



Sociodemographic, health and criminological risk factors for post-imprisonment mental health and substance use-related service contacts: A nationwide retrospective cohort study using linked data (RELEASE)

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Abstract

Purpose To quantify differences in health service (community, unscheduled/emergency, inpatient) contact for mental health and substance use pre and post-release from prison, and explore variations between subgroups based on sociodemographic, health and criminological risk factors.

Methods We conducted a nationwide retrospective cohort study of mental health and substance use-related health service contacts for everyone released from a Scottish prison in 2015. A whole-systems approach utilising linked administrative health and prison data was used to assess contacts over a four-year follow-up period, across nine health services spanning community, unscheduled/emergency, and inpatient care. The analysis is focused on subgroup variations among people released from prison; we have previously reported findings from a matched population comparison elsewhere [1]. Incidence rate ratios, using person-years of time-in-community as a denominator, with 95% confidence intervals, were estimated to compare community contacts prior to, and following, the 2015 index release. Multivariable negative binomial models were fitted for each service to explore subgroup variation.

Results Contact incidence rates increased in the follow-up period in four out of nine services compared to the four years prior. Sociodemographic, health and criminological risk factors contribute to variability, and demonstrate complex patterning, across the nine services. The number of pre-index prison episodes, time spent in prison, and circumstances of index release (e.g., supervision, probation) were independently associated with post-imprisonment contacts.

Conclusion Cumulative time in prison and repeated short-term imprisonment, and circumstances of release, contribute to different experiences upon release and variations in post-imprisonment health service contacts for mental health and substance use. Health and criminal justice policymakers must consider how imprisonment and release may exacerbate health needs and service demands, and ensure harms of imprisonment are minimised.

Keywords Mental health · Substance use · Imprisonment · Whole-system analysis · Linked data

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Introduction

The prison population is characterised by elevated rates of mental health and substance use problems [2], including a high prevalence of comorbid serious mental illness and substance use disorders [3, 4]. Due to mental ill-health and substance use problems, the challenges associated with release from prison include interruption of care, stigma [5–7], marginalisation [8], difficulties accessing community mental health and substance use services [9], and high levels of need for emergency services [10, 11]. Mortality rates

following release from prison are extremely high, particularly in the days and weeks following release [11], and substance use-related deaths and suicide are the leading causes of death, both internationally [12] and within Scotland [13].

The number of people in prisons globally has increased rapidly in recent decades and is currently estimated to be 11.7 million [14]. Scotland has one of the highest rates of imprisonment among high-income countries in Europe [15], with an average daily prison population of 8,216 in 2024-25 [16]. The rate of drug-related deaths recorded in Scotland has also risen sharply since 2014, ranking it amongst the highest internationally [17, 18]. These developments have occurred in the broader context of longstanding inequalities, reinforced by over a decade of austerity policies implemented within the United Kingdom (UK) which have adversely affected the most vulnerable populations due to cuts to critical welfare and social care services [19].

The importation model proposes that people in prison ‘import’ their risk of adverse health outcomes from their lives prior to imprisonment, which explains why elevated risks of poor outcomes are observed among people imprisoned [20, 21]. Further, people in prison disproportionately return to areas impacted by socioeconomic deprivation and are thus at risk of being released into communities with underfunded, inadequate, or inaccessible services. Barriers to receiving adequate early intervention may then worsen mental health and substance use problems [22].

Imprisonment may itself contribute to harm [23], including ill-health, and mental health and substance use problems. In Scotland, healthcare is universally available and free at the point of use from the National Health Service (NHS). The NHS provides health services in prison (since 2011), and being admitted to prison should offer an opportunity for accessing healthcare [24]. However, current prison mental health and substance use services are insufficient for the levels of need, typically not well integrated with each other, and are variably engaged with other agencies involved in maintaining health and wellbeing (including the Scottish Prison Service [SPS], social work, and third sector organisations) [25, 26]. These barriers to adequate service provision for people with multiple support needs (e.g., co-occurring mental health and substance use problems, physical ill-health, housing) are a critical challenge [24–26], with strong implications for the period following release. The deprivation model indicates that prison harms go beyond insufficient psychiatric care to include prison conditions and experiences of imprisonment, including a loss of autonomy and social relations. These can lead to poor health outcomes [20, 21, 23, 27]. Transition back to the community following release further contributes to deteriorating health if support is inadequate [28], and the circumstances of release (e.g., supervision, probation) are associated with distinct

harms, or what is often referred to in criminological terms as ‘pains’ [23].

Being released with conditions in place (termed ‘released on licence’ in Scotland) is associated with the challenge of reorganising one’s life around sanctions for failure to meet requirements and the constant threat of being recalled to prison, sometimes due to minor infringements [29, 30]. Electronic monitoring includes potential harms in the form of restricted liberty, lack of privacy, and stigma associated with wearing ‘the tag’ [31]. Desistance (the process of moving away from crime and associated lifestyles) can be a source of harm due to necessary removal from social networks, challenges establishing new supportive relationships, and relocation [32]. There are collateral consequences of having a criminal record, in terms of stigma and exclusion from services and employment, which persist long after the cessation of offending [29]. The period following imprisonment can involve isolation, loneliness and a lack of hope [32]. Imprisonment is extremely disruptive, and people with repeated short-term periods of imprisonment, including people on remand (in custody pending trial or awaiting sentencing), may be particularly vulnerable due to challenges receiving healthcare both in and out of prison [24, 33]. All of these challenges can be considered potential harms associated with release, which exacerbate stress and mental ill-health, impact contact with services, and may increase risk of mental health and substance use-related emergency care use, repeated imprisonment, and mortality.

Despite this background, there is limited evidence on post-imprisonment service contact outside of North America and Australia. This impacts policymakers and practitioners’ ability to make evidence-informed decisions about service design and delivery. This paper makes a significant original contribution by exploring post-release service contact in a European context and by conducting the first whole-systems analysis internationally; this is critical to better understand and improve the health and justice outcomes of people who have been imprisoned. The RELEASE study aimed to quantify health service (community, unscheduled/emergency, inpatient) contact for mental health and substance use among people released from prison in Scotland, compared to a matched population sample, and explore differences between subgroups based on sociodemographic, health and criminological risk factors. This paper reports service contacts for subgroups in the prison population. We have reported findings on the matched population comparison elsewhere [1].

Methods

Study design and data sources

We conducted a nationwide retrospective observational cohort study. The cohort included everyone released from a Scottish prison in 2015 ($n = 8,313$). We used routinely collected linked data from SPS, Public Health Scotland

(PHS), and National Records Scotland (NRS). The cohort was created by identifying everyone with a release record in 2015 in the SPS database, *Prisoner Records 2* (PR2), the operational system used to record prison admissions and releases in Scotland. Probabilistic data linkage was used to match individuals' prison records to their health records (see protocol paper for details) [34]. Table 1 describes the data sources. Figure 1 represents the data linkage process.

