

**Mortality After Prison Release in England and Wales, 2019-2022: A Comparative Analysis of Cause-Specific Death Rates and Risk Profiles**

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Key words: prison, probation, mortality, death, suicide, drug poisoning, homicide.

## **Mortality After Prison Release in England and Wales, 2019-2021: A Comparative Analysis of Cause-Specific Death Rates and Risk Profiles**

### **Abstract**

**Background:** Mortality risk is elevated among people released from prison; however, comprehensive analyses of cause-specific death patterns and associated factors remain limited.

**Methods:** This retrospective cohort study analysed 1,511 deaths of people under post-release supervision in England and Wales (2019-2021) using standardised ICD-10 mortality classifications. For the 12-month post-release period, crude mortality rates (CMRs), age-standardised mortality ratios (SMRs) and temporal patterns were calculated. Demographic and criminogenic factors were analysed across causes of death.

**Results:** The all-cause CMR was 857 deaths per 100,000 person-years, with a higher rate among women (1260 [993-1544]) than men (825 [762-889]). Injuries accounted for 49% of deaths, with drug poisoning as the leading cause, accounting for 54% of deaths among women and 38% among men. SMRs revealed dramatic elevations compared to the UK population: drug poisoning (74.1 [38.4 - 153.2]), interpersonal violence (63.3 [11.3 - 264.3]) and suicide (9.9 [3.3 - 27.8]). Temporal trends followed a bimodal pattern, with rates peaking immediately after release and again after six months. Further demographic disparities emerged: interpersonal violence deaths characterised by young age and minority ethnic representation; non-communicable disease deaths concentrated in older groups. Women exhibited comparable suicide rates to men, contrary to general population trends. Social inequalities were evident, with acute deaths associated with housing instability, unemployment and breach of release conditions.

**Conclusions:** Post-release mortality rates are very high, influenced by intersecting demographic, criminal justice, and social factors. Gender-specific approaches and cross-system coordination between health, justice, and social services are needed during imprisonment and the critical first year after release.

**Key words:** prison, probation, mortality, death, suicide, drug poisoning, homicide.

## Introduction

People released from prison face a significantly elevated mortality risk, particularly in the first weeks after release (Binswanger et al., 2007; Redacted et al., 2024; Zlodre & Fazel, 2012). Internationally, studies have shown that formerly incarcerated individuals die at rates several times higher than their peers in the general population, primarily from drug-related causes, suicide, and cardiovascular disease (Redacted et al., 2024; Kinner et al., 2013; McNeeley et al., 2023). This elevated mortality reflects the challenges of re-entry after prison to the community, with a high prevalence of mental health conditions and substance use disorders, and barriers to accessing timely healthcare and basic needs such as housing and employment in the community (Binswanger et al., 2007; Brooker et al., 2020). With over 30 million people released from prison globally each year (Fair & Walmsley, 2021), this represents a significant – yet largely preventable – public health crisis.

While deaths in state custody are rigorously investigated under international human rights legislation (United Nations, 2018), the mortality of individuals under community supervision by the criminal justice system remains relatively understudied, due largely to differences in the state's duty of care in different regions (Perrett et al., 2024). Despite comprising two distinct groups – i.e., those directly sentenced to community supervision, and those who have transitioned from prison to the community – the post-release population faces additional challenges due to resettlement and reconnection needs that may affect mortality risk (Souza et al., 2015). These challenges, combined with the increasing policy emphasis on early-release programmes in the United Kingdom (UK) (Ministry of Justice, 2024b), make understanding mortality patterns and antecedents in this group urgent and critical for public health and criminal justice reform.

International evidence demonstrates that contact with the criminal justice system is associated with poor health outcomes and premature mortality (Skinner & Farrington, 2023). Research also points to an increase in premature mortality among those under probation supervision in recent years. North American data highlight a 6% increase premature mortality in 2020 (US Department of Justice, 2020), and a further 41% increase (from 14,611 deaths in 2020 to 20,550 deaths in 2022) for those under probation supervision (US Department of Justice, 2022). In England and Wales there has been a steady increase in the number of deaths of people in contact with the criminal justice system in the community from 557 in 2014/15 to 1,439 in 2022/23 (Ministry of Justice, 2024a). A recent study identified 999 deaths under probation supervision that occurred between April 2019 and March 2020 in England and Wales, and a further 1,449 in the following 12 months (Redacted et al., 2024). Just under half (49%) were among people serving a post-release community sentence.

Drug-related deaths in the UK are presently described as a public health crisis (Holland et al., 2024) with an exceptional risk of drug-related death following release from prison, reported at 16 times the general population rate and 36 times higher for women (Office for National

Statistics, 2023b). This risk is most acute in the weeks immediately post-release, but remains elevated for up to a year (Cooper et al., 2023). The increase in drug overdose deaths after prison release is influenced by multiple risk factors, including reduced tolerance to substances, limited social support, medical conditions, financial hardship, and pervasive drug exposure in their living environments (Binswanger et al., 2012).

Significant knowledge gaps persist, particularly regarding gender-specific vulnerabilities and needs in the UK context. The epidemiology of fatal behaviours shows gender differences, with women more likely to die from drug poisoning or use of drug poisoning as a method of suicide (Lewer & Edge, 2024a; Office for National Statistics, 2023b) and that, unlike men, the high risk of mortality remains even after controlling for demographic and behavioural factors (Massoglia et al., 2014). This suggests the need for gender-specific intervention strategies. The interplay between criminal justice-related factors and mortality risk remains unclear, with many causes of death too infrequent to permit targeted analyses or draw clear conclusions (Sattar, 2003). Previous UK research has also had challenges in the quality of linked data and outcome variables, leading to the use of non-standardised definitions (Phillips et al., 2018; Redacted et al., 2024) focussed on a single cause of death (Pratt et al., 2006), while other foundational studies in this field would benefit from updating, as they were conducted over two decades ago (Sattar, 2001).

