 45–49 year age-bands in respect of deaths with opioids than for non-opioid cases, where cases were more widely dispersed across the age-range. This may reflect an ageing cohort of opioid/opiate users in these regions/countries.

There was one infant who suffered an intrauterine death at 32 weeks gestation where cocaine was found in the post-mortem toxicology and implicated in the cause of death. It may be that other such cases occur occasionally but are not reported. In the UK some deaths of neonates (not due to cocaine use) caused by maternal drug use have not been the subject of a formal coroner's inquest because it was not thought to be in the 'public interest' and thus did not appear in the official record as being 'drug-related'. Therefore, it is possible that these and similar events may be under-recorded.

Cocaine mentioned in cause of death: mostly non-overdose

The data sub-sets, based on ICD codes, examined for cause of death were mostly non-overdose cases; because of differences in approach/definition and data-source there is some variation in the findings. In 4 countries most cases were ascribed to underlying cause, in one country cases were divided evenly between underlying and contributory causes, but in one region 96 % was 'other causes'. 'General medication condition' appears to play a large contribution to non-overdose cases, the proportion differing according to the definition used. This category captures a whole range of underlying causes of death which might merit closer examination in the future using a finer-grained approach. Deaths involving accidental injury and road traffic accidents also feature as do suicides (often by hanging) in most countries. Mental and behavioural disorders play a role in deaths in 2 countries. 'Other causes' of deaths are mentioned in 4 countries, often related to cardiovascular problems. The latter were noted as issues during the parallel session.

Methodological issues

Other countries interested in supplying information were unable to do so within the time-frame of the present project because of insufficient time or resources; others were unable to do so because of legal or confidentiality issues (e.g. Slovenia). The latter meant that some countries (e.g. France) were unable to provide age and gender breakdowns in case individual decedents became identifiable, although data requested were anonymised, aggregated statistics.

For the most part, it is difficult to compare the data provided by one country with that from another for several reasons: (a) different types of data-sources from registries with different roles, purposes and nature; (b) underlying differences in the data-items collected; (c) different definitions of DRDs, even where based on ICD 10 codes there are varying approaches; (d) different criteria used to define cocaine-related DRDs; and (e) varying lengths of time for which data are available. It is possible to look at trends over time within a country/region, but even then consistency of data may vary over time in terms of geographical coverage (e.g. the UK SMR), quality of data reported, and level of detail recorded. These are issues common to previous data-collation exercises conducted by the EMCDDA (e.g. Wirl, 2010).

There were some differences in data provided due to misunderstanding of what was required and/or adopting available data to the project so as to be able to submit something that could be used. Poisonings and somatic deaths overlap so it can be difficult to distinguish between them. Some registries focus on particular features which distinguish cocaine-related fatalities from other cases, whilst others do not have access to such detailed information on which to base their investigations. This may cause under-identification of relevant cases. For most GMRs, the mode of use or route of administration of cocaine is not known/recorded. Half of SMRs do record such information but this is dependent on the quality of data submitted. These factors may lead to under-identification of somatic cases associated with cocaine use, as the link would only be apparent from evidential information or intelligence.

Whilst not all cocaine metabolites are screened for in all countries, the common ones are typically identified. The products of combustion can be used as a means of distinguishing smoked cocaine/crack from other modes of intake. However, toxicologists are not usually looking for such products. Information on the use of crack immediately prior to death usually comes from police examination of the death scene and/or witness statements. But such information would not appear to be either systematically recorded or collated; thus the role of crack in cocaine deaths is probably under-reported.

There may be some types of death where toxicological analysis may not be undertaken or the role of psychoactive substances underplayed because of the main cause of death e.g. assaults, suicides (particularly using violent means such as hanging), or accidents (road traffic accidents, drowning, accidental injury). Such cases may therefore not be recorded as drug-related let alone as cocaine-related. Thus, the data provided here is likely an underestimate of the presence of cocaine in these kinds of unnatural death.

Levels of under-identification and reporting cannot be gauged without undertaking further investigations to establish in detail the full range of reasons for under-reporting and their extent. Some form of audit of relevant data-sources/providers is necessary, e.g. of coronial files (Ghodse et al., 2010). For this reason, we did not compute rates of cocaine-related mortality which could be misleading as the reporting systems differ and make difficult to compute sufficiently robust rates at the population level. This allows trends over time to be observed, but does not risk misleading the reader with estimates whose precision is open to question.