Table 1 Data sources and descriptions

Dataset Name	Description	Abbreviated Name used as Outcomes	Codes used to identify psychiatric contacts
The Community Health Index (CHI)	A population register used in Scotland for health care purposes. The CHI number uniquely identifies a person on the index and contains basic demographic data.		
Outpatient Appointments and Attendances (SMR00)	Episode-level data from patients on new and follow-up appointments at outpatient clinics in all specialities (except A&E and Genito-Urinary Medicine).	Mental health outpatient	Clinical speciality codes (only mental health-related contacts are captured).
The General / Acute and Inpatient Day Case dataset (SMR01)	Episode-level data on hospital inpatient and day case discharges from acute specialities from hospitals in Scotland including diagnosis. The dataset contains episode management data.	General inpatient	ICD10 codes.
The Mental Health Inpatient and Day Case dataset (SMR04)	Episode-level data on patients who are receiving care at psychiatric hospitals, including diagnosis, at the point of admission and discharge.	Psychiatric inpatient	ICD10 codes.
Scottish Drug Misuse Database (SDMD)	Information about clients seen at specialist drug services, general practitioners and prison drug services. This includes prescription profile, and initial and follow-up information.	Substance use outpatient	Only substance use-related contacts are captured.
Scotland's telehealth service (NHS24)	Information about unscheduled care contacts with Scotland's national telehealth and telecare service, including information on the nature and outcome of the call.	NHS24 helpline	Symptoms reported.
Scottish Ambulance Service (SAS)	Episode-level data on patients who have used unscheduled emergency transportation. Contains the Advanced Medical Priority Dispatch System (AMPDS) code and information on substance use.	Ambulance	AMPDS codes, complaint codes, substance use-specific codes.
Primary Care Out of Hours (OOH)	Episode-level data on patients receiving out of hours primary care services. Contains Read codes.	Out-of-hours general practice (GP)	Read codes.
Accident and Emergency (A&E)	Episode-level data on patients receiving unscheduled care across emergency departments, minor injuries units and community units. Contains ICD10 codes and diagnostic group codes.	Emergency department (ED)	ICD10 codes, diagnostic group codes, intent of injury.
Prescribing Information System (PIS)	Records of all medicines prescribed and dispensed in the community in Scotland, and prescriptions written in hospitals that are dispensed in the community. As GPs write the vast majority of these (a small minority are written by other authorised prescribers e.g., nurses, dentists), we can use prescribing data as a proxy for accessing primary care for MH/SU. Contains British National Formulary (BNF) codes, which will be used to identify prescriptions issued for MH/SU-related medicines.	Community prescribing	BNF codes.
National Register of Scotland Death Records (NRSDR)	Database containing information on all registered deaths in Scotland with information on cause(s) of deaths.		
Prisoner Records 2 (PR2)	Prison admission and liberation records and demographic data for all people in Scottish Prison Service (SPS) establishments. The dataset is split into two files – admissions and liberations, with demographic data associated with the liberations dataset.		

Linkage was coordinated by an independent third-party, the Electronic Data Research and Innovation Service (eDRIS), within PHS. We quantified service contacts associated with mental health, substance use, or both, across nine services: community services (community prescribing, mental health outpatient, substance use outpatient), unscheduled care (NHS 24-hour helpline, out-of-hours general practice [GP]), emergency care (emergency department [ED], ambulance) and inpatient care (psychiatric, general).

Setting

The data cover all 14 Scottish prisons operational at the time and all 14 Scottish Regional Health Boards. We defined an individual's *index date* as the most recent release date in 2015. The four years prior to (and excluding) the index date were defined as the *pre-index period*. The four years starting from the index date were defined as the *post-imprisonment period*. We censored follow-up at the point of death, where relevant. To quantify post-imprisonment service contacts, we only counted contacts while individuals were alive and not in prison, defined as *time-in-community* (i.e. when the individual was in community, 'at risk' of service contacts). The aggregated follow-up period totalled 24,451.05 person-years of time-in-community.

Study cohort

Individuals were included if they had a release record in 2015 in the PR2 database. In total, 8,917 individuals were identified from PR2 data, and 8,491 were successfully linked to the Community Health Index Database (CHI; register of all patients in NHS Scotland). We removed individuals with a release considered invalid (e.g., temporarily released to appear in court and readmitted to prison) and individuals with deaths recorded while in prison. The final study cohort consisted of 8,313 individuals. For data processing details, see Fig. 1.

Variables

Outcomes

We evaluated nine outcomes, our estimand being the rate of service contacts associated with mental ill-health and/or substance use per person-year of time-in-community for each of the nine services examined. Table 1 shows the clinical classification systems used to identify contacts associated with mental ill-health and substance use. Full details regarding the codes and algorithms used are available on GitHub [35]. We sought to identify psychiatric conditions

Fig. 1 Data linkage process and participant flowchart (reproduced from Connell et al. 2026 [1])

related to mental ill-health, and use of controlled substances and alcohol, consistently across services. Details on this process are provided in our protocol [34].

Predictors

Characteristics of the cohort are presented in Table 2, showing distributions for each predictor variable in the multivariable regression analysis and the data source.

Statistical analysis

We published our statistical analysis plan prior to analysis, following a review by our Project Advisory Group (public health practitioners and researchers, statisticians and epidemiologists) [34, 36]. Incidence rates with 95% confidence intervals (CIs) were calculated for pre-index and post-imprisonment service contacts across all services. Denominators were person-years of time-in-community in the pre-index and post-imprisonment period, respectively. We compared differences by calculating the incidence rate ratios of post-imprisonment contacts to pre-index contacts. To identify sociodemographic, health and criminological risk factors for post-imprisonment contacts, we fitted multivariable negative binomial models [37] for each service. These were preferred to Poisson models due to overdispersion and zero inflation in the data: they performed better on visual fit using hanging rootograms [38] and on log-likelihood tests of model fit. The model specifications were identical for all models, with service contacts being the outcome, the predictors shown in Table 2 as covariates, and post-imprisonment time-in-community as an offset, thus allowing us to model rates (service contacts per person-year of time-in-community) as opposed to counts. We present the model results with point estimates expressed as adjusted incidence rate ratios (aIRRs) and 95% CIs. Table 4 presents selected covariates focused on in our analysis (see Online Resource 1 for full model estimates).