Recent UK findings challenge common risk assumptions in post-release populations. A 2024 study revealed unexpected patterns, with comparable suicide rates between genders and higher risk among the employed, contrary to general population trends where employment typically serves as protection (Redacted et al., 2024). While research has identified various personal, health, and social risk factors (Kinner et al., 2013; Spittal et al., 2019; Zlodre & Fazel, 2012), the impact of the criminal justice system and the unique operation of protective factors in this population remains poorly understood, suggesting conventional approaches to risk assessment may need reconsideration.

This study aims to address these knowledge gaps by mortality patterns and correlates among people after release from custody over a three-year period between 2019 and 2021 in England and Wales, using standardised cause-of-death classifications (ICD-10) that allow for direct comparisons with national mortality statistics. With a particular focus on causes potentially amenable to criminal justice system intervention, including suicide, homicide, and drug overdose, we sought to examine how individual and social characteristics and criminal justice-related factors are associated with different causes of death, with a consideration of gender differences.

Specifically, we aimed to:

1. Calculate crude mortality rates (CMRs) and age- and gender-standardised mortality ratios (SMRs) for up to 12 months of release from prison, by cause of death, separated by men and women.

2. Assess relative mortality risk by cause of death over a 12-month period.
3. Compare individual and criminal justice-related risk factors across different causes of death.

## **Method**

### **Ethical approval**

Ethical approval was obtained from the Nottingham Trent University Business, Law and Social Science Research Ethics Committee, and approval was given by His Majesty's Prison and Probation Service (HMPPS) National Research Committee (2024-090).

### **Study Population**

This study is a retrospective cohort study, analysing the records of all people whose death was recorded after release from prison and were still under supervision by HMPPS in England and Wales between 01 January 2019 and 31 December 2021 (inclusive). During the study period, probation services were divided between the National Probation Service (high-risk population) and Community Rehabilitation Companies (low/medium-risk population). While 'death under supervision' includes all individuals supervised by Probation Services (MoJ and HMPPS, 2022), this study focused specifically on post-release deaths, excluding deaths during incarceration and those serving only community or suspended sentences.

### **Data Source**

Data were sourced from the HMPPS nDelius electronic case management system, which routinely records demographic, offence, and personal circumstances, and records deaths. The Ministry of Justice provided death records as published in October 2022 (Ministry of Justice, 2024a) to the Office for National Statistics (ONS) for matching with official death registers, completed in June 2023. The HMPPS National Applications Reporting Team extracted corresponding nDelius demographic and offence data for deaths between 1 January 2019 and 31 December 2021. The final dataset combined nDelius variables with ONS-matched cause of death data. Extracted data included dichotomous (e.g., present/absent) and choice-based options for data entry. Some data were recoded into pooled variables to create the variables.

HMPPS provided data on the total number of individuals released from prison between 1 January 2019 and 31 December 2020, and their corresponding 12-month recall rates. However, individual records were only provided for cases involving mortality.

### **Variables**

## ***Cause of Death***

Causes of death were categorised into a two-level, mutually exclusive categorisation system using ICD 10th edition codes for underlying cause of death in line with the ONS coding (ONS, 2024). The overarching categories and summary definitions utilised were Non-communicable disease; Infectious Disease; and Injuries. Injuries were further subdivided into Drug poisoning (unintentional or undetermined intent), Suicide (deaths given an underlying cause of intentional self-harm including intentional drug poisoning), Transport-related Accidents, and Interpersonal Violence (including cases coded as external causes of mortality).

## ***Demographic and Criminogenic Factors***

The following variables were extracted from multiple data sources:

From ONS death certificates:

**No Employment:** Defined as having no employment category listed, or classified as not stated, not classifiable, long-term unemployed, or missing. **Age** in years (continuous variable); **British-Born:** Country of birth recorded as binary (British born; non-British born)

From the electronic case management system:

**Gender:** Legally recognised gender as per MoJ, 2023 (recorded as male/female); **Ethnicity:** Categorised as Asian, Black, Mixed, or White; **Disability:** Self-reported (present/absent); **Accommodation:** Categorised as None, Settled, or Transient; **Offence Type:** Categorised according to Howard et al. (2007) at most recent sentencing: Violence against the person, Sexual offences, Theft, Public Order, Drug Offences, Summary Motoring, Criminal Damage, Other; **Sentence Type:** Determinate or Indeterminate (life sentence or IPP); **Recall Action:** action initiated (due to violation of supervision requirements/new offence) in the 28 days preceding death (present/absent); **Restraining Order:** Active at time of death (present/absent); **Time in Prison:** Total years between index sentence date and most recent release prior to death

Probation practitioner assessments (based on subjective evaluation, not structured tools):

**Suicide/Self-harm risk:** Present/absent; **Domestic violence (DV) perpetration:** Present/absent, including intimate partner and family member abuse; **Weapon possession:** Present/absent, including convicted and non-convicted history.

## Sample

A total of 1,744 deaths in the post-release cohort were reported between 2019 and 2021. There were 233 (13.4%) cases excluded from the sample because ONS could not match the data (predominantly due to the death occurring in a different location or country, inquest not being completed, or registration delay). In the final sample, 1,511 deaths were included.

The mean age of decedents at the time of death was 48.6 (15.7) years; 92% recorded as male. Further sample descriptives are shown in Table 2.

Nearly half of all deaths were from Injuries (48.7%), including Alcohol poisoning,  $n = 17$  (1.1%); Drug poisoning,  $n = 547$  (36.2%); Interpersonal violence,  $n = 39$  (2.6%); and Suicide,  $n = 133$  (8.8%). Non-communicable diseases (NCDs) accounted for 551 deaths (36.4%); Infectious diseases,  $n = 98$  (6.5%); and Other and ill-defined,  $n = 126$  (8.3%). Greater detail is provided in Table S1 [supplementary information].

## Data Analysis

Descriptive statistics were calculated across offence type, demographics, personal circumstances, and criminogenic factors, all grouped by cause of death.

