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Title	Trends in cocaine use and cocaine-related harms in Ireland: a retrospective, multi-source database study
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Publication date	2025-07-02
Original Citation	Mongan, D., Millar, S.R., Carew, A.M., Kelleher, C., Daly, A., Lyons, S., Galvin, B. and Smyth, B.P., 2025. Trends in cocaine use and cocaine-related harms in Ireland: a retrospective, multi-source database study. BMC Public Health, 25(1), pp.1-10. https://doi.org/10.1186/s12889-025-23224-y
Type of publication	Article (peer reviewed)
Link to publisher's version	10.1186/s12889-025-23224-y
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BMC Public Health

RESEARCH

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Trends in cocaine use and cocaine-related harms in Ireland: a retrospective, multi-source database study

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Abstract

Background Increased cocaine supply has coincided with increased global cocaine use. In 2019 Ireland had one of the highest last-year rates of cocaine use in Europe. However, there is a lack of data on the health-related impacts of cocaine use in European countries over time.

Methods This retrospective, multi-source database study utilised data from national databases to evaluate the following time trends: (1) prevalence of cocaine use; (2) number of cocaine-related hospital discharges; (3) number of cocaine-related psychiatric hospital admissions; (4) treatment demand for problem cocaine use; and (5) cocaine-related deaths. Joinpoint regression was used to examine change points over time and average annual percentage changes (AAPCs).

Results Last-year cocaine use among 15–64-year-olds increased from 1·1% in 2002/03 to 2·4% in 2022/23. The number of cocaine-related acute hospital discharges per 100,000 population increased from 1·4 in 2000 to 24·3 in 2023 (AAPC: 13·0%; 95% CI: 11·95, 14·84), and psychiatric hospitalisations increased from 0·2 in 2000 to 2·4 in 2022 (AAPC: 11·1%; 95% CI: 9·41, 15·48). Treatment entrants reporting cocaine as a main problem drug increased from 1·5 per 100,000 population in 2000 to 93·2 in 2023 (AAPC: 17·6%; 95% CI: 15·89, 20·74), while cocaine-related deaths increased from 0·3 in 2000 to 5·6 in 2020 (AAPC: 16·9%; 95% CI: 14·71, 21·70). In general, rates of harm increased from 2000 to 2007, decreased until 2011–2013, and since 2013 have increased significantly and consistently.

Conclusions Multiple databases show significant increases in cocaine-related harm since 2000. Responding to cocaine-related health problems and prevention efforts focused on cocaine constitute a public health priority.

Keywords Cocaine, Use, Trends, Harms, Treatment, Deaths

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Introduction

Cocaine is a natural product extracted from the leaves of *Erythroxylon coca* Lam (coca leaves). Its most common forms comprise hydrochloride salt, appearing as a fine white powder, and base (crack cocaine), appearing crystal- or rock-like in form [1]. Cocaine use is associated with a number of negative health consequences [2]. It has a high potential for drug abuse and addiction, with 5–6% of people who use cocaine becoming dependent within their first year of use [3]. Overall mortality is substantially elevated among people with regular or problematic cocaine use when compared with the general population. A 2021 systematic review estimated the all-cause standardised mortality rate of people with regular or problematic cocaine use to be six times that of non-users and found that cocaine use was associated with suicide, overdose, accidental injury, homicide and AIDS-related mortality [4]. As a vasoconstrictor, cocaine is also associated with a number of cardiovascular diseases including hypertension, tachycardia, ventricular arrhythmias, myocardial infarction and stroke [5]. In 2017, it was estimated that 0·32% of all-cause deaths globally were associated with cocaine dependence, equating to 178,000 excess all-cause deaths [6]. In Europe, cocaine is the second most frequently reported illicit drug by first-time entrants to treatment and it is estimated that cocaine was involved in one fifth of drug overdose deaths in 2022. Among hospital emergency departments that participated in the Euro DEN project in 2022, cocaine was the second most reported substance in acute drug-toxicity presentations [7].

Cocaine use is also associated with adverse non-fatal health harms including psychosis, respiratory disease, blood-borne viruses and sexually transmitted infections [6]. Prenatal use of cocaine use is associated with maternal morbidity including hypertension, myocardial infarction, pulmonary oedema and renal failure, while foetal effects include prematurity, intrauterine growth restriction and neurological deficits [8].

In 2023, the United Nations Office for Drugs and Crime (UNODC) reported that the global cocaine supply was at a record high, with Western Europe, alongside Central Europe and North America, being the largest destination markets for cocaine [9]. Cultivation of cocaine doubled between 2013 and 2017, peaked in 2018, and rose sharply again in 2021. The process from coca bush cultivation to cocaine hydrochloride has become increasingly efficient, further contributing to the global supply of cocaine [9]. In 2022, 323 tonnes of cocaine were seized in the European Union (EU); this was the sixth consecutive year that seizures exceeded previous records [7]. Similar trends have been observed in Ireland, with a 620% increase in the number of cocaine seizures between 2003 and 2022 (from 566 to 4,020) [10].