To avoid increased risk of Type II errors, we did not adjust for multiple comparisons in our main analysis [39, 40]. As we examined distinct patterns in service contacts by subgroup variability among a population impacted by marked health inequalities and marginalisation, we judged it preferable to risk a Type I rather than a Type II error: failing to acknowledge that subgroups of people released from prison have increased risks of service contacts potentially has more serious implications than erroneously identifying that subgroups have increased risks of service contacts when they do not. However, we provide full unadjusted and within-term Bonferroni-adjusted p-values in Online

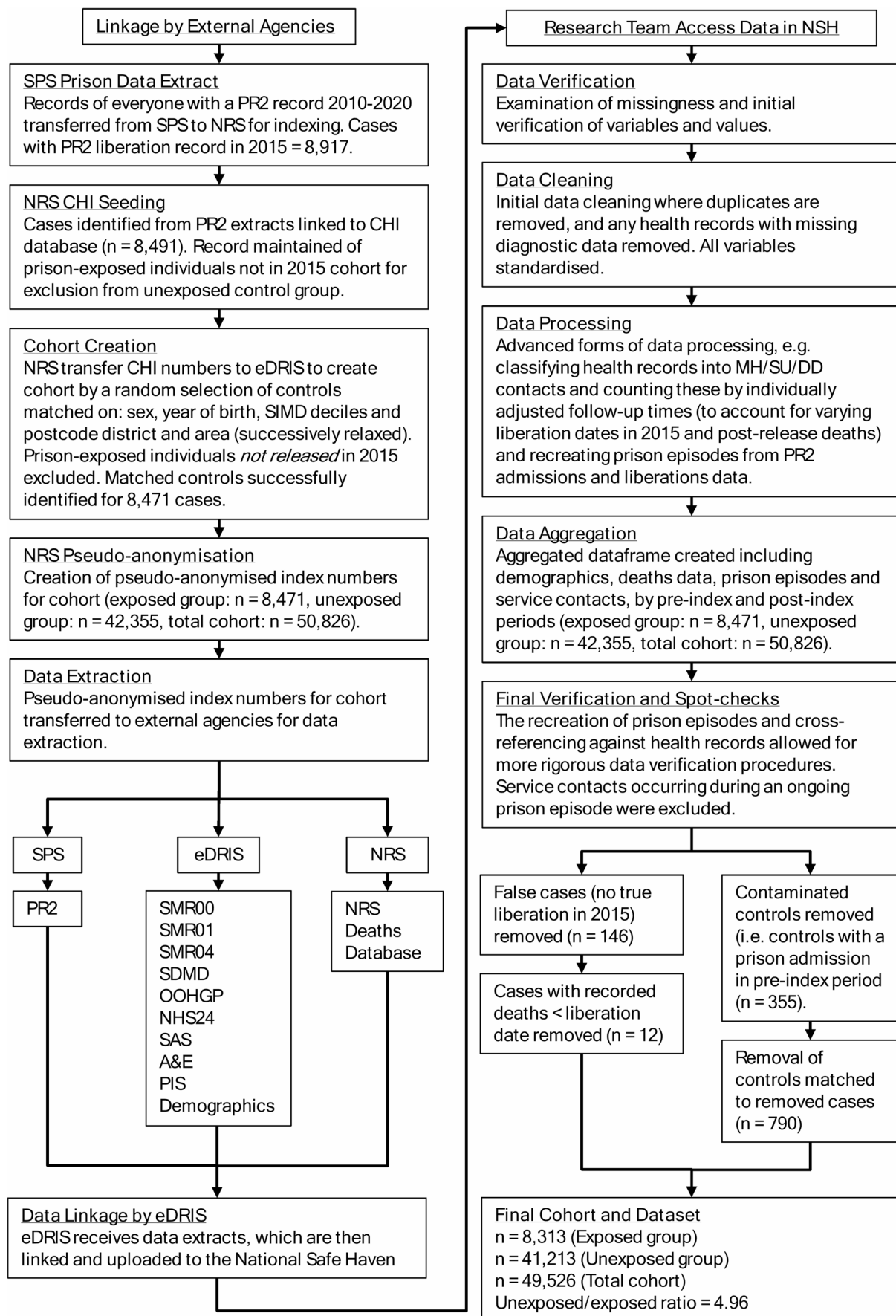


Table 2 Risk factor descriptions, cohort characteristics and data sources

Characteristic	<i>n</i> (%); Mean (SD)	Description	Data Source
<i>Sex</i>		Derived from electronic health records.	Demographics
Male (reference level)	7,606 (91.5%)		
Female	707 (8.5%)		
<i>Ethnicity</i>		Derived from the most recent prison admission record.	PR2
White (reference level)	8,064 (97.0%)		
Non-White	249 (3.0%)		
<i>Age Groups</i>		Age at index date in 2015. Derived from electronic health records.	Demographics
16–24	1,490 (17.9%)		
25–44 (reference level)	5,306 (63.8%)		
≥45	1,517 (18.2%)		
<i>Marital Status</i>		Self-reported. Derived from the most recent prison admission record.	PR2
Single (reference level)	6,513 (78.3%)		
Married or civil partnership	548 (6.6%)		
Common law partner	764 (9.2%)		
Divorced, separated or widowed	488 (5.9%)		
<i>Sexual Orientation</i>		Self-reported. Derived from the most recent prison admission record.	PR2
Straight (reference level)	7,986 (96.1%)		
LGBTQ+	327 (3.9%)		
<i>Religion</i>		Self-reported. Derived from the most recent prison admission record.	PR2
None (reference level)	3,875 (46.6%)		
Church of Scotland	2,026 (24.4%)		
Roman Catholic	1,666 (20.0%)		
Muslim	160 (1.9%)		
Other Religion	586 (7.0%)		
<i>Disclosed Disability</i>		Self-reported. Derived from the most recent prison admission record.	PR2
No (reference level)	7,466 (89.8%)		
Yes	847 (10.2%)		
<i>Scottish Index of Multiple Deprivation (2016) Quintiles</i>		Scottish Index of Multiple Deprivation (SIMD); a relative composite measure of area-level deprivation, where deprivation scores are usually partitioned into deciles or quintiles (where a lower decile/quintile represents the most deprived areas). Derived from postcode recorded on, or closest to, index date. Matching was performed using deciles to maximise comparability between the exposed/ matched groups. We used quintiles in the analysis to avoid disclosing small numbers.	Demographics
1 (reference level)	4,363 (52.5%)		
2	2,014 (24.2%)		
3	1,063 (12.8%)		
4	689 (8.3%)		
5	184 (2.2%)		
<i>Release Type</i>		The circumstances of the 2015 index release, where each category represents:	PR2
Sentence Expiry (reference level)	5,990 (72.1%)	Having served the sentence;	
Court/Proc. Fiscal	1,105 (13.3%)	Released following appearance in court, which is an indication that the person has been on remand (untried, in custody and pending trial);	
Licence/Parole/SRO	526 (6.3%)	Released with conditions in place, including Supervised Release Order (SRO) and parole, which indicates that the person has served a longer sentence;	
Bailed	441 (5.3%)	Released from custody whilst awaiting court appearance/trial;	
Other	251 (3.0%)	Contains several release types that are less common, including immigration-related, discretionary early release, and release to psychiatric hospital.	
<i>Age at Index Date</i>	34.75 (10.77)	Age at index date in 2015. Derived from electronic health records.	Demographics
<i>Prison Episodes in Pre-Index</i>	2.41 (1.97)	Distinct periods of imprisonment occurring in the pre-index period, reconstructed from admissions and release records.	PR2