Analyses were performed to capture the mortality rate within the first 12 months post-release. While time to death in the total sample ranged from one day to several years, focusing on the 12-month post-release period enabled the calculation of standardised mortality rates aligned with England and Wales's minimum 12-month supervision requirements. The person-year calculation reflected the time-to-death for those who died and the time spent in the community for the baseline release sample (all releases during 2019-20). When calculating mortality rates, the person-year denominator was adjusted to account for time not spent in the community. MoJ data reports that individuals released in 2019-20 were in the community for an average of 82.8% of the 12-month follow-up period, rather than the full year. All CMRs were scaled to a rate per 100,000 person-years.

Crude mortality rates were calculated for all causes of death. 95% confidence intervals were then generated using the Poisson distribution to capture uncertainty around the rate. This approach was then applied by gender, by cause of death, and gender across causes of death. Age-standardised mortality ratios were calculated using UK population mortality data (2019-2021) from ONS data (ONS, 2024). Expected deaths were estimated for each age group based on person-years at risk, and SMRs were calculated by comparing observed to expected deaths. We calculated 95% confidence intervals for the SMRs based on the Poisson distribution. This analysis was stratified by gender and by cause of death utilising the World Health Organization (WHO) mortality database for 2020 (WHO, 2024)

To assess relative mortality risk by cause of death over 12 months post-release, an adjusted proportional mortality ratio (aPMR) was calculated. This adjustment accounted for the total

number of individuals and time intervals across each cause of death. The first month was divided into weekly intervals to capture more detailed mortality patterns in the early post-release period, with subsequent data grouped into monthly intervals. Each interval's mortality rate was standardised to allow for comparisons across time periods, resulting in an aPMR for each cause of death. For this analysis, other and ill-defined causes of deaths were omitted. The time from release to death was calculated as days between date of the most recent release and date of death.

Omnibus statistical tests were conducted to assess whether characteristics varied by cause of death. For categorical variables, Fisher's exact test with simulated p-values was used to account for low cell counts, and for continuous variables, linear regression was applied to examine group mean differences. Post hoc analyses were conducted to further explore specific pairwise relationships among causes of death. For categorical variables, pairwise Chi-square tests were applied to each unique pair of causes of death to determine whether characteristic distributions differed. For continuous variables, estimated marginal means were calculated. A False Discovery Rate adjustment was applied to the *p*-values for both approaches, controlling for the proportion of Type I errors across multiple tests.

## **Results**

### **Mortality rates**

Analysis calculated the mortality rate within the first 12 months post-release. There were 104,053 individuals released from prison between January 2019 and December 2020 (96,332 men; 7,721 women) (Ministry of Justice, 2021), of whom 735 (655 men; 80 women) died within 12 months of release.

The all-cause CMR was 857.5 deaths per 100,000 person-years [95% CI, 796 – 920]. The CMR for men was 825.2 per 100,000 [95% CI, 762 - 889]; for women, it was 1,260.6 per 100,000 [95% CI, 993 – 1544].

Cause-specific CMRs were calculated. The leading causes of death for men were Alcohol and Other Drug (AOD): Drug Poisoning (CMR = 374.5; 95% CI: 333 - 417, Non-Communicable Disease: Cardiovascular Disease (CMR = 82.8; 95% CI: 64 – 103), and Suicide (CMR = 76; 95% CI: 58 - 97). The leading causes of death for women were AOD: Drug Poisoning (CMR = 628.1; 95% CI: 440 - 832), Suicide (CMR = 156.6; 95% CI: 63 - 266), and Non-Communicable Disease: Cancer and other neoplasms (CMR = 93.9; 95% CI: 31 - 172). Full details are provided in Table S1.

### **Age-standardised mortality ratio**

Age-standardised mortality ratios revealed high proportionate elevations in mortality risk compared with the general population for the sample, with SMR = 6.9; 95% CI: 4 - 11, being higher for women (SMR = 8.3; 95% CI: 0.8 - 25) than men (SMR = 5.4; 95% CI: 3 - 7). This suggests that post-release women are eight times and post-release men are five times more likely to die within 12 months than the general England and Wales population.

Age-standardised SMRs were calculated for leading causes of death in a post-release population and are presented in Table 1. Drug poisoning showed the highest disparity, with a rate 74 times higher than the general population, followed by interpersonal violence (63 times higher), transport-related accidents (14 times higher) and suicide (10 times higher).

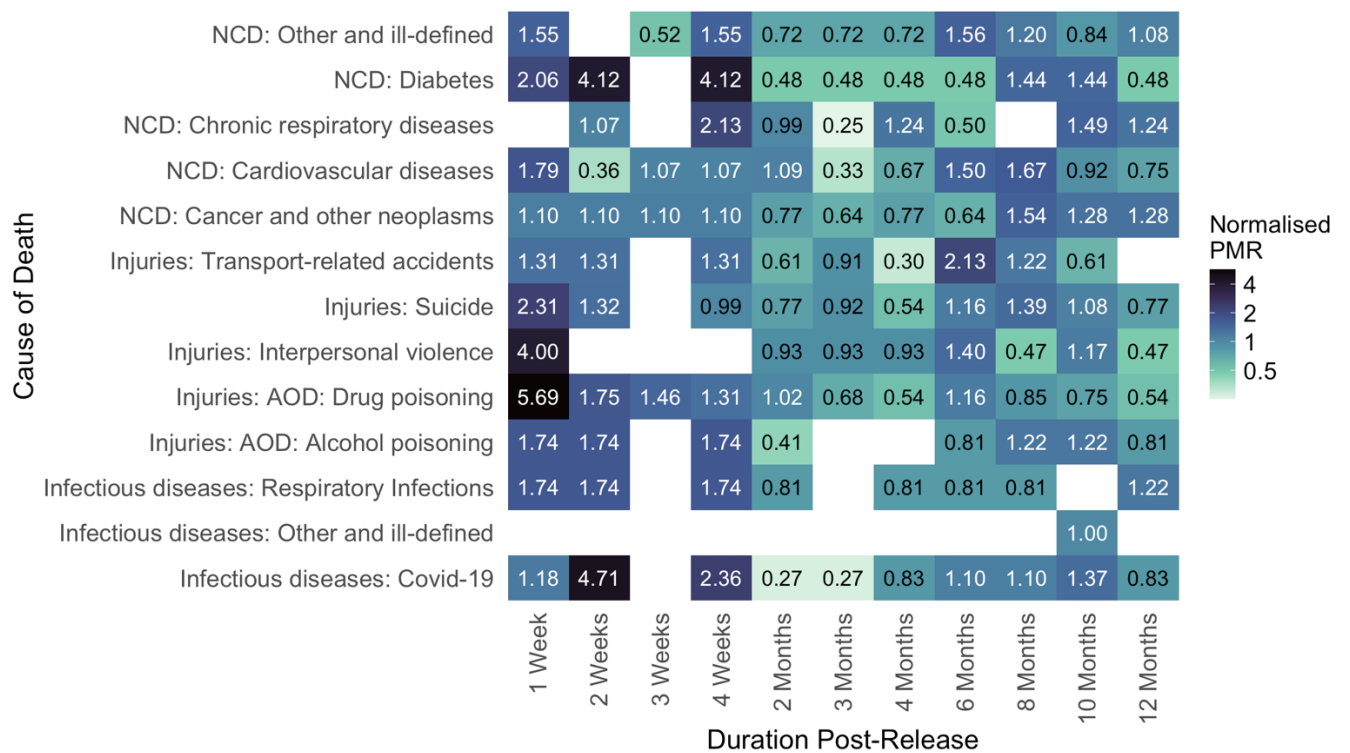
**Table 1: Age-standardised SMRs overall and by gender.**