Between 2022 and 2023, cocaine residues in municipal wastewater increased in two-thirds of the 88 European cities who participated in the Europe-wide network SCORE (Sewage analysis CORe group — Europe) [11]. Cocaine purity has also increased across Europe; at the retail level, cocaine purity ranged from 52 to 83% in 2022, a level 45% higher than in 2012 [12]. European drug checking services, although not nationally representative, reported that cocaine was the most common substance they screened in 2022. These trends have been accompanied by a 4% decrease in the price of cocaine between 2012 and 2022 [7]. As the increasing quantities of cocaine seized do not appear to have affected purity, price or levels of use across Europe, it is likely that the increase in cocaine seized reflects greater availability, rather than factors such as changes in law enforcement activity. A review of the relationship between price, purity and drug-related harm found consistent inverse relationships; increased purity-adjusted price was associated with lower harm, while reduced purity-adjusted price was associated with increased harm, in particular, with emergency department admissions and overdoses [13].

Increased cocaine supply has coincided with increased global cocaine use and in 2021 it was estimated that 22 million individuals worldwide used cocaine [9]. In 2019, Ireland had one of the highest last-year rates of cocaine use in Europe, at 2·4% in the general population aged 15–64 years. Furthermore, last-year cocaine use among 15–34-year-olds in Ireland was the second highest in Europe at 4·8% [14]. Given these increases in supply and use, it is important to examine the health-related impacts of cocaine use in Ireland. Therefore, the aim of this study was to describe trends in cocaine use and cocaine-related health harms to assess if changes in the international cocaine market over time have negatively affected health using four indicators: cocaine-related hospitalisations, psychiatric hospital admissions, numbers in treatment for cocaine use and cocaine-related mortality in Ireland.

Methods

Study design

For this retrospective, multi-source database study, data were requested from five national databases in Ireland to evaluate the following time trends: (1) prevalence of cocaine use in the general population, (2) number of cocaine-related hospital discharges, (3) number of cocaine-related psychiatric hospital admissions, (4) treatment demand for problem use of cocaine, and (5) number of people who died from cocaine-related causes. For each data source we included data from 2000 to the most recent year that data were available. Data are presented as the number per 100,000 of the general population based on national census and projected population figures

using data from the Central Statistics Office in Ireland [15]. As only aggregated, anonymised data were available, individual patient data from the different databases could not be linked.

Data sources

General population surveys on drug use

Since 2002/03, national surveys on drug use have been conducted approximately every four years (2002/03, 2006/07, 2012/11, 2014/15, 2019/20, 2022/23) in Ireland [14, 16–20]. The first five surveys were standalone drug surveys that interviewed respondents in their own home about their tobacco, alcohol and drug use. The Healthy Ireland survey has been conducted annually in Ireland since 2015 and collects information on a wide range of health behaviours. In 2022/23, for the first time, it included questions on drug use, and respondents were interviewed by telephone. As the first three surveys only included 15–64-year-olds, prevalence rates across the whole time period are presented for this age group. The response rates for the surveys ranged from 61 to 70% for the first five surveys and 50% for the 2022/23 survey. Last-year prevalence of cocaine use was recorded in each survey and population rates for 15–64-year-olds are presented in this analysis.

Hospital in-patient enquiry scheme

The Hospital In-Patient Enquiry Scheme (HIPE) is a national health information system designed to collect episode-level demographic, clinical and administrative information on discharges from acute public hospitals. Acute hospitals are defined as those that provide medical and surgical treatment of relatively short duration [21]. HIPE is managed by the Health Service Executive and HIPE data from 2000 to 2023 are included in this analysis. From 2000 to 2004, diagnoses were coded using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). From 2005 to 2019, the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) was used. In 2020, HIPE changed its classification coding to use the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification and Australian Classification of Health Interventions (ACHI) and Australian Coding Standards (ACS), collectively referred to as ICD-10-AM/ACHI/ACS. The number of secondary diagnoses recorded by HIPE changed four times over the study period, from 5 in 2000 to 9 in 2002, 19 in 2005, and finally 29 in 2011. For 2000–2004, we included all discharges that had either a primary or secondary diagnosis with any of the following ICD-9-CM codes: 304·2, 304·21–304·23, 305·6, or 305·61–305·63. For 2005–2023 we included all discharges with a primary or secondary diagnosis with any of the following ICD-10-AM codes: F14·0–F14·9, T40·5, or R782 (Table S1).

National psychiatric in-patient reporting system

The National Psychiatric In-Patient Reporting System (NPIRS) gathers data on admissions to, and discharges from, public and private psychiatric hospitals and units in Ireland that are on the Register of Approved Centres under the Mental Health Act (2001). The NPIRS is managed by the Health Research Board (HRB) and data for 2000–2022 are included in this analysis. Admissions and discharges represent episodes rather than individual patients. The clinical coding used by the NPIRS is the World Health Organization (WHO) International Classification of Diseases (ICD-10). From 2000 to 2020, the primary diagnosis and one secondary diagnosis were recorded. Since 2021, up to four diagnoses can be recorded. For this analysis, we included all admissions reported to the NPIRS with either a primary or secondary diagnosis with any of the following ICD-10 codes: F14·0–F14·9 (Table S1).

