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RESEARCH

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Physical multimorbidity, concurrent psychiatric morbidity, and emergency department presentation among adults released from prison: a prospective cohort study from Queensland, Australia

Elliott Cope^{1*}, Stuart Kinner², Rohan Borschmann³ and Jesse Young⁴

Abstract

Background People released from prison have elevated rates of physical and psychiatric morbidity, and emergency department (ED) presentation when compared with the general population. However, little is known about the specific health concerns that are associated with these high rates of ED presentation. The aims of this study were to (a) ascertain the prevalence of multimorbidity (physical multimorbidity and concurrent psychiatric morbidity) in a sample of adults prior to release from prison, and (b) examine the association between physical multimorbidity, psychiatric morbidity, and ED presentations in this sample following release from prison.

Methods We prospectively linked pre-release survey data collected between 1 August 2008 and 31 July 2010 from a representative cohort of 1325 sentenced adults in Queensland, Australia, to person-level ED, correctional, and death records. We assessed the multimorbidity of participants using the Cumulative Illness Rating Scale. The association between multimorbidity and rate of ED presentations was assessed by fitting a multivariable Andersen-Gill model to identify sociodemographic and criminal justice covariates. A sensitivity analysis was also conducted in which psychiatric morbidity was disaggregated into a 4-level dual diagnosis variable (none, mental illness only, substance use disorder only, dual diagnosis) and was fit separately from the physical multimorbidity measure to ascertain the degree to which these factors predicted ED presentation rates.

Results 502 (48.0%) participants had multimorbidity, 265 (25.3%) had physical multimorbidity, and 608 (58.2%) had psychiatric morbidity. After adjustment for model covariates including dual diagnosis status, there was no statistically significant association between physical multimorbidity and ED presentation rate. However, after adjusting for model covariates including physical multimorbidity, participants with a diagnosis of either mental illness (aHR: 1.48; 95%CI: 1.08–2.03) or both mental illness and substance use disorder (aHR: 1.78; 95%CI: 1.33–2.37) had a higher rate of ED presentation than their counterparts without these diagnoses.

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Conclusion The presence of psychiatric morbidity is associated with an increased rate of ED presentation. Targeted interventions for adults released from prison with psychiatric morbidity are urgently needed.

Keywords Multimorbidity, Prison healthcare, Emergency department, Mental illness, Chronic physical illness, Dual diagnosis

Background

Globally, there are over 11.5 million people in the prison system on any given day (UNODC, 2024). Furthermore, the global prison population has increased by 5.5% from the previous decade (UNODC, 2024). This rise is also reflected in Australia, where the incarceration rate has grown at a pace in excess of general population growth, increasing by 167 to 201 per 100,000 adults between 2013 and 2023 (AIHW, 2023). As of March 2024, the average daily number of people in Australian prisons was 43,305 (ABS, 2024). People who are incarcerated (both globally, and in Australia) often have multiple and complex physical health needs including a higher prevalence of cardiovascular disease (CVD), chronic respiratory disease, and blood-borne viruses such as hepatitis C and HIV, when compared to their non-incarcerated counterparts (AIHW, 2015, 2019; Butler et al., 2005; Macalino et al.). Psychiatric disorders are also more prevalent in incarcerated populations; people who are incarcerated have a higher prevalence of post-traumatic stress disorder and other anxiety disorders, psychotic disorders, mood and personality disorders, and substance use disorders (SUDs) compared to their community counterparts (Butler et al., 2006; Fazel & Danesh). There is growing evidence, particularly from the United States, that once an individual is incarcerated they may experience negative changes in their health status, including increased rates of infectious diseases, worsening of CVD (including weight gain), and worsening of mental health (Massoglia & Pridemore, 2015). However, in Australia the available evidence suggests that health (both physical and mental) often improves for people during incarceration (AIHW, 2019), likely due to low-threshold access to onsite health services, and reduced availability of illicit substances (Marshall et al., 2001). However, without adequate and appropriate transitional support, starting in prison and continuing into the community beyond the point of release, any health improvements during incarceration are often quickly lost following return to the community (Forsyth et al., 2018; Kinner, 2006; Marshall et al., 2001).