Table 2 (continued)

Characteristic	<i>n</i> (%); Mean (SD)	Description	Data Source
<i>Years in Community in Pre-Index</i>	2.56 (1.18)	The aggregate time, measured in years, an individual was alive and not in prison during the pre-index period.	PR2; NRS DR
<i>Years in Community in Post-Index</i>	2.94 (1.25)	The aggregate time, measured in years, an individual was alive and not in prison during the post-index period. Modelled as an offset in the negative binomial models.	PR2; NRS DR
<i>Number of Comorbidities (Pre-Index)</i>	0.72 (1.14)	A count of diagnosed comorbidities from the Elixhauser Index, reported during the pre-index period. Used as an indicator for general health.	SMR01; SMR04
<i>Pre-Index Service Contacts</i>	(see Table 3 for incidence rates)	Operationalised in the same way as our outcome variables, but contacts were only counted in the pre-index period. Used as predictors in negative binomial models (e.g., when ambulance contacts were estimated, pre-index ambulance contacts were used as a predictor). All contacts cross-referenced against prison and death records to ensure we only counted contacts prior to death and whilst not imprisoned.	PIS; SMR00; SDMD; NHS24; OOH; SMR04; SMR01; A&E; SAS; PR2; NRS DR

Resource 3, where adjustments are based on repeated testing of the same risk factors across the nine outcomes. Across all model terms (9 models $\times$ 30 terms = 270 terms), 155/270 terms were significant at $\alpha = 0.05$ prior to adjustment, and 141/270 terms were significant at $\alpha = 0.05$ following Bonferroni adjustment.

Lived experience advisory panel

We were advised by our Lived Experience Advisory Panel, formed of individuals of varying age, gender, and time since release from prison. They provided invaluable input throughout, from our initial research aims to the focus, framing, and presentation of results. The focus on criminological risk factors and the ‘pains’ or harms of imprisonment and release result from these discussions.

Results

Cohort descriptives and service contact incidence rates

In the cohort, 91.5% are males, 97.0% are White, 96.1% are heterosexual, and 52.5% are from the most deprived SIMD quintile in Scotland. 78.3% report being single, and the average age at the index date was 34.75 (sd=10.77). Mean follow-up time in years was 3.83 (sd=0.66), and the median was 4.00. 712 deaths were recorded in the post-imprisonment period (8.6% of the entire cohort), with 406 (57%) of these deaths being drug-related. Mean days until a recorded death following liberation were 735.90 (sd=446.38), with a median of 773.00 days.

In the pre-index period (four years prior to release), the mean number of years spent in the community was 2.56 (sd=1.18), the mean number of prison episodes was 2.41 (sd=1.97), and the mean number of diagnosed Elixhauser

comorbidities was 0.72 (sd=1.14). The most common reason for release was having served the full sentence (i.e., sentence expiry; 72.1%) with 13.3% released from court (indicative of having been remanded to custody pending trial), and 6.3% released on licence, parole, or on a supervised release order (SRO).

While the IRR point estimates in Table 3 for most services were higher in the follow-up period, compared to the pre-index period, the confidence intervals indicate uncertainty in most estimates. The increases were largest, and statistically significant, for out-of-hours GP contacts (IRR=2.17 [95% confidence interval: 1.37–3.80]), followed by general inpatient (1.40[1.01–1.99]), community prescribing (1.31[1.26–1.36]), substance use outpatient (1.18[1.01–1.38]). The point estimates in the follow-up period were lower for psychiatric inpatient (0.90[0.57–1.42]), ambulance (0.83[0.69–1.01]), and NHS24 helpline (0.75[0.54–1.03]) service contacts; however, these were not significant. Emergency department and ambulance contact rates are broadly comparable to mental health outpatient and substance use outpatient contacts, and several times higher than other unscheduled care services (e.g., ambulance contacts are 2.9x higher than NHS24 helpline and 3.6x higher than out-of-hours GP contacts).

Multivariable analysis

Sociodemographic factors

Women have significantly higher contact rates than men for prescribing (1.31[1.17–1.47]), substance use outpatient (1.51[1.28–1.78]), all unscheduled and emergency care services (out-of-hours GP=2.77[1.99–3.86]; NHS24 helpline=2.11[1.51–2.94]; ambulance=1.54[1.28–1.84]; ED=1.47[1.20–1.79]), and psychiatric hospitalisations (1.47[1.08–2.02]).

Table 3 Pre-index and post-imprisonment contact incidence rates (contacts per 1,000 person-years of time-in-community) with 95% confidence intervals for all services

Service	Pre-index incidence rate (95% CI)	Post-imprisonment incidence rate (95% CI)	Incidence Rate Ratio* (95% CI)
Community prescribing	4352.59 (4324.63–4380.69)	5685.93 (5656.08–5715.90)	1.31 (1.26–1.36)
Mental health outpatient	514.93 (505.34–524.65)	539.12 (529.95–548.40)	1.05 (0.93–1.18)
Substance use outpatient	281.92 (274.84–289.14)	331.89 (324.71–339.19)	1.18 (1.01–1.38)
NHS24 helpline	89.02 (85.06–93.11)	66.99 (63.79–70.32)	0.75 (0.54–1.03)
Out-of-hours GP	25.14 (23.06–27.36)	54.44 (51.55–57.44)	2.17 (1.37–3.80)
Emergency department	176.11 (170.52–181.84)	191.53 (186.08–197.09)	1.09 (0.89–1.33)
Ambulance	235.91 (229.44–242.52)	196.96 (191.44–202.61)	0.83 (0.69–1.01)
Psychiatric inpatient	40.43 (37.77–43.22)	36.28 (33.93–38.74)	0.90 (0.57–1.42)
General inpatient	58.77 (55.56–62.11)	82.41 (78.85–86.09)	1.40 (1.01–1.99)

* Ratio = post-imprisonment incidence rate compared to pre-index incidence rate

Age is associated with all community services use, and unscheduled/emergency care but not inpatient care. People aged 25–44 have consistently higher rates for use of community services than people aged 16–24 and people aged ≥ 45 . However, the association between ≥ 45 and community prescribing is non-significant. Compared to 25–44 s, people aged 16–24 have higher rates of NHS24 helpline (1.77[1.36–2.30]) and out-of-hours GP contacts (1.35[1.03–1.77]). The ≥ 45 s have lower rates compared to the 25–44 s for emergency department (0.69[0.58–0.81]) and ambulance contacts (0.72[0.62–0.84]).