National drug treatment reporting system

Data on cocaine treatment were obtained for 2000–2023 from the National Drug Treatment Reporting System (NDTRS), a national register of addiction treatment in Ireland that is maintained by the HRB. NDTRS data are collected according to the European Union Drugs Agency (EUDA) Treatment Demand Indicator (TDI) protocol [22]. Treatment data are provided by statutory and non-statutory services, including out-patient services, residential centres and prisons, and includes public, voluntary and private treatment services in receipt of public funds. Service providers collect data including client demographic and socioeconomic information, and current problem drugs (up to five substances). The NDTRS records episodes, or cases of treatment; individuals may appear more than once if treated in different centres or if they return to treatment in the same service. We included NDTRS cases where cocaine was identified by the client as (i) their main drug of concern, and (ii) either their main or secondary drug of concern. As there have been changes throughout the study period in the number of treatment centres participating in the NDTRS, we undertook a sensitivity analysis using opioids as a 'control' substance to assess if trends were similar.

National drug-related deaths index

Data on cocaine mortality were collected for 2000–2020 from the National Drug-Related Deaths Index (NDRDI), which is also managed by the HRB. It is classified as a special register for the purposes of reporting to EUDA [23]. Coronial files are the main data source for the NDRDI. Other data sources include the general mortality register

(via the Central Statistics Office), acute hospitals data (via the HIPE database) and the national opioid agonist treatment register (via the Central Treatment List). All data are matched across sources to avoid duplication and to enable a complete census of drug-related deaths nationally. The NDRDI records both poisoning and non-poisoning drug and/or alcohol-related deaths. The NDRDI's definition of a poisoning death is a death directly due to the toxic effect of one or more drugs on the body, as indicated by the death certificate. The NDRDI also records all other deaths that are not poisonings among persons with a recorded history of drug and/or alcohol dependence or non-dependent misuse of drugs irrespective of whether the drug was (or was not) directly implicated in the death (defined as "non-poisoning"). For this study we included (i) deaths due to cocaine poisoning; and (ii) all deaths (cocaine poisoning deaths and non-poisoning deaths where the person had a history of cocaine use).

The authors had access to each of the datasets included in this study, with the exception of the HIPE dataset. Further information on the data sources may be found in the Supplementary File.

Data analysis

Joinpoint Regression Program (Version 5·0 Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute) [24] was used to examine temporal changes in cocaine-related hospitalisations, treatment and mortality since 2000 and to identify points in time at which statistically significant changes in trends occurred. The joinpoint model determines the number of segments needed to characterise a trend, where the segments start and end, and the annual percentage change (APC) for each segment. The point where two segments meet is called a 'joinpoint' or 'change point' [25]. A change point is a specific time point where a statistically significant trend change occurred (or a change in the APC). Time periods for change in APCs varied according to whether (or not) there were statistically significant change points. Where a joinpoint was detected, we report the APC for each segment to showcase the change in trend. For each indicator in this analysis, a summary of the overall trend since 2000 was expressed as the average annual percentage change (AAPC). The AAPC is a summary measure which describes the weighted average of the APCs from the joinpoint model. Both an APC and AAPC were considered statistically significant if the corresponding 95% confidence intervals (CIs) did not contain the null value.

Results

Cocaine use

Figure 1 shows trends in the prevalence of last-year cocaine use among 15–64-year-olds in Ireland during the study period. The prevalence of cocaine use increased, from 1·1% in 2002/03 to 2·4% in 2022/23. The largest increase occurred between 2014/15 and 2019/20 (from 1·4% to 2·3%).

Cocaine hospitalisations

There was an overall increase in the number of acute hospital discharges with a cocaine-related diagnosis per 100,000 population from 1·4 in 2000 to 24·3 in 2023 (Fig. 2), corresponding to an AAPC of 13·0% (95% CI: 11·95, 14·84) (Table 1). Joinpoint regression analysis identified three change points across the study period. A significant increase in discharges was observed between 2000 and 2007 (APC: 36·7%; 95% CI: 31·03, 44·96),