People released from prison have higher rates of multimorbidity (defined as the co-occurrence of two or more chronic conditions – physical and/or mental) (Wallace et al., 2015) compared to the general population (Binswanger et al., 2009). In Australia, increased rates of primary care and hospital admission among people released from prisons has been attributed to the high prevalence of

multimorbidity within this population (Kabir et al., 2024). Additionally, high rates of emergency department (ED) presentation in this population have been attributed to aspects of psychosocial vulnerability such as poverty and homelessness (Byrne et al., 2003; Mandelberg et al., 2000). There is emerging evidence that physical health conditions (including cardiovascular, metabolic and respiratory diseases) are likely undertreated relative to symptomatic mental illness and physical trauma among people released from incarceration (Butler et al., 2007). Thus, these chronic physical conditions are often treated later, misdiagnosed, or remain unidentified in emergency care settings, which is often the first point of contact for identifying and treating health issues among people released from prison (Lloyd et al., 2017; Reimer et al., 2021). In addition to adversely impacting upon prognosis for patients, this causes avoidable financial and resource burden on EDs to triage and treat conditions which could potentially be more effectively managed in primary care settings (Whyatt et al., 2019). Therefore, it is critical to understand the burden of multimorbidity and its relationship with ED presentations among people released from prison.

To date, no studies have examined the association between multimorbidity and ED presentation in people released from prison. Using data from a representative sample of adults released from prisons in Queensland, Australia, we aimed to: (1) ascertain the prevalence of multimorbidity in this sample prior to release from prison; and (2) examine the association between physical multimorbidity, psychiatric morbidity, and the rate of ED presentation following release from prison.

Methods

Participants

This study used data previously collected from the Passports study, a randomised controlled trial of a low-intensity service brokerage intervention for adults released from prison (Kinner et al., 2013). Briefly, 1325 adults serving a custodial sentence were interviewed by trained research interviewers within six weeks of expected release from seven prisons in Queensland, Australia between August 2008 and July 2010. The Passports study sought to recruit a representative sample of adults being released from Queensland prisons, with the exception that women were intentionally over-sampled to permit sex-stratified analyses. The study achieved an 85% recruitment fraction, and the study

cohort is representative of adults released from prisons in Queensland during the recruitment period, on assessed demographic and criminal justice factors (Kinner et al., 2013). The prison sentence during which the baseline survey was conducted is herein referred to as the index prison sentence. Informed, written consent was obtained from all participants prior to participation.

Baseline measures

The structured baseline interview assessed sex, age, Indigenous status, relationship status (stable/unstable), years of school completed (<10/≥10), social visits in prison in the past month (none/at least one), accommodation in the 3 months prior to index incarceration (stable/unstable), employment status in the 3 months prior to index incarceration (employed/unemployed), intellectual disability (yes/no), and history of juvenile detention (yes/no). Intellectual disability (ID) was identified by a participant screening positive with the Hayes Ability Screening Index (HASI - a validated screening tool to help identify ID (Baatveit et al., 2018), and reporting either prior attendance at a specialist school or a previous diagnosis of ID (Dias et al., 2013).

We used the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) to identify harmful alcohol, methamphetamine and heroin use in the three months before incarceration; ASSIST scores for each substance were dichotomised using standard cut-offs (low-moderate/high risk) (Humeniuk et al., 2010). We used the Patient Activation Measure (PAM) to measure participant confidence in managing their own health needs (Hibbard et al., 2004), and the ENRICH Social Support Inventory (ESSI) as a measure of participants' perceived social support (Mitchell et al., 2003). Low ESSI and PAM scores were defined as scores at least one standard deviation below the sample mean.

Measurement of multimorbidity

Utilising data from the Passports study, trained coders used the International Classification of Primary Care (ICPC-2) to code paper-based prison medical records for all participants, for every health encounter they had in custody during their index incarceration (Oxford University Press, 1998). ICPC-2 codes and notes, plus selected variables from the baseline survey (high risk use of alcohol, methamphetamine, and heroin; and tobacco use), were used by the authors to further code participant medical information using the Cumulative Illness Rating Scale (CIRS) (Hudon et al., 2005). The CIRS uses a scoring system to classify chronic illnesses into 14 distinct anatomical domains (with psychiatric illness being scored as a single domain) and assigns each illness a severity rating of zero (least severe) to four (most severe - range 0–4)

for each domain. The basis for this scoring system was Miller and Paradis' CIRS-G manual (Miller et al., 1992).