Single people have increased mental health and substance use outpatient contact rates compared to people who are married/civil partnership or have a common law partner. The contact rates for single people are also consistently higher for all unscheduled/emergency care services. Compared to single people, those with a common law partner have lower rates of psychiatric inpatient (0.69[0.49–0.98]) and general inpatient contacts (0.62[0.47–0.81]). People who are married/in a civil partnership have lower rates for general inpatient contacts (0.66[0.47–0.94]).

Health factors

The number of contacts in the pre-index period is strongly and positively associated with post-imprisonment contacts across all services; nevertheless, interpretation of the precise relationship between pre-index and post-index service contacts is challenging due to skewed distributions. Contact rates are significantly higher for people with multiple contacts in the pre-index period, compared to people with no contacts in the pre-index period. The confidence intervals in some cases are very wide, and the point estimates thus not well-suited for interpretation, particularly for comparisons between groups of people with five or more pre-index service contacts, compared to people with no contacts. This is primarily driven by comparatively few cases with five or more contacts in the pre-index period and a very high number of contacts in the post-index period.

The number of diagnosed comorbidities is also positively associated with contact rates across all services. It is stronger for inpatient care (general inpatient=1.68[1.58–1.79]; psychiatric inpatient=1.29[1.20–1.40]), and unscheduled/emergency care (out-of-hours GP=1.53[1.41–1.67]; NHS24 helpline=1.47[1.35–1.60]; emergency department=1.43[1.36–1.50]; ambulance=1.38[1.32–1.45]), compared to community services (mental health outpatient=1.21[1.15–1.27]; substance use outpatient=1.20[1.15–1.25]; community prescribing=1.13[1.09–1.16]).

People who disclosed having a disability at prison admission have increased contact rates of use across all services, with the exception of substance use outpatient services (1.01[0.86–1.17]). The associations are again strongest for inpatient care (psychiatric inpatient=2.00[1.53–2.61]; general inpatient=1.52[1.22–1.88]), followed by unscheduled/emergency care (out-of-hours GP=1.76[1.28–2.41]; NHS24 helpline=1.60[1.17–2.19]; ambulance=1.58[1.35–1.85]; and emergency department=1.49[1.25–1.77]).

Criminological factors

The number of pre-index prison episodes is negatively associated with prescribing (0.98[0.96–1.00]), but positively associated with substance use outpatient (1.04[1.01–1.06]) and all emergency/unscheduled care (out-of-hours GP=1.20[1.13–1.26]; emergency department=1.18[1.15–1.21]; NHS24 helpline=1.14[1.08–1.20]; ambulance=1.12[1.09–1.15]) and inpatient care (general inpatient=1.17[1.13–1.22]; psychiatric inpatient=1.10[1.05–1.16]) services.

A higher number of years spent in the community (i.e. not in prison) in the pre-index period is associated with lower post-imprisonment contacts across all community services (substance use outpatient=0.69[0.66–0.72]; prescribing=0.72[0.70–0.74]; mental health outpatient=0.73[0.69–0.77]), emergency services (ambulance=0.78[0.74–0.82]; emergency department=0.87[0.82–0.92]), and inpatient services (general inpatient=0.89[0.83–0.96]; psychiatric inpatient=0.89[0.81–0.98]).

Table 4 Negative binomial model estimates for service contacts with community services, unscheduled/emergency and inpatient care

Term	Community Services			Unscheduled and Emergency Care			Inpatient Care		
	Community Prescribing	MH Outpatient	SU Outpatient	NHS24	OOH GP	ED	Ambulance	Psychiatric Inpatient	General Inpatient
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Intercept	3.84*** (3.40–4.33)	0.48*** (0.39–0.60)	0.44*** (0.37–0.53)	0.01*** (0.01–0.02)	0.01*** (0.01–0.02)	0.08*** (0.06–0.10)	0.12*** (0.10–0.15)	0.02*** (0.01–0.03)	0.03*** (0.02–0.04)
Pre-index contact (ref: 0 contacts)									
1 pre-index contact	1.73*** (1.52–1.96)	4.21*** (3.43–5.17)	2.76*** (2.37–3.21)	4.30*** (2.98–6.19)	5.95*** (3.53–10.04)	2.25*** (1.91–2.66)	2.42*** (2.10–2.79)	4.36*** (3.10–6.14)	1.86*** (1.46–2.37)
2 pre-index contacts	1.95*** (1.67–2.28)	5.54*** (4.20–7.32)	3.79*** (3.18–4.51)	9.64*** (5.09–18.24)	16.72*** (5.52–50.65)	3.35*** (2.57–4.37)	3.78*** (3.07–4.65)	8.37*** (4.92–14.25)	2.87*** (1.80–4.56)
3 pre-index contacts	2.59*** (2.18–3.07)	7.09*** (4.93–10.18)	4.84*** (3.94–5.93)	13.34*** (5.57–31.95)	12.50*** (2.95–52.92)	4.70*** (3.20–6.90)	4.95*** (3.72–6.60)	10.18*** (4.38–23.62)	1.90 (0.82–4.43)
4 pre-index contacts	2.86*** (2.36–3.45)	5.96*** (3.95–8.99)	5.39*** (4.21–6.90)	10.64*** (2.91–38.88)	2.80 (0.14–56.29)	11.74*** (7.57–18.20)	5.74*** (4.01–8.21)	5.70* (1.29–25.09)	3.90** (1.53–9.93)
5+ pre-index contacts	5.82*** (5.38–6.28)	14.06*** (11.44–17.27)	7.32*** (6.05–8.87)	67.06*** (29.10–154.52)	56.94*** (10.54–307.54)	9.25*** (6.65–12.86)	9.55*** (7.30–12.49)	32.11*** (10.99–93.84)	8.97*** (4.28–18.79)
Pre-index time-in-community (years)	0.72*** (0.70–0.74)	0.73*** (0.69–0.77)	0.69*** (0.66–0.72)	1.02 (0.92–1.14)	1.01 (0.91–1.12)	0.87*** (0.82–0.92)	0.78*** (0.74–0.82)	0.89* (0.81–0.98)	0.89** (0.83–0.96)
Number of pre-index prison episodes	0.98* (0.96–1.00)	0.99 (0.96–1.03)	1.04** (1.01–1.06)	1.14*** (1.08–1.20)	1.20*** (1.13–1.26)	1.18*** (1.15–1.21)	1.12*** (1.09–1.15)	1.10*** (1.05–1.16)	1.17*** (1.13–1.22)
Pre-index Elixhauser comorbidities	1.13*** (1.09–1.16)	1.21*** (1.15–1.27)	1.20*** (1.15–1.25)	1.47*** (1.35–1.60)	1.53*** (1.41–1.67)	1.43*** (1.36–1.50)	1.38*** (1.32–1.45)	1.29*** (1.20–1.40)	1.68*** (1.58–1.79)
Sex (ref: Male)									
Female	1.31*** (1.17–1.47)	1.16 (0.94–1.43)	1.51*** (1.28–1.78)	2.11*** (1.51–2.94)	2.77*** (1.99–3.86)	1.47*** (1.20–1.79)	1.54*** (1.28–1.84)	1.47* (1.08–2.02)	1.25 (0.97–1.61)
Age groups (ref: 25–44)									
16–24	0.78*** (0.72–0.86)	0.71*** (0.60–0.83)	0.69*** (0.61–0.79)	1.77*** (1.36–2.30)	1.35* (1.03–1.77)	1.17 (1.00–1.36)	0.95 (0.82–1.10)	0.98 (0.75–1.29)	0.86 (0.69–1.06)
≥45	0.97 (0.89–1.06)	0.71*** (0.60–0.83)	0.49*** (0.42–0.56)	1.09 (0.80–1.47)	0.82 (0.60–1.11)	0.69*** (0.58–0.81)	0.72*** (0.62–0.84)	1.00 (0.77–1.31)	0.85 (0.69–1.04)
Release type (ref: Sentence served)									