	Men	Women	Overall
<b>Drug poisoning</b>	61.0 (44.8 - 81.9)	87.2 (32 - 224.5)	74.1 (38.4 - 153.2)
<b>Suicide</b>	6.9 (3.6 - 12.1)	14.1 (3 - 48.6)	9.9 (3.3 - 27.8)
<b>Interpersonal Violence</b>	51.7 (15.9 - 155.4)	86.5 (2.2 - 482.1)	63.3 (11.3 - 264.3)
<b>Non-Communicable Disease</b>	0.3 (0.2 - 0.4)	0.6 (0.1 - 2.6)	0.4 (0.1 - 1.5)
<b>Road Traffic Accident</b>	7.1 (2 - 21)	43.2 (5.2 - 156.1)	14.3 (2.6 - 48)

### **Mortality rate over the 12-month period following release from prison**

The normalised proportional mortality ratio (PMR) was calculated to reflect the rate of deaths for each cause of death, adjusted for the total number of deaths within each cause and time interval. The normalised PMR allows for a comparison of death rates across different time intervals and causes of death. A normalised PMR greater than 1 indicates a higher relative rate of deaths for that cause compared to the overall mortality rate for the full 12-month average.

**Figure 1: Normalised proportional mortality ratio for the 12 months following release from prison, categorised by cause of death.**



Note: Empty cells refer to those with no observed deaths at a given time point.

Analysis of mortality timing revealed distinct patterns of risk following prison release. The first week post-release showed peak mortality rates for drug poisoning, interpersonal violence, and suicide. NCD: Diabetes and COVID-19 deaths peaked during weeks 2-4, although low numbers in NCD: Diabetes makes analysis unreliable. While mortality rates declined to a rate <1 across all causes during the first three months, a secondary rise is observed after six months post-release, with elevated rates across all causes of death. This bimodal pattern suggests that different risk mechanisms may operate at different post-release stages.

### Comparison of individual and criminal justice factors across cause of death.

Analysis of the full sample was undertaken comparing known causes of death. Descriptive tables were created (see Table 2) to summarise offence type, demographic, personal circumstances, and criminogenic characteristics across cause of death. For each characteristic, e.g., gender, age) the table shows a *p* value from a statistical test, indicating whether significant differences exist across all causes of death. To identify where these differences occur, post hoc pairwise comparisons were conducted. These post hoc results are indicated by letter assignments: if two causes of death share the same letter, they do not differ significantly in the levels of that characteristic (e.g., proportions of males/females, or mean age), while different letters indicate statistically significant differences in distribution.

The leading disproportionate causes of mortality in the sample were drug poisoning, interpersonal violence, and suicide. Without detailed health data available, the categories of NCD and Infectious disease were collapsed for this analysis of demographic and criminogenic factors. Further categories that were excluded due to difficulties in interpretation were the transport-related accident category (due to small numbers and the absence of toxicology data). To ensure findings are based on verifiable causes, the cause of death category "Other and ill-defined" was omitted from the analysis.

**Table 2: Comparison of individual and criminal justice factors across cause of death.**

<b>Characteristic</b>	<b>Overall</b> N = 1,385 <i>n (%)</i>	<b>Alcohol poisoning</b> N = 17 <i>n (%)</i>	<b>Drug poisoning</b> N = 547 <i>n (%)</i>	<b>Infectious diseases</b> N = 98 <i>n (%)</i>	<b>Interpersonal violence</b> N = 39 <i>n (%)</i>	<b>Non-communicable diseases</b> N = 551 <i>n (%)</i>	<b>Suicide</b> N = 133 <i>n (%)</i>	<b><i>p</i><sup>1</sup></b>
<b>Offence Type</b>		a	b	c	a	d	e	<0.001
Criminal damage	56 (4.0%)	1 (5.9%)	25 (4.6%)	1 (1.0%)	1 (2.6%)	21 (3.8%)	7 (5.3%)	
Drug offences	112 (8.1%)	0 (0%)	52 (9.5%)	11 (11%)	6 (15%)	36 (6.5%)	7 (5.3%)	
Motoring offences	56 (4.0%)	0 (0%)	15 (2.7%)	5 (5.1%)	4 (10%)	26 (4.7%)	6 (4.5%)	
Public order	105 (7.6%)	3 (18%)	62 (11%)	3 (3.1%)	1 (2.6%)	24 (4.4%)	12 (9.0%)	
Sexual	224 (16%)	2 (12%)	9 (1.6%)	33 (34%)	0 (0%)	171 (31%)	9 (6.8%)	
Theft	312 (23%)	2 (12%)	190 (35%)	14 (14%)	10 (26%)	70 (13%)	26 (20%)	