A score of two or more in any single domain was considered indicative of morbidity. Participants were then sorted into three categories based on an a priori definition of multimorbidity (Wallace et al., 2015): no multimorbidity (0–1 domains with morbidity), moderate multimorbidity (2 domains), and complex multimorbidity (3 or more domains).

Calculation of physical multimorbidity

To assess mental illness and SUD as potential predictors of ED presentation independent of physical morbidity, a total CIRS physical multimorbidity (13 CIRS anatomical domains) score was calculated after the removal of the psychiatric domain, and utilising the same methodology and categorisation as the original multimorbidity score.

Psychiatric morbidity and dual diagnosis

Scores on the CIRS psychiatric morbidity domain were disaggregated into the 4-level variable 'dual diagnosis'. This variable was comprised of four mutually exclusive and collectively exhaustive categories: (1) no mental disorder; (2) SUD alone; (3) mental illness alone; and (4) dual diagnosis of SUD and mental illness.

Linked administrative data

Baseline survey data were probabilistically linked prospectively to state-wide, person-level ED, correctional, and National Death Index (NDI) records by the Queensland Health data linkage unit and the Australian Institute of Health and Welfare (for NDI records) using first name, surname, sex, date of birth, postcode of residence, and any known aliases (Tibble et al., 2018). Follow-up time for each participant commenced on their date of index release and was right censored on 31 July 2012 (the final date the ED records were obtained), reincarceration, or death if earlier.

Prison records contained all dates of release and reincarceration during the study period. The following covariates were also coded from participant surveys: prior history of adult incarceration (first/repeat); released on parole (yes/no); and duration of the index prison sentence (<90 days/90–365 days/>365 days). Correctional records were deterministically linked using a unique prisoner identification number.

Statewide ED records provided information on all ED presentations among study participants in Queensland during the study period. We used these data to ascertain presentation dates which were then used to calculate the number and rate of ED presentations.

Data analysis

We calculated descriptive statistics for all measures. Differences between groups on categorical and continuous measures were assessed using chi-square and unadjusted linear regression respectively. We calculated crude ED presentation incidence rates in the cohort per 1000 person-years and stratified the incidence rates by CIRS physical multimorbidity and dual diagnosis status.

Given that individuals can present to the ED on multiple occasions, we fit univariate and multivariate Andersen-Gill models (a modified Cox proportional hazards model which accounts for the correlation between recurrent events) to examine the association between the multimorbidity groups and ED presentations after release from prison. To assess the degree to which mental illness and/or substance use disorder predicted ED presentation independent of physical multimorbidity, a second model was fit with dual diagnosis status as a separate covariate, in addition to physical multimorbidity. Disaggregating the exposure in this way allowed us to examine the extent to which psychiatric morbidity drove any increase in ED presentation rates.

Hazard ratios were adjusted for the following covariates: age, sex, employment status, years of schooling, accommodation status, relationship status, social visits while in prison, intellectual disability, ESSI, PAM, ASSIST scores for alcohol, methamphetamines and heroin, history of juvenile detention, and receipt of the Passports intervention. Covariates were selected based on a review of the literature and were hypothesised or known to be associated with higher rates of ED presentations (Byrne et al., 2003; Mandelberg et al., 2000). In a sensitivity analysis, missing covariate data were replaced by multiple imputation (100 imputed data sets) using chained equations (White et al., 2011). Statistical significance for all analyses was set at $p < 0.05$. All data analyses were performed using STATA version 15.1 (StataCorp. Stata Statistical Software: Release 15. College Station).