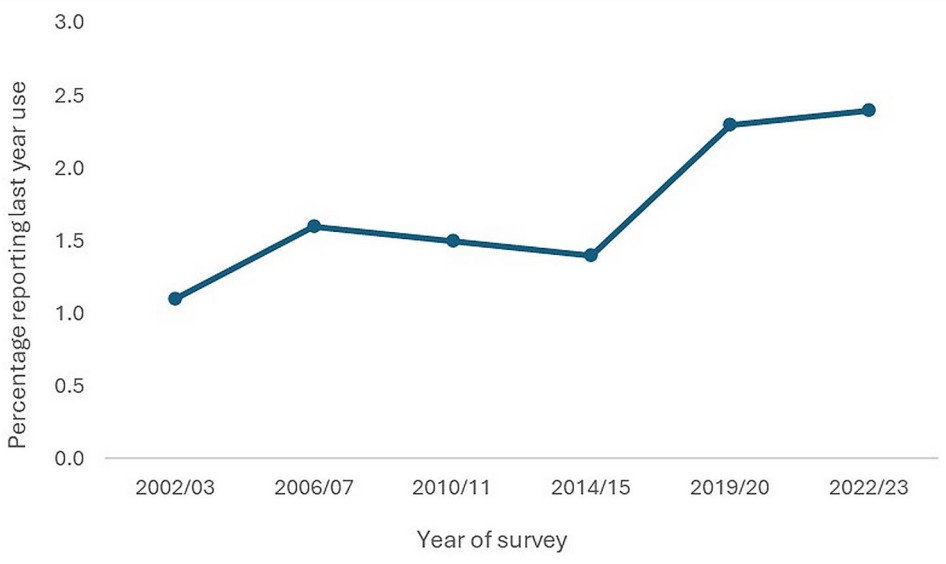


Fig. 1 Last year prevalence of cocaine use among 15–64-year-olds in Ireland 2002/03–2022/23

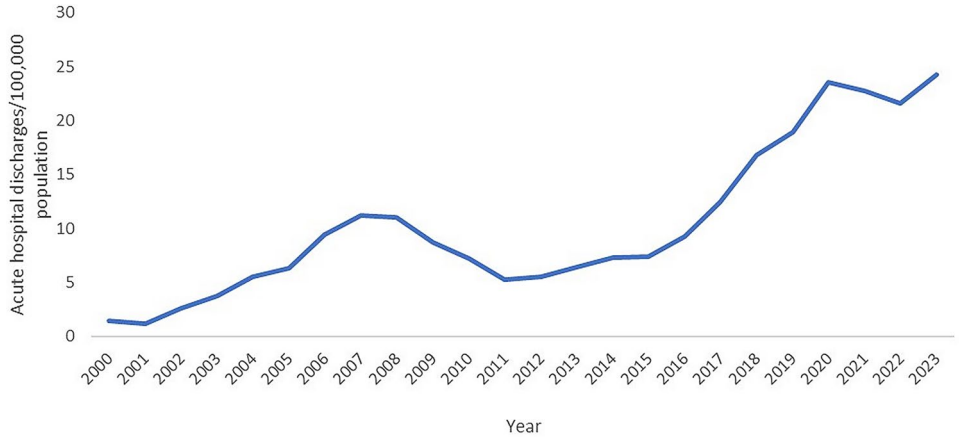


Fig. 2 Number of acute hospital discharges per 100,000 population with a cocaine-related diagnosis, 2000–2023

Table 1 Joinpoint analysis – average annual percentage change across each indicator, and number of change points

	Years	AAPC*	95% CI	*p*-value	Number of change points
Acute hospital discharges	2000–2023	13·03	11·95, 14·84	< 0·001	3
Psychiatric hospital admissions	2000–2022	11·08	9·41, 15·48	< 0·001	3
Treatment demand – cocaine as main problem drug	2000–2023	17·62	15·89, 20·74	< 0·001	2
Treatment demand – cocaine as any problem drug	2000–2023	10·08	9·43, 11·09	< 0·001	3
Cocaine deaths – poisoning	2000–2020	15·65	13·75, 19·12	< 0·001	2
Cocaine deaths – all causes	2000–2020	16·86	14·71, 21·70	< 0·001	3

AAPC: average annual percentage change

followed by a significant decrease between 2007 and 2012 (APC: -17·1%; 95% CI: -23·91, -12·30), and a significant increase from 2012 to 2020 (APC: 21·3%; 95% CI: 18·70, 26·40) (Table 2). Cocaine-related discharges remained stable from 2020 to 2023.

An increase in psychiatric hospitalisations from 0·24 per 100,000 population in 2000 to 2·4 in 2022 (Fig. 3) was observed with an AAPC of 11·1% (95% CI: 9·41, 15·48) (Table 1). Three change points were identified; psychiatric hospitalisations significantly increased between 2000 and 2006 (APC: 20·8%; 95% CI: 11·44, 60·16), decreased between 2006 and 2011 (APC: -11·9%), and significantly increased between 2011 and 2018 (APC: 28·4%; 95% CI: 22·52, 59·07) (Table 2). Hospitalisations remained stable from 2018 to 2022.