Characteristic	Overall	Alcohol poisoning	Drug poisoning	Infectious diseases	Interpersonal violence	Non-communicable diseases	Suicide	P <sup>1</sup>
	N = 1,385 <i>n</i> (%)	N = 17 <i>n</i> (%)	N = 547 <i>n</i> (%)	N = 98 <i>n</i> (%)	N = 39 <i>n</i> (%)	N = 551 <i>n</i> (%)	N = 133 <i>n</i> (%)	
Violence against the person	464 (34%)	9 (53%)	176 (32%)	27 (28%)	14 (36%)	180 (33%)	58 (44%)	
Other offences	56 (4.0%)	0 (0%)	18 (3.3%)	4 (4.1%)	3 (7.7%)	23 (4.2%)	8 (6.0%)	
<b>Demographics</b>								
Gender								0.017
Female	113 (8.2%)	2 (12%)	61 (11%)	6 (6.1%)	2 (5.1%)	30 (5.4%)	12 (9.0%)	
Male	1,272 (92%)	15 (88%)	486 (89%)	92 (94%)	37 (95%)	521 (95%)	121 (91%)	
		ab	a	ab	ab	b	ab	

Characteristic	Overall	Alcohol poisoning	Drug poisoning	Infectious diseases	Interpersonal violence	Non-communicable diseases	Suicide	P <sup>1</sup>
	N = 1,385 <i>n</i> (%)	N = 17 <i>n</i> (%)	N = 547 <i>n</i> (%)	N = 98 <i>n</i> (%)	N = 39 <i>n</i> (%)	N = 551 <i>n</i> (%)	N = 133 <i>n</i> (%)	
Age (mean, SD)	48.6 (15.7)	49.2 (10.8) <sup>a</sup>	39.8 (8.8) <sup>b</sup>	60.8 (16.5) <sup>c</sup>	29.9 (8.1) <sup>b</sup>	58.8 (14.4) <sup>c</sup>	38.6 (10.4) <sup>b</sup>	<0.001
Ethnicity		<sup>a</sup>	<sup>b</sup>	<sup>c</sup>	<sup>d</sup>	<sup>b</sup>	<sup>e</sup>	<0.001
Asian or British Asian	25 (1.8%)	2 (12%)	4 (0.7%)	2 (2.0%)	3 (7.7%)	13 (2.4%)	1 (0.8%)	
Black	34 (2.5%)	0 (0%)	8 (1.5%)	2 (2.0%)	4 (10%)	18 (3.3%)	2 (1.5%)	
Mixed or multiple	28 (2.0%)	1 (5.9%)	8 (1.5%)	2 (2.0%)	6 (15%)	5 (0.9%)	6 (4.5%)	
Other/Unknown	25 (1.8%)	0 (0%)	8 (1.5%)	0 (0%)	2 (5.1%)	14 (2.5%)	1 (0.8%)	
White	1,273 (92%)	14 (82%)	519 (95%)	92 (94%)	24 (62%)	501 (91%)	123 (92%)	
Place of Birth		<sup>ab</sup>	<sup>a</sup>	<sup>ab</sup>	<sup>ab</sup>	<sup>b</sup>	<sup>ab</sup>	<0.001

Characteristic	Overall	Alcohol poisoning	Drug poisoning	Infectious diseases	Interpersonal violence	Non-communicable diseases	Suicide	<i>P</i> <sup>1</sup>
	N = 1,385 <i>n</i> (%)	N = 17 <i>n</i> (%)	N = 547 <i>n</i> (%)	N = 98 <i>n</i> (%)	N = 39 <i>n</i> (%)	N = 551 <i>n</i> (%)	N = 133 <i>n</i> (%)	
British	1,271 (92%)	14 (82%)	521 (95%)	87 (89%)	34 (87%)	488 (89%)	127 (95%)	
Non-British born	114 (8.2%)	3 (18%)	26 (4.8%)	11 (11%)	5 (13%)	63 (11%)	6 (4.5%)	
<b>Personal Circumstances</b>								
Without Employment	884 (64%)	12 (71%) <sub>abc</sub>	413 (76%) <sub>a</sub>	54 (55%) <sub>bc</sub>	27 (69%) <sub>abc</sub>	287 (52%) <sub>b</sub>	91 (68%) <sub>ac</sub>	<0.001
Accommodation		a	b	c	a	d	c	<0.001
None	137 (10%)	5 (29%)	77 (14%)	7 (7.7%)	8 (21%)	26 (4.8%)	14 (11%)	
Stable	981 (72%)	10 (59%)	349 (65%)	72 (79%)	20 (53%)	432 (80%)	98 (74%)	

Characteristic	Overall	Alcohol poisoning	Drug poisoning	Infectious diseases	Interpersonal violence	Non-communicable diseases	Suicide	<i>P</i> <sup>1</sup>
	N = 1,385 <i>n</i> (%)	N = 17 <i>n</i> (%)	N = 547 <i>n</i> (%)	N = 98 <i>n</i> (%)	N = 39 <i>n</i> (%)	N = 551 <i>n</i> (%)	N = 133 <i>n</i> (%)	
Temporary	240 (18%)	2 (12%)	115 (21%)	12 (13%)	10 (26%)	81 (15%)	20 (15%)	
Suicide Risk	388 (28%)	4 (24%) <sub>abc</sub>	179 (33%) <sub>a</sub>	19 (19%) <sub>b</sub>	12 (31%) <sub>abc</sub>	113 (21%) <sub>b</sub>	61 (46%) <sub>c</sub>	<0.001
Disability	717 (52%)	8 (47%)	304 (56%)	46 (47%)	16 (41%)	272 (49%)	71 (53%)	0.2
<b>Criminogenic Factors</b>								
Sentence Type		ab	a	b	-	b	a	<0.001
Determinate	1,227 (89%)	16 (94%)	535 (98%)	71 (72%)	39 (100%)	440 (80%)	126 (95%)	
Indeterminate	158 (11%)	1 (5.9%)	12 (2.2%)	27 (28%)	0 (0%)	111 (20%)	7 (5.3%)	
Time in Prison (years)	3.6 (6.1)	1.8 (3.6) <sub>a</sub>	1.3 (2.7) <sub>a</sub>	6.0 (7.4) <sub>b</sub>	1.1 (1.2) <sub>a</sub>	5.8 (7.6) <sub>b</sub>	2.0 (3.2) <sub>a</sub>	<0.001