Results

Baseline measurements

Of the 1325 individuals included in the Passports study, 1046 (79%) consented to their medical records being examined, had CIRS data coded, and were linked to administrative records. Most included participants were male ($n = 792$; 76%), non-Indigenous ($n = 794$; 76%), 25–40 years of age ($n = 535$; 51%), had a prior history of incarceration ($n = 688$; 66%), and were released from an index prison sentence 90–365 days in duration ($n = 529$; 51%). Approximately half of included participants ($n = 550$; 52%) were employed prior to their index incarceration and had received a social visit from a family or friend in the month prior to baseline interview ($n = 477$; 46%) (Table 1).

Multimorbidity measurement

Almost half ($n = 502$; 48.0%) of the individuals had multimorbidity: 27% ($n = 285$) had moderate multimorbidity, and 21% ($n = 217$) had complex multimorbidity. Females ($n = 148$; 58%) were more likely than males ($n = 354$; 45%; $p < 0.001$) to have multimorbidity. Nearly half ($n = 100$; 46%) of those in the 41+ age group had complex multimorbidity and approximately half of the individuals aged 25–39 years ($n = 257$; 48%) had either moderate or complex multimorbidity (Table 1). Additionally, individuals with moderate or complex multimorbidity were more likely than those without multimorbidity to be non-Indigenous, to have completed < 10 years of education, to have been unemployed prior to incarceration, to have screened positive for high-risk methamphetamine and/or heroin use, to have had no social visits in the month prior to baseline interview, to report low levels of social support, to have had one or more prior incarcerations, and to be released on parole (all $p < 0.05$).

Approximately one quarter of individuals had physical multimorbidity ($n = 265$; 25.3%); 58.2% ($n = 608$) had psychiatric morbidity, and 189 (18.1%) had both physical multimorbidity and co-occurring psychiatric morbidity. Mental illness only and dual diagnosis were more common among those with complex physical multimorbidity, whereas SUD only was more common among those with moderate physical multimorbidity (Fig. 1).

ED presentation rate and predictors

Over 1989 person-years of follow-up, with a median of 2.2 years of follow-up per person, there were 1770 ED presentations, yielding a crude incidence rate of 890 (95%CI: 849–932) ED presentations per 1000 person-years. The incidence of ED presentation according to CIRS physical multimorbidity and dual diagnosis status is presented in Table 2. The incidence of ED presentation increased in a dose-dependent manner with increasing physical multimorbidity (837, 1034, and 1107 ED presentations per 1000 person-years in the none, moderate, and complex physical multimorbidity groups respectively). Compared to those without psychiatric morbidity, the crude incidence of ED presentations was higher among those with mental illness only, SUD only, and dual diagnosis (888, 1027, and 1525 ED presentations per 1000 person-years, respectively). The highest crude incidence of ED presentations occurred among individuals with both complex physical multimorbidity and SUD (Table 2).

In a multivariable Anderson-Gill model, only complex multimorbidity was associated with an increased ED presentation rate (aHR: 1.65; 95%CI 1.26–2.16). However, when the psychiatric domain was removed from the overall multimorbidity score and participants were grouped according to dual diagnosis status, there was no

Table 1 Cohort characteristics according to pre-release multimorbidity score (14 CIRS domains)