Cocaine treatment

Treatment entrants reporting cocaine as their main problem drug increased from 1·5 per 100,000 population in 2000 to 93·2 in 2023 (Fig. 4) with an AAPC of 17·6% (95% CI: 15·89, 20·74) (Table 1). Two change points were identified. The number of treatment entrants significantly increased between 2000 and 2007 (APC: 35·7%; 95% CI: 26·26, 54·88), decreased between 2007 and 2013 (APC: -3·3%), and increased significantly between 2013 and 2023 (APC: 19·7%; 95% CI: 17·88, 22·31) (Table 2). Among treatment entrants who reported cocaine as any problem drug, an increase from 16·3 per 100,000 population to 140·2 was observed between 2000 and 2023, giving an AAPC of 10·1% (95% CI: 9·43, 11·09). The number of treatment entrants with cocaine as any problem drug increased significantly between 2000 and 2003 (APC: 34·5%; 95% CI: 24·39, 55·10) followed by another statistically significant increase (albeit to a lesser extent) between 2003 and 2009 (APC: 8·7%; 95% CI: 5·69, 11·43). Between 2009 and 2013, the number of entrants decreased significantly (APC: -10·4%; 95% CI: -14·17, -7·01) before increasing significantly between 2013 and 2023 (APC: 13·4%; 95% CI: 12·64, 14·43) (Table 2).

Cocaine deaths

The number of cocaine poisoning deaths increased from 0·13 per 100,000 in 2000 to 2·6 in 2020 with an AAPC of 15·7% (95% CI: 13·75, 19·12) (Fig. 5; Table 1). Two change points were identified; poisoning deaths increased significantly between 2000 and 2007 (APC: 44·4%; 95% CI: 34·97, 60·60), decreased significantly between 2007 and 2011 (APC: -27·8%; 95% CI: -40·37, -16·43), and increased significantly between 2011 and 2020 (APC: 20·0%; 95% CI: 16·32, 23·50). A similar trend was observed for deaths from all causes, with these deaths increasing from 0·29 in 2000 to 5·6 in 2020 with an AAPC of 16·9% (95% CI: 14·71, 21·70) (Fig. 5; Table 1). Two change points were identified; deaths increased significantly between 2000 and 2006 (APC: 49·6%; 95% CI: 34·75, 80·09), decreased significantly between 2006 and 2011 (APC: -13·2%: 95%

Table 2 Joinpoint analysis to identify changes in trends between 2000 and 2023

	Crude rate per 100,000 population at joinpoints				
	Start	**End**	**APC**	**95% CI**	***p*-value**
Acute hospital discharges					
2000–2007	1·42	11·20	36·67	31·03, 44·96	< 0·001
2007–2012	11·20	5·55	-17·05	-23·91, -12·30	< 0·001
2012–2020	5·55	23·51	21·30	18·70, 26·40	< 0·001
2020–2023	23·51	24·29	0·66	-7·13, 6·44	0·776
Psychiatric hospital admissions					
2000–2006	0·24	0·69	20·76	11·44, 60·16	0·002
2006–2011	0·69	0·28	-11·91	-31·48, 0·27	0·06
2011–2018	0·28	2·14	28·38	22·52, 59·07	0·002
2018–2022	2·14	2·41	1·67	-7·62, 9·06	0·605
Treatment demand – cocaine as main problem drug					
2000–2007	1·50	18·01	35·71	26·26, 54·88	< 0·001
2007–2013	18·01	15·34	-3·26	-15·37, 2·42	0·218
2013–2023	15·34	93·21	19·67	17·88, 22·31	< 0·001
Treatment demand – cocaine as any problem drug					
2000–2003	16·26	37·92	34·50	24·39, 55·10	< 0·001
2003–2009	37·92	59·36	8·68	5·69, 11·43	< 0·001
2009–2013	59·36	43·17	-10·38	-14·17, -7·01	< 0·001
2013–2023	43·17	140·24	13·42	12·64, 14·43	< 0·001
Cocaine deaths – poisonings					
2000–2007	0·13	1·46	44·41	34·97, 60·60	< 0·001
2007–2011	1·46	0·52	-27·80	-40·37, -16·43	< 0·001
2011–2020	0·52	2·61	19·96	16·32, 25·50	< 0·001
Cocaine deaths – all causes					
2000–2006	0·29	2·86	49·61	34·75, 80·09	< 0·001
2006–2011	2·86	1·53	-13·17	-28·38, -3·82	0·012
2011–2020	1·53	5·59	16·89	13·25, 23·84	< 0·001

APC: annual percentage change

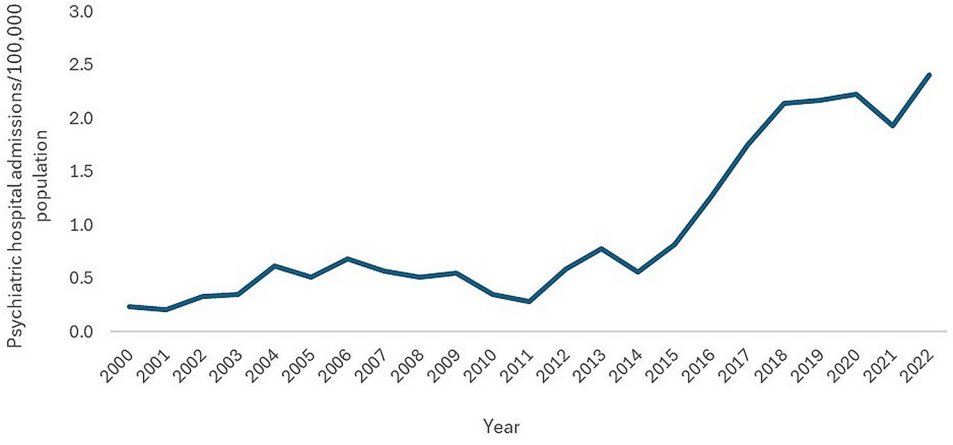


Fig. 3 Number of psychiatric hospital admissions per 100,000 population with a cocaine-related diagnosis, 2000–2022

CI: -28·38, -3·82) before increasing significantly between 2011 and 2020 (APC: 16·9%; 95% CI: 13·3, 23·8) (Table 2).