Table 4 (continued)

Term	Community Services			Unscheduled and Emergency Care			Inpatient Care		
	Community Prescribing	MH Outpatient	SU Outpatient	NHS24	OOH GP	ED	Ambulance	Psychiatric Inpatient	General Inpatient
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Court/Procurator Fiscal	1.06 (0.96–1.16)	1.00 (0.84–1.20)	0.95 (0.83–1.10)	1.76*** (1.32–2.34)	1.54** (1.15–2.07)	1.37*** (1.16–1.61)	1.10 (0.94–1.29)	1.32 (1.00–1.75)	1.13 (0.92–1.40)
Licence/parole/S.R.O	0.92 (0.80–1.05)	0.67** (0.52–0.86)	0.69*** (0.56–0.85)	0.70 (0.41–1.21)	0.64 (0.37–1.12)	0.68** (0.52–0.91)	0.44*** (0.33–0.58)	0.59* (0.35–0.99)	0.40*** (0.26–0.62)
Bailed	0.91 (0.79–1.05)	1.19 (0.91–1.54)	0.79 (0.63–1.01)	1.23 (0.76–1.96)	0.98 (0.60–1.59)	0.79 (0.59–1.06)	0.87 (0.67–1.14)	1.48 (0.97–2.26)	0.92 (0.64–1.33)
Other	0.48*** (0.40–0.59)	1.45* (1.04–2.03)	0.25*** (0.17–0.36)	1.31 (0.71–2.40)	0.79 (0.41–1.53)	0.54** (0.36–0.81)	0.51*** (0.35–0.76)	4.46*** (2.93–6.77)	0.50* (0.28–0.88)
Marital status (ref: Single)									
Married or civil partnership	0.91 (0.80–1.04)	0.58*** (0.45–0.74)	0.73** (0.59–0.91)	0.48** (0.29–0.81)	0.40** (0.23–0.70)	0.56*** (0.42–0.74)	0.55*** (0.42–0.72)	0.74 (0.49–1.14)	0.66* (0.47–0.94)
Common law partner	0.93 (0.84–1.03)	0.73** (0.60–0.89)	0.81** (0.69–0.95)	0.69* (0.48–1.00)	0.54** (0.37–0.80)	0.59*** (0.48–0.73)	0.75** (0.62–0.90)	0.69* (0.49–0.98)	0.62*** (0.47–0.81)
Divorced, separated or widowed	1.00 (0.87–1.15)	0.92 (0.72–1.19)	0.82 (0.66–1.03)	0.40*** (0.23–0.68)	0.68 (0.41–1.11)	0.83 (0.64–1.08)	0.96 (0.76–1.22)	0.83 (0.55–1.25)	0.78 (0.57–1.08)
Disclosed disability (ref: No disclosed disability)									
Disclosed disability	1.24*** (1.12–1.38)	1.38*** (1.14–1.66)	1.01 (0.86–1.17)	1.60** (1.17–2.19)	1.76*** (1.28–2.41)	1.49*** (1.25–1.77)	1.58*** (1.35–1.85)	2.00*** (1.53–2.61)	1.52*** (1.22–1.88)
n	8313	8313	8313	8313	8313	8313	8313	8313	8313
Log-likelihood	-27641.2	-9992.85	-9646.38	-2618.79	-2627.99	-6646.64	-7005.63	-2421.65	-4075.42
R2	0.40	0.34	0.37	0.41	0.32	0.41	0.42	0.23	0.34
Nagelkerke									
BIC	55562.17	20265.5	19572.55	5517.38	5535.78	13573.07	14291.05	5123.08	8430.62

* $p < .05$; ** $p < .01$; *** $p < .001$

Compared to people released at sentence expiry (released with no conditions), people released on licence/parole/SRO have lower contact rates with mental health outpatient (0.67[0.52–0.86]), substance use outpatient (0.69[0.56–0.85]), emergency services (ambulance=0.44[0.33–0.58]; emergency department=0.68[0.52–0.91]), and inpatient care (general inpatient=0.40[0.26–0.62]; psychiatric inpatient=0.59[0.35–0.99]).

People released for ‘other’ reasons (immigration-related, discretionary early release, release to psychiatric

hospital), compared to people released at sentence expiry, have higher rates for contacts with mental health outpatient (1.45[1.04–2.03]) and psychiatric services (4.46[2.93–6.77]), but lower rates for prescribing (0.48[0.40–0.59]), substance use outpatient (0.25[0.17–0.36]), emergency services (ambulance=0.51[0.35–0.76]; emergency department=0.54[0.36–0.81]) and general inpatient (0.50[0.28–0.88]).

