

# The Socio-Demographics and Health Service Use of Opioid Overdose Decedents in Wales: A Cross-Sectional Data Linkage Study

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## Keywords

Opioids · Overdose · Epidemiology · Emergency department

## Abstract

**Background:** Fatal opioid overdose is a significant public health problem with increasing incidence in developed countries. This study aimed to describe demographic and service user characteristics of decedents of opioid overdose in Wales to identify possible targets for behaviour modification and life-saving interventions. **Methods:** A retrospective cross-sectional analysis was conducted of a census sample of opioid overdose-related deaths recorded between January 01, 2012, and October 11, 2018, in Wales. UK Office for National Statistics, Welsh Demographic Service, and National Health Service datasets were linked deterministically. Decedents' circumstances of death, demographic characteristics, residency, and health service use were characterized over 3 years prior to fatal overdose using descriptive statistics. **Results:** In total, 638 people died of opioid overdose in Wales between January 01, 2012, and October 11, 2018, with an incidence rate of 3.04 per 100,000 people per year. Decedents were predominantly male (73%) and middle aged

(median age 50 years). Fatal overdoses predominantly occurred in the community (93%) secondary to heroin (30%) or oxycodone derivative use (34%). In the 3 years prior to death, decedents changed address frequently (53%) but rarely moved far geographically. The majority of decedents had recently visited the emergency department (83%) or were admitted to the hospital (64%) prior to death. Only a minority had visited specialist drug services (32%). **Conclusions:** Deaths from opioid overdose typically occur in middle-aged men living peripatetic lifestyles. Victims infrequently visit specialist drug services but often attend emergency medical services. Emergency department-based interventions may therefore be important in prevention of opioid overdose fatalities in the community.

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## Introduction

Opioids are involved in fatal overdose more often than any other drug [1]. The global opioid market is growing, and fatal overdoses related to illicit opioids such as heroin (diamorphine) and to the misuse of opioid painkillers have increased to record levels in the developed world [2].

**Table 1.** Source datasets and associated coding frameworks

Data	Source database	Coding framework
Mortality Events Cause of death	ONS (births, deaths, and marriages)	ICD-10
Demographic Decedent age and sex	ONS (births, deaths, and marriages)	ICD-10
Residential stability Registered address	WDS database	NHS Wales Data Dictionary Version 4.9
Service utilization ED attendance data	EDDS	NHS Wales Data Dictionary Version 4.9
Substance misuse service attendance data	SMDS	NHS Wales Data Dictionary Version 4.9
Hospital admission data	PEDW	ICD-10

WDS, Welsh Demographic Service; EDDS, Emergency Department Dataset; SMDS, Substance Misuse DataSet; PEDW, Patient Episode Database for Wales.

The UK experiences the most opioid-related deaths of any European nation total and per head of population, with 3,256 deaths recorded in 2017 [3]. In addition to the human cost of opioid overdose, the economic cost to society is also significant. In a study based in the USA, the burden of heroin use disorder was estimated at USD 51.2 billion per year [4].

A recent study of fatal opioid overdose decedents in the UK is lacking [5]. We describe findings from a retrospective cross-sectional study using routine linked data to identify and describe characteristics of death (including substances involved and intent), demographic characteristics, residential mobility, and patterns of healthcare service usage of opioid overdose decedents over 3 years prior to death. We aimed to identify potential targets for prevention of drug-related deaths in the community.

## Materials and Methods

A retrospective cross-sectional study was conducted in Wales between January 01, 2012, and October 11, 2018, including a census sample of all overdose-related deaths directly attributable to opioids. The study period was chosen as being sufficiently recent to reflect the current incidence of opioid overdose death and to ensure that complete death registration data would be available. Cases were identified from the UK Office for National Statistics (ONS) Births, Deaths and Marriages dataset using ICD-10 diagnostic codes for opioid overdose (online suppl. material; see [www.karger.com/doi/10.1159/000521614](http://www.karger.com/doi/10.1159/000521614) for all online suppl. material) [6, 7]. Cases were eligible if opioid drug was the primary or secondary cause of death and where the underlying cause of death was indicative of opioid overdose. Fatal overdoses with opioid drugs as co-ingestions, but where cause of death would primarily be attributable to another type of drug or injury, were excluded.

Data on decedents' circumstances of death, demographic characteristics, residency, and health service use over 3 years prior to death were captured from linked ONS Births, Deaths and Marriages and NHS Wales Informatics Service datasets (see Table 1 for source datasets and associated coding frameworks) [8]. Individual case record linkage was performed by NHS Wales Informatics Service using an individual, unique, NHS number supplemented with name, address, and date of birth, an approach previously demonstrated to achieve high specificity (>99%) and sensitivity (>95%) [9]. Information was available at the level of small geographical areas ("lower super output areas," broadly contiguous with postcode areas), corresponding to populations between 1,000 and 3,000 people.