Discussion

In this study, multiple Irish data sources demonstrated fluctuations in levels of cocaine-related harm since 2000, with very similar trends observed for each indicator. The prevalence of last-year cocaine use has increased in Ireland since 2002/03, with significant increases observed between 2002/03 and 2006/07 and between 2014/15 and 2019/20. Increased drug use in Ireland in the early 2000s has been attributed to young people possessing greater levels of disposable income, reduced parental monitoring due to high employment [26] and increased demand

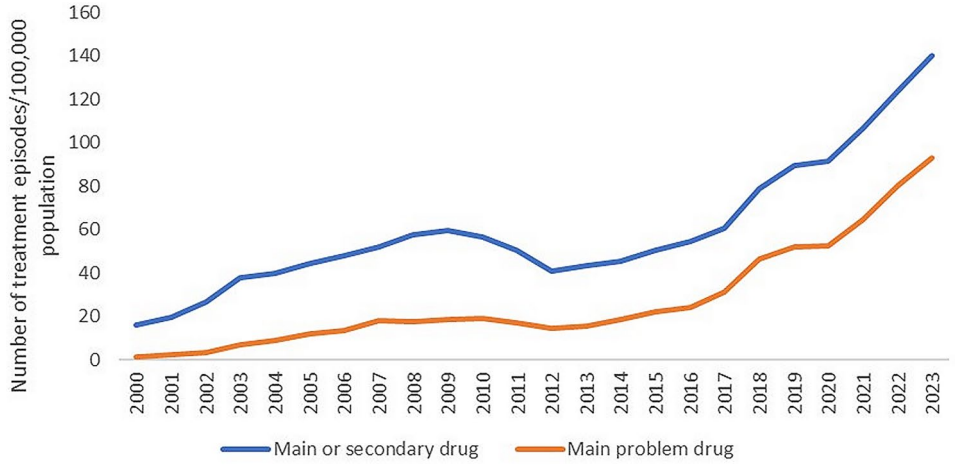


Fig. 4 Addiction treatment episodes involving cocaine per 100,000 population in Ireland 2000–2023

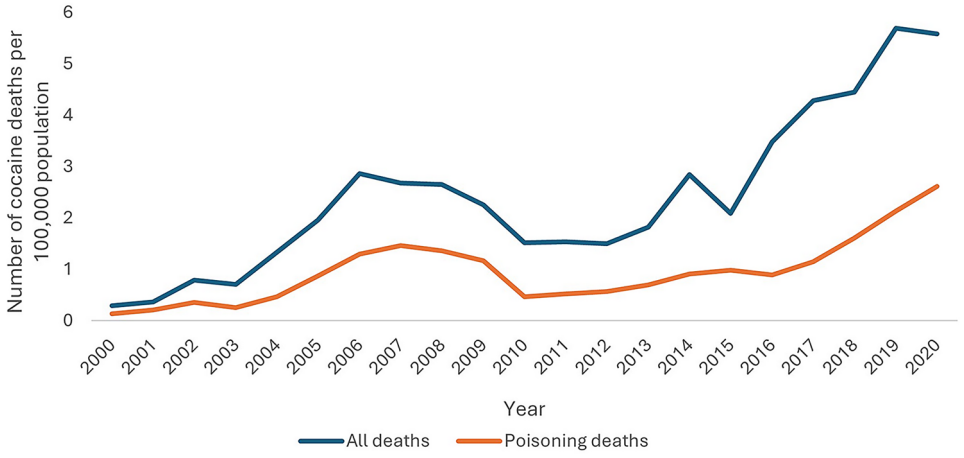


Fig. 5 Cocaine-related deaths per 100,000 population in Ireland 2000–2020

for drugs among the middle classes [27]. The increase in cocaine use in the early 2000s coincided with significant increases in cocaine-related harm, albeit from a very low base. Between 2000 and 2007, the annual percentage increase for cocaine hospitalisations was 36·7%; for treatment presentations with cocaine as a main problem drug the increase was 35·7%, and for cocaine poisoning deaths it was 44·4%. This was followed by a reduction in cocaine-related harm across all indicators until 2011–2013, with the largest decrease observed in cocaine-related deaths from all causes (APC of -27·8%) between 2007 and 2011. Since 2011–2013 there has been a consistent and significant increase across all cocaine harm indicators. It should be noted that the hospital admission data shown in this study likely represent the tip of the iceberg of acute cocaine-related health problems, as research suggests that only 22% of cocaine-related attendances at emergency departments are admitted to hospital [28]. Of note, the COVID-19 pandemic does not appear to have had any impact on cocaine-related harm trends in Ireland, suggesting that restrictions associated with the pandemic did not have a major influence on cocaine supply.