	CIRS category (% of cohort)			All Participants N = 1046 (100%)	p- value
	No multimorbidity: 0–1 (52.0%)	Moderate mul- timorbidity: 2 (27.2%)	Complex multimorbidity: 3+ (20.8%)		
Age in years					
18–24	173 (31.8)	67 (23.5)	16 (7.4)	256 (24.5)	
25–40	278 (51.1)	156 (54.7)	101 (46.5)	535 (51.1)	
41+	93 (17.1)	62 (21.8)	100 (46.1)	255 (24.4)	< 0.001
Sex					
Male	438 (80.5)	200 (70.2)	154 (71.0)	792 (75.7)	
Female	106 (19.5)	85 (29.8)	63 (29.0)	254 (24.3)	0.001
Indigenous					
No	398 (73.2)	219 (76.8)	177 (81.6)	794 (75.9)	
Yes	146 (26.8)	66 (23.2)	40 (18.4)	252 (24.1)	0.046
Years of education					
<10 years	211 (38.9)	132 (46.5)	105 (48.6)	448 (43)	
≥10 years	322 (61.1)	152 (53.5)	111 (51.4)	595 (57)	0.019
Stable relationship ^{&}					
No	304 (56.5)	172 (60.6)	127 (58.8)	603 (58.1)	
Yes	234 (43.5)	112 (39.4)	89 (41.2)	435 (41.9)	0.519
Social visit ^{&}					
No	267 (49.1)	166 (58.2)	136 (62.7)	569 (54.4)	
Yes	277 (50.9)	119 (41.8)	81 (37.3)	477 (45.6)	0.001
Stable accommodation ^{&}					
No	88 (16.2)	47 (16.7)	44 (20.4)	179 (17.2)	
Yes	455 (83.8)	235 (83.3)	172 (79.6)	862 (82.8)	0.376
Employment ^{&}					
No	215 (40.4)	149 (52.3)	126 (59.2)	490 (47.6)	< 0.001
Yes	317 (59.6)	136 (47.7)	87 (40.8)	550 (52.4)	
Intellectual disability					
No	476 (90.0)	257 (92.4)	199 (93)	932 (91.3)	
Yes	53 (10.0)	21 (7.6)	15 (7.0)	89 (8.7)	0.304
High-risk alcohol use					
No	467 (86.0)	238 (83.5)	191 (88.4)	896 (85.8)	
Yes	76 (14.0)	47 (16.5)	25 (11.6)	148 (14.2)	0.291
High-risk methamphetamine use					
No	505 (93.0)	238 (83.5)	182 (83.9)	925 (88.5)	
Yes	38 (7.0)	47 (16.5)	35 (16.1)	120 (11.6)	< 0.001
High-risk heroin use					
No	521 (96.1)	247 (86.7)	192 (88.5)	960 (92.0)	
Yes	21 (3.9)	38 (13.3)	25 (11.5)	84 (8.0)	< 0.001
PAM score mean(± sd)	42.9 (5.66)	42.7 (5.64)	42.9 (5.78)	42.9 (5.68) [§]	0.884*
ESSI score mean(± sd)	23.8 (6.41)	22.9 (7.07)	22.7 (6.86)	23.3 (6.70) [¶]	0.030*
History of juvenile detention					
No	403 (74.6)	203 (72.0)	150 (69.4)	756 (72.8)	
Yes	137 (25.4)	79 (28.0)	66 (30.6)	282 (27.2)	0.327
Adult prison sentence					
First	223 (41.1)	74 (26.1)	59 (27.2)	356 (34.1)	
Repeat	320 (58.9)	210 (73.9)	158 (72.8)	688 (65.9)	< 0.001
Release on parole					
No	323 (59.4)	192 (67.4)	142 (65.4)	657 (62.8)	
Yes	221 (40.6)	93 (32.6)	75 (34.6)	389 (37.2)	0.052
Duration of index prison sentence					
< 90 days	171 (31.5)	92 (32.5)	47 (21.9)	310 (29.8)	

Table 1 (continued)

	CIRS category (% of cohort)			All Participants N= 1046 (100%)	p-value
	No multimorbidity: 0-1 (52.0%)	Moderate multimorbidity: 2 (27.2%)	Complex multimorbidity: 3+ (20.8%)		
90-365 days	280 (51.6)	137 (48.4)	112 (52.1)	529 (50.8)	0.012
> 365 days	92 (16.9)	54 (19.1)	56 (26.0)	202 (19.4)	

* calculated from the unadjusted linear regression; † number of participants 1012; ‡ number of participants 1016;