<b>Characteristic</b>	<b>Overall</b> N = 1,385 <i>n (%)</i>	<b>Alcohol poisoning</b> N = 17 <i>n (%)</i>	<b>Drug poisoning</b> N = 547 <i>n (%)</i>	<b>Infectious diseases</b> N = 98 <i>n (%)</i>	<b>Interpersonal violence</b> N = 39 <i>n (%)</i>	<b>Non-communicable diseases</b> N = 551 <i>n (%)</i>	<b>Suicide</b> N = 133 <i>n (%)</i>	<b>P<sup>1</sup></b>
Recall Action	223 (16%)	7 (41%) <sub>a</sub>	121 (22%) <sub>a</sub>	11 (11%) <sub>bc</sub>	8 (21%) <sub>abc</sub>	47 (8.5%) <sub>b</sub>	29 (22%) <sub>ac</sub>	<0.001
Domestic Violence Perpetrator	313 (23%)	5 (29%) <sub>ab</sub>	155 (28%) <sub>a</sub>	16 (16%) <sub>ab</sub>	12 (31%) <sub>ab</sub>	91 (17%) <sub>b</sub>	34 (26%) <sub>ab</sub>	<0.001
Weapon Possession	130 (9.4%)	0 (0%) <sub>-</sub>	72 (13%) <sub>a</sub>	3 (3.1%) <sub>b</sub>	8 (21%) <sub>a</sub>	32 (5.8%) <sub>bc</sub>	15 (11%) <sub>ac</sub>	<0.001
Restraining Order	66 (4.8%)	2 (12%) <sub>ab</sub>	39 (7.1%) <sub>a</sub>	3 (3.1%) <sub>ab</sub>	0 (0%) <sub>-</sub>	16 (2.9%) <sub>b</sub>	6 (4.5%) <sub>ab</sub>	0.007

<sup>1</sup> Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates). Fisher's exact test assumes fixed marginals, however since the data represent the population, the test can be considered to provide an appropriate measure of association. Linear regression was used for continuous data.

	<b>Overall</b>	<b>Alcohol poisoning</b>	<b>Drug poisoning</b>	<b>Infectious diseases</b>	<b>Interpersonal violence</b>	<b>Non-communicable diseases</b>	<b>Suicide</b>	
	N = 1,385	N = 17	N = 547	N = 98	N = 39	N = 551	N = 133	
<b>Characteristic</b>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<b>P<sup>1</sup></b>

Letters indicate groupings based on pairwise Fisher’s exact tests (with simulated p-values) of cause of death categories (CoDs) to assess distributional differences in the characteristic of interest. CoDs sharing the same letter do not differ significantly in their distribution, while CoDs with different letters indicate statistically significant distributional differences ( $p < 0.05$ ), adjusted for multiple comparisons using the False Discovery Rate (FDR) method.



Different causes of death were associated with distinct prior offence patterns, with substance-related deaths linked to violence and public order offences. In contrast, NCD and infectious disease deaths were associated with higher rates of sexual offences. Women had higher proportions of drug poisoning versus NCD deaths. Infectious diseases and NCDs showed older age profiles, while interpersonal violence showed the youngest. Minority ethnic categories had higher rates of alcohol poisoning and interpersonal violence deaths, while non-British-born individuals showed higher NCD rates than drug poisoning. Alcohol poisoning had the highest rate of no accommodation, while interpersonal violence showed 47% with no or temporary accommodation. Suicide deaths had the highest rates of identified suicide risk. Drug poisoning, interpersonal violence, and suicide cases were more likely to have had determinate sentences. Infectious diseases and NCD cases spent more extended periods in prison. Suicide, alcohol and drug poisoning deaths had more recall reviews within 28 days of death. Drug poisoning was more often identified as domestic violence perpetrators, compared to NCDs, and along with interpersonal violence and suicide cases, it had more weapon-related flags than infectious diseases and NCD categories.

## **Discussion**

Our analysis of mortality during 2019-2021 after release from incarceration in England and Wales demonstrates markedly elevated mortality risk and distinct patterns of risk within causes of death. Our findings reveal complex patterns of demographic, criminogenic, and social factors contributing to this population's increased mortality risk. The crude mortality rate of 857 deaths per 100,000 person-years aligns with international evidence for this population (Redacted et al., 2024). Women demonstrated particularly elevated risk (1,261 deaths per 100,000 person-years) compared to men in the sample (825 deaths per 100,000 person-years) and international cohorts (Redacted et al., 2024), warranting focused attention on gender-specific risk. The leading cause of death for both men and women was drug poisoning. For women, this was followed by suicide and NCD: Cancer and neoplasms. For men, this was followed by NCD: Cardiovascular disease and suicide.

The analysis of 735 individuals who died within 12 months after being released from prison demonstrates a high rate of mortality due to injuries and preventable causes. Compared with the general population, drug poisoning showed the highest disparity, with a rate 74 times higher than the general population, followed by interpersonal violence (63 times higher), transport-related accidents (14 times higher) and suicide (10 times higher). NCDs showed a lower likelihood of death (2.5 times lower). There was an elevated risk in the immediate post-release period, particularly for drug-related deaths, interpersonal violence and suicide, which emphasises the critical need for pre-release planning and immediate post-release support. A secondary peak in mortality risk across causes at 6-8 months post-release suggests the need for extended support beyond the immediate transition period.

Developments supporting pre- and post-transitional healthcare continuity, including immediate access to prescriptions and services, as well as emotional and practical support, including safety/crisis planning, are critical in preventing mortality in the first week (Binswanger et al., 2011; Frank et al., 2023). Further understanding the mechanisms contributing to the later peak and whether it relates to service withdrawal/disengagement, changing social circumstances, or other factors would support appropriate interventions. Recent initiatives like the 'Reconnect' programme that aims to provide initial, and ongoing, support to people leaving prison to maintain access to health services after release may go some way to mitigating risks (NHS England, 2024). Furthermore, increased monitoring towards the end of the probation supervision period to ensure suitable support networks may further mitigate risks.