To some extent, these fluctuations in trends mirror those observed for Ireland's economic situation since 2000, although this cannot be confirmed due to the descriptive approach of our study. Ireland's economy experienced unprecedented growth from the mid-1990s to 2007, a period colloquially referred to as the 'Celtic Tiger'. This was followed by a deep recession beginning in 2008 which brought about dramatic changes in the Irish labour market. While the unemployment rate had been 4–5% for most of the period between 2000 and 2007, it rose sharply from 2008 before peaking at 15% in 2011, with males and young adults being disproportionately affected. Unemployment remained high through to 2012; however, by 2013 it fell quite rapidly, in line with an improving economy which has continued to thrive [29]. While trends for cocaine-related harms track those for Ireland's economic status until the mid-2010s, given the accelerated increase in harms observed since then, it

is likely that other factors, most likely market factors, are also at play. It would appear that there is high availability of cocaine in Ireland, as cocaine use and harms have increased since 2000, despite a substantial increase in the number of cocaine seizures (from 566 in 2003 to 4,020 in 2022). It is difficult to determine the origin of cocaine being transported to Ireland, as Ireland is primarily an end source and not a transit country [10]. Further research on the interplay between economic and market factors and cocaine use is warranted.

To the best of our knowledge this is the first European analysis of cocaine-related harms using a range of indicators over a prolonged period of time. A similar Australian multi-source study of trends in cocaine indicators from 2003 to 2019 also found that rates of cocaine use, cocaine-related hospitalisations and treatment episodes increased. However, the magnitude of increases observed were modest when compared with the trends observed in our study [30]. There is evidence of increased cocaine-related harms in Europe. In 2024, the EUDA reported that there were increasing signs that increased availability of cocaine in Europe was having negative effects on health, with cocaine involved in 23% of drug-induced deaths and in 28% of acute drug-toxicity presentations to hospital emergency departments [7]. Analysis of treatment data from 10 European countries (including Ireland) between 2011 and 2018 reported a decreasing proportion of cocaine-related treatment entrants between 2011 and 2014, followed by a strong increase in 2015, with Ireland experiencing the largest increase. The share of cocaine as the primary drug in treatment demand ranged between 5% in Germany and 43% in Spain [31]. In France there was a four-fold increase in cocaine-related hospitalisations between 2010 and 2019 [32], while the proportion of drug-related deaths involving cocaine increased from 31% in 2011 to 58% in 2019 [33]. Research in the United Kingdom found that for the years 2000–2019, the number of deaths where cocaine was detected at post-mortem increased by 3·8% for each year of study [34].

In the United States, the estimated prevalence of last-year cocaine use among adults peaked in 2006–2007 (2·5%), declined to 1·7% in 2010–2011, and then increased to 2·1% in 2018–2019 [35]. The decrease observed between 2006 and 2010 has been attributed by the UNODC to large reductions in the amount of coca available to be converted to cocaine in Colombia due to intense spraying and a large increase in manual eradication efforts [36, 37]. These changes in cocaine use prevalence coincided with fluctuations in cocaine-related overdose deaths, which increased significantly from 1·3 to 2·5 per 100 000 population from 2000 to 2006, declined to 1·4 in 2010, and increased to 2·1 in 2015 [38]. It is possible that the reduced cocaine supply from Colombia which impacted the United States may also explain fluctuations observed in Ireland at around the same time.

Regardless of the reasons for recent increases in cocaine-related harm in Ireland, it is clear from these data that cocaine use has become a significant public health issue that requires comprehensive and wide-ranging responses. Late adolescence is a prime time for cocaine initiation in Ireland. Analysis of the Growing Up In Ireland 1998 cohort found that 4% of 17-year-olds reported past year cocaine use compared with 23% of 20-year-olds [39]. Cocaine use is also prevalent among students in third-level institutions in Ireland; a 2021 survey of 11,592 third-level students found that 26% had ever used cocaine [40]. Irish survey data from 2019 to 2020 also suggests that fewer younger adults perceive using cocaine to be a risky behaviour when compared with data from 2010 to 2011 [14, 41]. Given the pace of increase and level of current health harms, prevention efforts focussing on late adolescence and based in university settings are urgently required.

While evidence on effectiveness is limited, prevention strategies may include screening and brief interventions, skills training, and individually tailored, electronically delivered interventions [42, 43]. The increase in cocaine hospitalisations and deaths observed in this research also reinforce the need for harm reduction strategies targeted at reducing overdoses, injuries and other health harms. Harm reduction approaches currently undertaken include the avoidance of rapid-onset routes of administration, limiting the quantity of use, identifying signs of psychosis and general health advice; however, little evaluation has been conducted on their efficacy [6]. Given that most people who use cocaine have little contact with treatment services, harm reduction may play an important role in reducing overdoses and deaths due to cocaine use.