Analysis was performed in the Secure Anonymised Information Linkage (SAIL) gateway [9, 10]. The incidence rate of fatal opioid overdose was determined using publicly available Welsh Government census data to quantify the population denominator [11]. Sample characteristics were described using summary statistics. Medians and interquartile ranges (IQRs) were calculated for non-normal data and means and standard deviations where data were normally distributed. IBM SPSS (Statistical Package for the Social Sciences, Version 26.0, IBM Corp. Armonk, NY, USA) was used for data analysis. As census samples of available cases during the study period were included, sample size calculations were therefore not performed.

## Results

From January 1, 2012, to October 11, 2018, 638 fatalities primarily attributable to opioid overdose were recorded in Wales, corresponding to an incidence rate of 3.04 per 100,000 people per year. Around 419 overdose fatalities were excluded where opioid drugs were a potentially contributory factor, but it was uncertain if death could be directly attributed to their use. All 638 included cases were successfully linked to the Welsh Demographic Service and the NHS service datasets.

**Table 2.** Summary of service use in 3 years prior to fatal opioid overdose

Service	Usage (n, %; N = 638, unless stated)
ED attendance	
3 years prior to death	531 (83.23)
2 years	495 (77.59)
1 year	423 (66.3)
1 month	157 (24.61)
Median visits per decedent	4, IQR = 5
Hospital admission	
3 years prior to death	406 (63.64)
2 years	362 (56.74)
1 year	281 (44.04)
1 month	98 (15.36)
Median admissions per decedent	2, IQR = 4
Drug treatment services over	
3 years prior to death	205 (32.13)
2 years	195 (30.56)
1 year	166 (26.02)
1 month	82 (12.85)
Median contacts per decedent enrolled in drug treatment services	12, IQR = 52
Attendees who died whilst in treatment, n	62/205 (30.24)

Cases were mostly male (73%,  $n = 463/638$ ) with a mean age of 49.6 (standard deviation 20.72) years. The primary opioid substances involved in each death were most often heroin (30%) or other non-synthetic opioids (methadone 13% and oxycodone, hydrocodone, and their derivatives 34%). The least often involved were synthetic opioids (8%; fentanyl, propoxyphene, and meperidine). A small minority of deaths were classified as suicides (8%,  $n = 52/638$ ). Most fatal overdoses occurred in the community (i.e., non-health care settings, 93%,  $n = 611/638$ ).

In the 3 years prior to death, more than half of decedents changed address (53%,  $n = 337/638$ ), with frequent moves observed both between and within small geographical areas, often “back and forth” between the same address (total changes of address 1,221). The median number of addresses that decedents had lived at was 2 (IQR: 2).

The health service usage of opioid overdose decedents in the 3 years prior to death is summarized in Table 2. The majority of decedents visited the emergency department (ED) in the 3 years prior to death (83%,  $n = 531/638$ ), with a quarter doing so within a month of death (25%,  $n = 157$ ). The majority attended on several occasions (median visits = 4, IQR = 5) and were conveyed by emergency ambulance (80%,  $n = 426/638$ ). Most decedents were admitted to hospital in the 3 years prior to death (64%,  $n = 406/638$ ). Most were admitted more than once during the observa-

tion period median admissions = 2, IQR = 4). Under a third of decedents visited specialist drug services in the 3-year period prior to fatal overdose (32%,  $n = 205/638$ ), though those that did make contact did so on multiple occasions (median contacts = 12, IQR = 52). Notwithstanding this, a significant proportion of fatal overdoses occurred in individuals enrolled in drug services treatment at the time of their deaths (30%,  $n = 62/205$ ).

## Discussion

### Summary of Results

In total, 638 people died of opioid overdose in Wales between January 01, 2012, and October 11, 2018, with an incidence rate of 3.04 per 100,000 people per year. Decedents were predominantly male (73%) with a median age of 50 years. Most fatal overdoses were presumed accidental (92%), generally occurred in the community (93%), and were most commonly secondary to heroin (30%) or oxycodone derivative use (34%). In the 3 years prior to death, decedents changed address frequently (53%), usually within a limited geographical locale. A large majority of decedents had recently visited the ED (83%) or had been admitted to hospital (64%) prior to death. Few victims of a fatal opioid overdose were engaged in specialist drug services (32%).