The contact rates are higher for people released from court (indicative of remand), compared to those released at

sentence expiry, for NHS24 helpline (1.76[1.32–2.34]), out-of-hours GP (1.54[1.15–2.07]), and emergency department (1.37[1.16–1.61]) contacts.

Discussion

We conducted the first whole-systems analysis of post-imprisonment mental health and substance use-related service contacts internationally, calculating incidence rates pre-index and post-imprisonment, and examining how selected sociodemographic, health, and criminological factors contribute to contact patterns across community services, unscheduled/emergency care, and inpatient care. This builds on our novel linkage and analysis of Scottish health, prison and deaths data that demonstrated increased rates of post-imprisonment contacts associated with mental health, substance use and dual diagnosis, compared to a matched general population sample [1].

Our current analysis sought to establish the relationship between pre-index and post-imprisonment service contacts, and ascertain which factors conferred additional risk among people released from prison. The findings demonstrate increases in post-imprisonment contact rates, compared to pre-index contact rates, in four out of nine services, and the importance of criminological risk factors, in addition to sociodemographic and health-related factors, in assessing post-imprisonment health service contact. The results advance understandings of the epidemiology of post-imprisonment mental health and substance use-related service contact, with significant implications for health, social, and criminal justice policy and practice in the UK and beyond. Whilst not the focus of this study, an extremely high mortality rate was observed, reinforcing the need to improve care in transitional periods and longer-term post-release.

Finding higher contact rates among women compared to men is consistent with previous research suggesting women with a history of imprisonment experience worse mental health and social outcomes, and are more likely to have a dual diagnosis, than men [41–44]. The reason for the sex differences identified in service contacts is unclear. It may be due to differences in mental health and substance use needs, help-seeking behaviours, or how imprisonment and release are experienced due to the confluence of gendered risk factors: women released from prison are, compared to men, at an increased risk of intimate partner violence and homelessness, which may exacerbate mental ill-health and substance use [43].

We observed inconsistent age patterns across the different services, where people aged 25–44 have increased contact rates for community and emergency services. While understanding the reasons contributing to the observed age

patterns is challenging, it is important to note that the prison population is biologically older on average than the general population due to the detrimental effects of, and life circumstances associated with, imprisonment [24], and that Scotland, like other countries, has an ageing prison population [45]. The implications of this are that health care needs are becoming more complex, and that there is a growing population experiencing disabilities associated with ageing. Elevated contact rates for people with a disclosed disability, diagnosed comorbidities, and prior mental health and substance use-related service contacts suggest that the complexity of health needs may alter experiences of release and contact with services. Tri-morbidity, the co-occurrence of physical ill-health, mental ill-health and substance use [46], is a possible factor potentially driving the patterns observed. Further research is required, however, to understand what conditions are prevalent in the prison population. Services need to be attentive to how sex, age, and disability may alter help-seeking behaviours and service access, and able to accommodate complex multi- and tri-morbidity in the prison population.

Our findings support contemporary understandings of mental health in prison contexts, which integrate both ‘importation’ and ‘deprivation’ models [47]. The findings indicate that a high level of pre-index service contact in the community (i.e. when not in prison) is strongly associated with post-imprisonment contacts. The confluence of different factors, such as tri-morbidity and victimisation, often with a shared aetiology, for instance, poverty, unemployment and socioeconomic deprivation, has cumulative effects upon health and further marginalisation, and such synergies have previously been referred to as syndemics [48–50]. Because people from communities experiencing syndemic effects are overrepresented in prison, we therefore expect the risk of adverse outcomes to be higher in the prison population. However, our results show that while controlling for prior mental health and substance use-related contacts (an indicator of needs), and a range of other sociodemographic and health factors, there is a distinct effect of imprisonment upon mental health – reflecting accounts of the harms associated with imprisonment. Our findings – that not only is the duration of time spent in prison associated with an increase in contacts, but also the number of previous prison episodes and circumstances of release – suggest there may be additional harms associated with being released under different conditions.

We identified repeated imprisonment as an important risk factor for increased post-imprisonment health service contacts. However, it is important to recognise that repeated imprisonment itself could reflect deteriorating mental health, or escalating substance use, leading to a greater likelihood of committing, being arrested and imprisoned for

crimes. The associations between previous prison episodes and post-imprisonment contact are strongest for unscheduled/emergency and inpatient care, and weaker, reversed, or insignificant for community services. People who serve multiple short sentences/periods on remand face repeated disruptive transitions between prison and community relatively close together in time. Transitional phases, including admission to, or release from, prison, are associated with increased stress and vulnerability to mental ill-health. These are liminal periods characterised by a loss of social ties and support, uncertainty and disruption, where individuals may not have fully adapted to life in prison or life after release [23]. The remand population is characterised by elevated health and social needs, faces uncertainty and stress awaiting trial or sentencing [51], has limited access to support and services, and is at increased risk of prison suicide [52, 53]. Timely and sustained mental health and substance use-related care is particularly challenging for people with repeated short-term imprisonment, both while in prison and upon release, given long waiting times, delays between diagnosis and referral, and release/reimprisonment prior to treatment [24]. The decreased rate of community contacts identified can possibly be attributed to the disruption and harms caused by repeated short-term imprisonment. Insufficient preventative and transitional care, coupled with a high level of needs exacerbated by imprisonment and/or release, is potentially a driver of the increased contact rates with unscheduled/emergency/inpatient care observed in our cohort. A lack of continuity of mental health and substance use-related care exacerbates pre-existing issues as people are released from prison, particularly if people are unable to register with a GP (often due to homelessness). It is therefore vital that services can ensure care continuity at scale for people released from prison to prevent unmet needs from becoming acute, leading to high levels of emergency services utilisation.

The cumulative time spent in prison (the inverse of pre-index time-in-community) is independently associated with post-imprisonment service contacts. Prison is an institution of both care and control, and the effects of this have been described as the ‘paradoxical damage’ of imprisonment: measures and interventions in place to reduce harm may, on average, exacerbate or create new harms [54]. Imprisonment offers an important opportunity for intervention (i.e. a ‘captive audience’), and some describe imprisonment as an opportunity to engage with healthcare that may be more accessible than in the community [24]. However, overcrowding, constant stress/sense of danger, lack of meaningful activities, limited access to (evidence-based) services, and institutionalisation may contribute to stress, mental ill-health and changes in substance use patterns due to exposure to new substances and difficulties in coping with the

new environment. Our findings indicate that the association of time spent in prison with future contacts is strongest for community services, and weaker for unscheduled and inpatient care. This suggests that spending more time in prison may make it easier to receive adequate support and potentially some form of continuation of treatment upon release to community (e.g. throughcare, which is typically provided for those who have served a longer sentence). This may result in lower rates of inpatient and emergency care, compared to populations characterised by the combination of a long duration of time spent in prison spread over multiple, short-term periods of imprisonment.