Drug poisoning emerged as the leading cause of death across both genders, accounting for half of all female deaths and 35% of all male deaths. The overall proportion of deaths attributable to drug poisoning (40%) substantially exceeds international averages (~21%) (Redacted et al., 2024) indicating potential systemic differences to the UK context, including fewer homicide and infectious deaths compared with some other countries (Redacted et al., 2024). The introduction of naloxone distribution programmes have shown promising results in reducing drug-related deaths among recently released individuals in England and Wales (Ministry of Justice, 2024a) and expansion of the availability of methadone or long-acting injectable buprenorphine could further help prevent overdose deaths (Lewer & Edge, 2024; Malta et al., 2019). However, naloxone is, by design, a bystander intervention requiring the presence of others (Miller et al., 2022) and polydrug use is common, which may or may not include opioids (Smith et al., 2011), particularly in the context of an increasingly changing drug supply in the UK (Holland et al., 2024).

These elevated risks reflect the need for attention to the social determinants of health, which reflect the circumstances in which people live, work, and grow up (WHO, 2008) and include factors like meaningful work, social connections, financial stability, community safety, and housing security. Research suggests these social factors account for around half of all health outcomes (Hood et al., 2016). Since many of these same factors also influence criminal behaviour, the criminal justice system has a unique opportunity to address them. By tackling these issues while people are in contact with courts, prisons, or probation services, it may be possible to reduce both reoffending and deaths after release.

People who died from drug poisoning were characterised by unstable social circumstances, along with complex criminogenic factors with a gender disparity, suggesting that women face additional challenges in the post-release period. Furthermore, when considering social stability markers and mortality although deaths from external causes (alcohol or drug poisoning, suicide, and interpersonal violence) were associated with lower rates of employment (Garcy & Vågerö, 2012; Roelfs & Shor, 2023), patterns for housing stability were more complex. While less than 60% of those dying from interpersonal violence or alcohol poisoning had stable accommodation, this rose to over 74% for suicide. This challenges

simplistic narratives about social stability supporting a reduction in mortality, whereby accommodation alone may be insufficient to prevent suicide. Accommodation for a criminal justice-involved population, even when stable, can remain precarious, be of poor quality, or act as a stressor due to financial instability (Pevalin et al., 2017; Roelfs & Shor, 2023).

Suicide rates were also exceptionally elevated, accounting for one in every ten deaths. However, fewer than half were identified within probation records as being at a historical or current risk of suicide, indicating that improved assessment, training and information sharing to probation services may support prevention (HMI Probation, 2022; Slade et al., 2024). A further finding is the gender parity in suicide rates, which contrasts with the general population, where male risk is typically threefold higher (Office for National Statistics, 2024) suggesting women face disproportionate post-release suicide risk with gaps in addressing their specific vulnerabilities. While attention has focused on elevated suicide risk among people serving indeterminate sentences within UK prisons (Prison Reform Trust, 2020), this pattern does not persist post-release. Counter-intuitively, individuals released from indeterminate sentences showed significantly lower rates of violent death, suicide, and drug poisoning compared to determinate sentences, with 87% of deaths attributed to NCDs or infectious diseases. This may be due to an older age profile but may indicate that those at greater risk of acute causes of death also experience re-imprisonment (recall) rather than remaining in the community, with psychological distress potentially concentrating during re-imprisonment, where uncertainty and hopelessness can be acute (Fitzalan Howard, 2019).

There was a disproportionate representation of minority ethnic groups among people dying from interpersonal violence, alcohol-related deaths, suicide and NCDs. Deaths from interpersonal violence (i.e. homicide) revealed substantial demographic disparities and were characterised by being of young age, a high representation of minority ethnic groups and the highest rates of housing instability, in keeping with international studies (Lize et al., 2015; Office for National Statistics, 2023a). Their criminal justice profiles typically involved drug and motoring offences, weapon possession and Redacted prison sentences, suggesting greater involvement with gang membership and social disadvantage (Boden, 2019; Taylor et al., 2008). In contrast, NCD mortality showed a markedly different pattern, associated with older age, sexual offending, longer sentences, and greater social stability, but also higher rates of non-British-born individuals. This distinct profile suggests different risk mechanisms requiring age-specific intervention strategies and improved chronic disease management during incarceration and after release (Herbert et al., 2012; Munday et al., 2019). Gender-specific mortality patterns are also prominent, with an elevated risk of drug poisoning and suicide deaths amongst women likely reflecting complex histories of domestic abuse, trauma, mental health challenges, and substance use (Massoglia et al., 2014; Ministry of Justice, 2022). In contrast, male mortality is characterised by higher rates of cardiovascular disease, violence, and traffic accidents, potentially reflective of reduced healthcare engagement, risk-taking behaviours, and sustained involvement in criminal activities (Pratt et

al., 2006). The demographic patterns raise concerns about structural inequalities and reflect disparities in access to healthcare services present for disadvantaged communities (Klein & von dem Knesebeck, 2018; Nelson et al., 2002; The King's Fund, 2023; WHO, 2008). Prevention strategies require gender and cultural-specific approaches (Ministry of Justice, 2022) and targeted interventions based on population-specific evidence, supported by justice-health linked data exploring differential experiences of women and minority groups (Garcy & Vågerö, 2012; Kinner et al., 2013; Massoglia et al., 2014). Incorporating mortality risk analysis into Equality Impact Assessments would strengthen prevention planning (NHS England, 2015).

A marked pattern emerges around the clustering of violence-related risk factors (violent offence, domestic violence perpetration, weapon possession and restraining orders) with drug poisoning, suicide and victims of interpersonal violence, suggesting common underlying mechanisms or vulnerabilities. This suggests that a history of multiple violence modalities increases the risk of violent or unnatural death (Steege et al., 2019), and may be due to social factors whereby they live in areas concentrated with higher environmental or social network risks or deprivation (de Courson et al., 2023), behavioural factors such as a higher likelihood to engage in high-risk behaviours or substance use (Motley et al., 2017) or disproportionately lower access to healthcare (Semenza et al., 2020) and addressing these factors may indirectly reduce mortality in this population.