### *Interpretation of Findings*

According to the English Housing Survey [12], residents in England change address every 11 years on average, with private renters moving more often (every 4 years) than council tenants (slightly over 11 years) or homeowners (18 years). Our findings indicate that those dying from opioid overdose exhibit much greater residential mobility than the general population. Public Health Wales (PHW) data suggest that 40% of recreational opioid users in Wales are in contact with specialist drug treatment services [13]. Our data also indicate that victims of fatal opioid overdoses make contact significantly less (32%). Taken together, these findings confirm that the highest risk opioid users live a peripatetic lifestyle, are more difficult to engage in drug treatment services, and that alternative approaches will be required to reduce harm from drug use in this subgroup.

NHS Digital and publicly available census data covering 2017–2019 shows that in Wales, around 26% of the population attended the ED per year [14, 15]. In comparison, our data suggest that people at high risk of fatal opioid overdose visit the ED disproportionately often (66% in year prior to death). Moreover, most decedents in this study were admitted to hospital more than once during the study period (44% in year prior to death). In comparison, NHS Digital and census data for the year 2018–2019 indicate that 29% of the general population of England were admitted to hospital per year. It therefore appears that the local hospital is a common denominator for patients at high risk of fatal opioid overdose, offering a potential opportunity for harm reduction strategies.

Previously reported ED-initiated interventions for patients with opioid use disorder include motivational interviewing, brief behavioural education, referral to drug treatment services, opioid agonist treatment, and take-home naloxone administration [16]. A recent systematic review reported that the ED was an appropriate setting for commencing such interventions, but high-quality evidence was lacking on effectiveness of alternative approaches [16]. The clear opportunity to access patients at high risk of death from opioid-related overdose highlights the need for further research to delineate the most efficacious approach.

### *Generalizability Comparison to Existing Literature*

This national study population from Wales should provide generalizability to other UK nations. External validity to other settings is less clear, and risk factors for fatal opioid overdose could vary according to culture, demographics, drug use patterns, and health service organi-

zation. For example, heroin was the most likely single largest contributor to death in the current study, contrasting with North America [17], where fentanyl overdose presents a significant public health concern.

The current study's findings are supported by previous small-scale UK studies. Ryan and Spronken [18] carried out a retrospective analysis of ED usage by decedents of opioid overdose in Brighton and found that 33 of 36 decedents visited the ED within 1 year of death. Thanacoody and Sherval reported that median time from hospital contact to deaths was 5 months in Edinburgh [19]. Jones et al. [20] reported similar demographics in a sample from Glasgow, with 48% attending the ED in the year prior to death.

A recent systematic review carried out by van Amsterdam et al. [5] concluded that the increased opioids overdose deaths in Scotland compared to England and Wales can be explained by multiple factors, notable amongst which are concurrent use of benzodiazepines and gabapentinoids. These findings confirm data from North-American studies identifying concurrent benzodiazepine use as increasing risk of fatal overdose in opioid users. Based on the successful application of the methods described in this paper, the authors recommend further application of linked-data autopsy studies to investigate opioid overdose deaths involving benzodiazepine and gabapentinoid drugs on a national level.

### *Limitations*

This is the largest UK study to investigate service use patterns of decedents of opioid overdose, with previous studies conducted at the city level, rather than nationally. Moreover, the current investigation is the first time that ONS, ED, inpatient, and drugs services data have been linked. Further strengths include a robust data linkage methodology and excellent data completeness. However, there are some limitations. Retrospective data may be inaccurate, secondary to unrecorded data e.g., subjects moving between unregistered addresses. Primarily, attributing death to opioid overdose in retrospect is not always straightforward, and misclassification arising from routine ONS coding may introduce information bias despite using robust methods for classification. It is also possible that some service use was not captured due to lack of patient identification, e.g., unknown overdose victims self-discharging from the ED before, or incorrect identifiers being provided to retain anonymity. Furthermore, information on previous overdoses was unavailable. Finally, it was not possible to collect diagnostic or treatment data of a sufficient quality for report from emergency or hospital datasets.

## Conclusions

High-risk opioid users are commonly middle-aged men living peripatetic lifestyles. Victims of opioid overdose commonly use emergency medical services shortly prior to death and are unlikely to be engaged with specialist drug services. Harm reduction strategies to reduce opioid overdose fatalities should focus on interventions via emergency services or inpatient hospital settings.

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Data scoping, capture, linkage, and anonymization was carried out by the SAIL databank.

## Statement of Ethics

Individual participant informed consent was not needed due to the retrospective nature of the study and anonymous data. The study was subject to ethical review by an independent Information Governance Review Panel constituted by the SAIL databank, which gave the project a favourable opinion (agreement number 0712).

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## Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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## Author Contributions

G.W.F. conceived the study and wrote the manuscript. M.J. carried out data collection and analysis. All the authors read and approved the final manuscript. A.W. consulted on statistical reporting and analysis.

## Data Availability Statement

The data that support the findings of this study are available from the SAIL databank, but restrictions apply to the availability of these data, which were used under licence for the current study and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of SAIL.