Whilst there are harms associated with imprisonment, there are important potential harms associated with the release process and post-imprisonment arrangements. Our findings suggest variation in post-imprisonment service contact based on the circumstances of release. A criminal justice social worker is a requirement for people released on licence/parole/SRO in Scotland, and this transitional support may have a salutogenic effect upon post-imprisonment contact patterns. The negative association with outpatient contacts may be a result of specific ‘harms of release’, which include stigma associated with wearing an electronic tag, surveillance, and strict licence conditions, making it more challenging to access and receive treatment [9, 31, 55].

Like services within Scottish prisons, NHS community services are also under significant pressure and unable to meet the levels of need among the general population [25, 26]. Under-resourced services, coupled with variations in service provision, may result in people with high levels of need, particularly people released from remand and/or experiencing short-term repeated imprisonment, not receiving treatment which could prevent adverse post-imprisonment health outcomes. Elevated post-imprisonment contact rates identified in this study may be attributable to both a high underlying level of need prior to imprisonment, limited access to the right support whilst imprisoned, that being released back to the community itself is exceptionally challenging, and that community-based services are under significant demand pressures limiting access. It is critical that people receive the support required whilst imprisoned, that transitional care plans are in place prior to being released from prison, and that sustained, targeted support is provided in the transitional period and beyond. People released from prison have high levels of physical and psychiatric comorbidity and multimorbidity, so a critical priority is to ensure early referral to mental health and substance use services. It is essential that community care teams are aware and understand how criminological risk factors, including the number and duration of prison episodes, and the conditions in place upon release, contribute to elevated use of emergency care. Our findings demonstrate the importance of linking justice

and health data, and the value that epidemiological health monitoring of routine prison data may have upon service and transitional planning from prison to the community. In addition to being a national public health priority, addressing people's health needs can reduce reimprisonment [56, 57] and is therefore an important criminal justice priority.

Strengths and limitations

This study offers the most comprehensive overview to date of post-imprisonment mental health and substance use-related contact across different services. The study used a unique, large-scale dataset consisting of a nationwide cohort, a long follow-up period, a combination of social and criminological predictor variables, a rigorous data linkage process, and health data spanning the continuum of community to emergency care. The results are of significant importance in facilitating discussions on how to optimise service provision for subgroups in prison populations, and to inform future research into the syndemic effects contributing to ill-health and negative justice outcomes within the UK and internationally.

The study has limitations. Firstly, the routine health data used allows us to estimate service contacts, as opposed to the prevalence of mental health and substance use-related conditions or levels of need. Relatedly, our findings may reflect a downward bias in the estimation of post-imprisonment service contacts: individuals censored for death may have had distinct trajectories of service contacts from those alive at the end of follow-up. Most deaths were drug-related, which means a counterfactual scenario is plausible where decedents survived and had high contact rates on average, particularly in emergency/unscheduled care. Future research should consider comparing care pathways between people who died following release from prison versus those who survived. Secondly, since reimprisonment is not uncommon in this population, several individuals had prison episodes in the follow-up period, which means that different release reasons on later prison episodes, not controlled for in our models, may have contributed to variation in service contact. Thirdly, the number of outcome variables and predictor variables adds complexity to the interpretation of model outputs; we focused on the main effects, but interaction effects will be important to explore in future work given the importance of syndemics. Fourthly, our data spans 2010–2020; further analysis using more recent data would be beneficial. Finally, whilst our prison cohort may be similar/comparable to cohorts in different jurisdictions, caution must be exercised in generalising the findings to other international contexts with different justice and health systems and sociodemographic profiles.

Conclusion

This research used linked justice, health, and mortality data to assess the association between pre-index and post-imprisonment service contacts, and among sociodemographic, health and criminological risk factors and elevated contact rates. As the first study to take a whole-systems perspective to assess patterns of service contact, it demonstrates the importance of using linked justice and health data and makes an original and significant contribution to advancing understanding of the psychiatric epidemiology of post-imprisonment mental health and substance use-related service contacts. Results show how criminological, sociodemographic, and health-related risk factors are independently associated with post-imprisonment service contacts across community services, emergency/unscheduled care, and inpatient care. The findings suggest the number of prison episodes, the time spent in prison, and the context in which people are released, are all associated with future service contacts. There may be specific harms associated with long-term imprisonment and repeated short-term imprisonment, which contribute to different experiences upon release and variations in post-imprisonment mental health and substance use-related service contacts. Services must therefore be sensitive to how any potential harms of imprisonment and release may exacerbate health needs and lead to variations in service contact. It is vital for policymakers and practitioners in health and criminal justice contexts to review how they accommodate varied population needs and ensure that imprisonment does minimal further harm to people's health.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00127-026-03217-x>.

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Author contributions CC conceptualised the study with ND, JS, CH, AK, JW, KH, TP, AB and led funding acquisition with the same. Methodology was designed and developed by CC, RK, JS, AK, ND, and KH. Reproducibility and replicability were ensured by RK, JS and CC. Data collection were led by CC and RK with JS and KH. Data curation and formal analysis was conducted by RK and JS, conducted within a secure environment managed by eDRIS, Public Health Scotland. RK

and CC wrote the original manuscript draft with reviewing and editing by RK, CC, JS, AK, TP, KH, AB, ND, JW, CH, AL. Supervision was by CC and KH with mentorship by KH and TP. Project administration was by CC, RK and KH.

Data availability No data are available. Data are unavailable due to data protection and privacy arrangements with the Public Health Scotland Electronic Data Research and Innovation Service. Researchers wishing to conduct analyses with the RELEASE dataset need to apply through the procedures coordinated by eDRIS, including gaining ethical approvals and applying to the Public Benefit and Privacy Panel. Our team is open to discussions to support this, with a desire that the RELEASE dataset is used for public health benefit. The following are available: (1) protocol (<https://doi.org/10.23889/ijpds.v10i1.2971>), (2) statistical analysis plan (<https://osf.io/hefvu/>) and (3) analytical code (<https://github.com/rkjellgren/RELEASE>).

Declarations

Competing interests RK, CC and TP are employed at the Salvation Army Centre for Addiction Services and Research. The Salvation Army was not involved in this externally funded study. The team declare no other competing interests.

Ethical approval This study was approved by the University of Stirling General University Ethics Panel (7144) and the Public Benefit and Privacy Panel for Health and Social Care (2021–0145), and conforms to the standards required to conduct health research in Scotland's National Safe Haven. This study conforms to the ethical standards of the 1964 Declaration of Helsinki and its later amendments.

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