The relationship between recall to prison and mortality shows elevated recall rates within 28 days of death for external causes, particularly alcohol-related deaths (>40%), and approximately one-fifth of suicides, interpersonal violence, and drug poisoning deaths. This pattern, consistent with community probation findings (Borrill et al., 2017; Slade et al., 2024), suggests post-release challenges where individuals resume risky behaviours or violate release conditions. These violations often stem from serious life challenges, including job loss, homelessness, mental health crises, bereavement, or financial hardship, which can trigger both recall proceedings and increase mortality risk (Borrill et al., 2017). Fitzalan Howard (2019) characterised recall as a damaging process lacking perceived legitimacy, suggesting that enhanced procedural justice and trust-building could reduce mortality risk, whilst balanced against public protection considerations (Mackenzie et al., 2017). With its potential shift away from custodial sentences, the current Sentencing Review (Ministry of Justice, 2024b) provides an opportunity to redirect resources towards enhanced post-release support. Additional investment in probation, health, and community services as well as ensuring equality of access for individuals post-release, could help address both reoffending and mortality risks among those leaving prison.

This study represents the most comprehensive analysis of cause-specific mortality among people released from prison in England and Wales, with several key methodological strengths. The quality of mortality data was enhanced by integrating official death certification information, providing a robust classification of causes of death using standardised ICD-10 coding and allowing meaningful comparison with international studies

and general population mortality data. Additionally, the large sample size spanning three years provides sufficient statistical power to examine patterns across different causes of death and enables analysis of temporal patterns in mortality risk, revealing previously unidentified peaks in risk at different time points post-release. A particular strength lies in the comprehensive nature of the justice system data, which allowed a unique examination of multiple criminogenic factors, providing insights into how social and criminological factors and risk classifications interact with mortality risk.

Several limitations should be considered when interpreting these findings. Our inability to compare risk factors for deceased individuals with those who survived post-release limits our understanding of risk and protective factors. Using criminal justice system data, which relies on probation practitioner assessments rather than clinical diagnoses, means we lack integrated health system information about pre-existing conditions, treatment engagement, and healthcare access. Data quality within available data varied considerably, with potentially influential factors (e.g., drug use and gang membership) excluded due to recording inconsistencies. Developing routine systems for data matching and sharing is essential to ensure more accurate analysis in the future (Kinner et al., 2013). Cases were primarily excluded from matching due to pending inquests, potentially creating systematic bias and underestimation of acute deaths, particularly those requiring coroner investigation, such as suicides and drug-related deaths. Broad ethnicity categories available in the data may mask variations in risk and experiences between specific ethnic groups. A 12-month follow-up period will not capture longer-term mortality patterns or how different causes of death and the effects of associated risk factors, including cumulative disadvantage, may emerge at varying time points after release (Redacted et al., 2024). Despite these limitations, our findings provide important insights into patterns of post-release mortality and highlight areas where targeted intervention might reduce death rates in this vulnerable population.

In conclusion, our findings reveal that complex interactions between demographic, criminogenic, and social factors shape post-release mortality risk. While immediate post-release remains an acute risk, we identified a second mortality peak shortly after six months, suggesting the need to extend interventions beyond the early release period. Distinctive gender patterns in drug poisoning and suicide, alongside the overrepresentation of minority ethnic groups in violent deaths, indicate that to prevent these deaths, transitional and post-release strategies and programmes must be tailored to address both gender-specific needs and cultural backgrounds, particularly in the prevention of suicide, drug-related death and violence victimisation. The older age profile of NCD deaths indicates a need for improved chronic disease management during imprisonment and in transition planning. Prevention requires coordinated action across health, justice, and social care systems, with sustained and integrated support throughout incarceration and across the 12 months post-release.

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**Table S1: SMR Adjusted for Age and Gender across Cause of Death**

<b>Cause of death</b>	<b>CMR (95% CI)</b>	<b>Female CMR (95% CI)</b>	<b>Male CMR (95% CI)</b>
Injuries: AOD: Alcohol poisoning	12.8 (5.8 - 20.9)	<1	13.8 (6.3 - 22.6)
Injuries: AOD: Drug poisoning	393.3 (351.4 - 435.2)	628.1 (439.7 - 832.2)	374.5 (333.1 - 417.3)
Injuries: Interpersonal violence	26.7 (16.3 - 38.3)	31.3 (0 - 78.2)	26.3 (16.3 - 37.6)
Injuries: Suicide	82.4 (63.9 - 102.2)	156.6 (62.6 - 266.1)	76.5 (57.7 - 96.6)
Injuries: Transport-related accidents	18.6 (10.4 - 27.9)	31.3 (0 - 78.2)	17.6 (8.8 - 27.6)
NCD: Cardiovascular diseases	79 (60.4 - 98.7)	31.3 (0 - 78.2)	82.8 (64 - 102.9)
NCD: Cancer and other neoplasms	54.6 (39.5 - 70.8)	93.9 (31.3 - 172.1)	51.4 (36.4 - 67.7)
NCD: Chronic respiratory diseases	24.4 (15.1 - 34.8)	62.6 (15.6 - 125.2)	21.3 (11.3 - 32.6)
NCD: Diabetes	12.8 (5.8 - 20.9)	15.6 (0 - 46.9)	12.5 (5 - 21.3)
NCD: Other and ill-defined	55.7 (40.6 - 72)	78.3 (15.7 - 156.5)	53.9 (38.9 - 70.2)
Infectious diseases: Covid-19	25.5 (15.1 - 37.1)	15.6 (0 - 46.9)	26.3 (16.3 - 37.6)
Infectious diseases: Respiratory Infections	11.6 (4.6 - 19.7)	15.6 (0 - 46.9)	11.3 (5 - 18.8)
Infectious diseases: Other and ill-defined	1.2 (0 - 3.5)	15.6 (0 - 46.9)	<1
Other and ill-defined	55.7 (40.6 - 72)	78.3 (15.7 - 156.5)	53.9 (38.9 - 70.2)