It is not sensible either to add together the data presented here for each country/region for the reasons given above, and also because the small numbers given for several countries will be overshadowed by those from countries such as Spain and the UK. However, the examination conducted of the key characteristics of cases from each country shows many commonalities do exist. This is a good starting point for future research activities in this field.

5 Future collaborative research on cocaine-related DRDs in Europe

Widespread interest was expressed in the phenomenon of cocaine-related DRDs at the 2011 expert meeting, many countries participating in the earlier phases of this project. Although only 9 countries/regions were able to contribute data during the present time-scale, others have expressed a desire to submit data, with additional countries willing to do so if legal, ethical and data privacy obstacles can be overcome.

GMR information, where available, provided some indications of long-term trends and possible numbers of cases, as did some SMR data. The latter were beneficial in providing a more in-depth understanding of aggregated datasets. As with other projects looking at DRDs, this project faced problems arising from the different nature, purposes, roles and type of data recorded by individual registries, especially SMRs. The level of detail, use or not of ICD codes and other information to identify relevant cases, as well as varying selection criteria are impacted by those differences. In turn, this affected the quality and type of data that were submitted. However, this project gives pointers for where further refinement could be targeted, especially around making data needs clearer.

Guidance is needed on the PM toxicology levels to define overdoses/poisonings. There are wide variations in levels considered toxic/fatal/lethal. These levels can be affected by polysubstance use, metabolism in terms of blood levels. It is important to know levels for sole cocaine deaths. The provision of such guidance across the EU may help improve case-identification both prospectively and in any future retrospective data analyses.

If this exercise were to be repeated, either for cocaine or other substances, the practical issues of identifying and extracting relevant cases from registries would be easier as they have already identified appropriate techniques. It would be valuable to ask those countries that were only able to provide limited data during the time-scale of the present project to submit their more complete data and to invite others who expressed interest to do so. This would enable a more complete picture of the phenomenon, especially of overdose/poisoning cases, to be described.

The analyses of non-overdose fatalities undertaken by this project suggests that it would be valuable to examine in more detail those cases ascribed to 'general medical conditions', 'cardiovascular and other issues', etc. scientific medical literature is increasingly featuring small-scale case-study or anecdotal reports of conditions associated with the acute and chronic use of cocaine. For example, the German, Spanish and Luxembourgois SMRs focus on the cardiovascular aspects of cocaine deaths. Fatal excited delirium cases have been noted in Germany, the Netherlands and the UK. A recent review by Mena et al. (2012) has found a considerable increase in the numbers of cocaine-related hospital episodes and emergency admissions

since the end of the 1990s in the countries that reported the highest number of episodes, numbers peaking around 2007/8 in Spain and the UK. This underlines the importance of seeking a more accurate picture of the numerical extent of such conditions and a fuller understanding of what conditions and diseases are caused, and how, by cocaine use. Thus would probably be best done by looking at anonymised individual case records. There is a consensus that future potential study participants should be asked if they could supply such data if approached to do so.

Other areas that could also be examined in the future include: the role of cocaine in deaths involving accidental injuries, Road Traffic Accidents, and suicides — especially by hanging. There is anecdotal material to suggest that stimulants (such as cocaine, MDMA, amphetamine, and more recently methcathinones) are often consumed by the decedents in such cases.

In conclusion, cocaine-related DRDs are an increasingly important feature of drug-related mortality in Europe - perhaps accounting for more than 1 000 deaths each year — and are likely to continue to be so in the future, due to the large number of chronic and problematic users. It is necessary to understand the nature and extent of this phenomenon. Despite a number of practical and legal issues, the main objectives of this project have been achieved in describing trends in numbers of such deaths, and identifying some of the key characteristics of decedents, the substances involved in their deaths, and why how they died. Some core commonalities have been observed, but more information is needed in order to flesh out the skeleton presented here. The data and information presented provide the first insights into the nature and possible extent of the phenomenon of cocaine-related DRDs in Europe.

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