Treatment options for cocaine use disorder are largely psychosocial, as no pharmacotherapy have been approved for use in Europe or the United States. A recent meta-analysis found that only contingency management programmes were consistently associated with a significant reduction in cocaine use among adults [44]. Internationally, treatment responses to cocaine use have typically occurred in treatment systems that were originally configured to address problem opioid use [6], and this has also been the case in Ireland. The six-fold increase in demand for treatment of cocaine use disorder in Ireland in the past decade highlights a key challenge for addiction services. Services must be flexible and adaptable to rapid shifts in the drug problem profile. There are few other areas in the health service, apart from infectious diseases, which experience such abrupt changes in patient presentation profiles. In this instance, it has been necessary to quickly build capacity in Ireland

to deliver more psychosocial elements of treatment. To achieve this, there has been significant funding of cocaine-specific services [45]. The continued investment in, and development of, appropriate service provision in Ireland for problem cocaine use will be essential to effectively deal with the current cocaine problem.

A major strength of our study is the use of a range of national databases that cover almost the entire population of Ireland, and which include a number of proxies for cocaine-related harm. Multi-source analyses can provide a deeper understanding of how trends emerge and evolve, and present a more complete picture of drug trends [46]. Notwithstanding this, our study has a number of limitations. Three of the databases included (HIPE, NPIRS and NDTRS) are case based, meaning that one individual can have numerous presentations in the one year. In addition, over a period of 20 + years, changes to coding, coverage and service capacity may partly explain some of the trends observed. For example, there have been major changes to the coding standards used by the HIPE database on acute hospital activity. Also, trends in the number of treatment entrants reported by the NDTRS and by NPIRS may reflect changes in the number of treatment agencies and hospitals providing services and their capacity. However, given the fact that all data sources provided consistently similar trends throughout the entire study period, we are confident that any changes incurred by the data sources had only minimal impact. Also, our sensitivity analysis indicates that trends in treatment for opioid use are considerably different when compared to those observed for cocaine use, with an increase noted between 2000 and 2010 and a decline from 2011 to 2023 (Figure S1), which correspond to a stabilisation in opioid use prevalence in Ireland [47]. It is additionally important to note that survey data were only available for six time points throughout the study period, which makes it difficult to accurately measure changes in cocaine use. Furthermore, there are no prevalence data on cocaine use disorder, which is an important data gap. This study analysed cocaine-related harm at the whole population level. Further research across subpopulations may help identify those at greatest risk of harm.

In conclusion, increased cocaine availability and use in Ireland has coincided with increased levels of cocaine-related harm. Significant trend changes were also noted across this relatively short timeframe. Cocaine use has moved from being of minimal significance from a public health perspective to being a major problem in a 25-year period. It will be important to continue to monitor both market indicators and health harms. Studying trends in the profile of people who use cocaine and those experiencing harm (in Ireland and elsewhere) may provide valuable insights for the development and provision of appropriate responses. Given the perfect storm of increased availability, increased price purity and greater affordability, there is potential for further increases in rates of use and harms. This warrants continued surveillance and enhanced collaboration in Ireland, across Europe, and the world, given the global nature of the cocaine market.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-23224-y.

Supplementary Material 1

Acknowledgements
We would like to acknowledge the Healthcare Pricing Office who provided aggregated data on cocaine-related discharges from acute Irish hospitals.

Author contributions
DM, SRM and BG conceptualised the study. AMC, CK, AD, SL curated the data from the NDTRS, NDRDI and NPIRS databases. DM led the data analysis with statistical support provided by SRM. DM and SRM accessed and verified the final data reported in the manuscript. DM drafted the manuscript. SRM, AMC, CK, AD, SL, BG, BS all carefully reviewed and provided critical feedback on a number of drafts of this manuscript. All authors have approved the final version of the manuscript to be published and are responsible for the decision to submit for publication.

Funding
Funding for the National Drug and Alcohol Surveys was provided by the Department of Health, Ireland. The funder had no role in the analysis, decision to publish or preparation of the manuscript. No additional funding was obtained to undertake this analysis.

Data availability
The data used and analysed for the purpose of this study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted according to the guidelines laid down in the 1964 Declaration of Helsinki and its subsequent revisions. Ethical approval for the National Drug and Alcohol Surveys was provided by the Royal College of Physicians Ireland (RCPI). The remaining analyses presented here used routinely collected and anonymised data; study-specific consent was, therefore, not required.

Consent for publication
Not applicable.

Competing interests
Professor Bobby Smyth has received payment for court reports on civil cases involving drug and/or alcohol intoxication and is Vice Chair of Alcohol Action Ireland, a charity involved in advocacy on alcohol policy (unpaid role). All other authors declare no competing interests.

Received: 20 January 2025 / Accepted: 19 May 2025
Published online: 02 July 2025

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