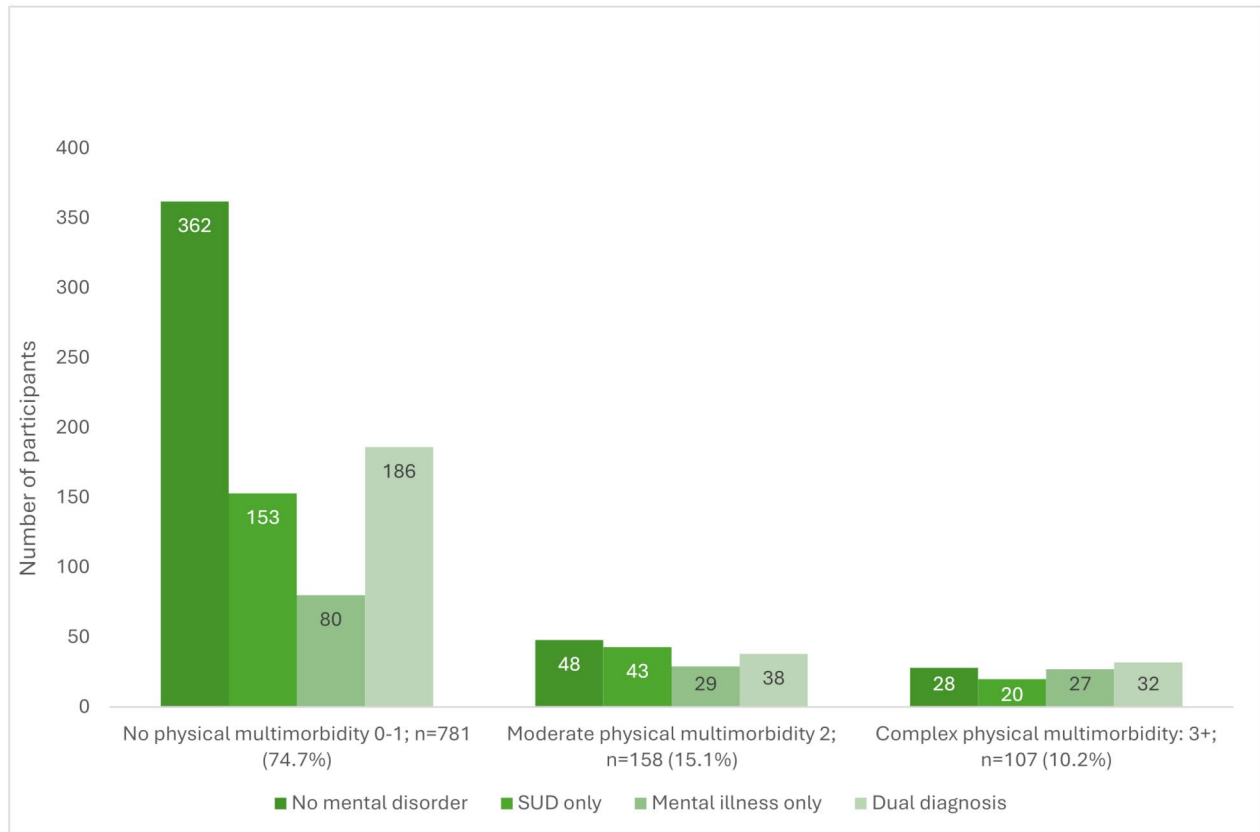


Fig. 1 CIRS physical multimorbidity score, according to dual diagnosis status. CIRS: Cumulative Illness Rating Scale; SUD: Substance use disorder

Table 2 Crude incidence rate of ED presentation according to dual diagnosis status and CIRS physical multimorbidity categories

Rate of ED presentation per 1000 person-years (95%CI)				
	No physical multimorbidity: CIRS 0-1	Moderate physical multimorbidity: CIRS 2	Complex physical multimorbidity: CIRS 3+	Overall
No mental disorder	580 (529-635)	630 (498-798)	642 (480-860)	590 (544-640)
SUD only	813 (704-940)	548 (385-779)	2478 (1907-3220)	888 (788-1000)
Mental illness only	911 (780-1065)	1608 (1334-1938)	670 (486-925)	1027 (918-1149)
Dual diagnosis	1521 (1386-1670)	1448 (1171-1791)	1632 (1321-2017)	1525 (1409-1651)
Overall	837 (792-884)	1007 (898-1128)	1117 (980-1273)	890 (849-932)

& variables which relate to a time period prior to index incarcerated as described in methods; CIRS: Cumulative Illness Rating Scale; ED: Emergency department; PAM: Patient Activation Measure; ESSI: ENRICH Social Support Inventory; N varies from 1030-1046 due to missing data

longer an association between physical multimorbidity and ED presentation rate. However, both mental illness (aHR: 1.48; 95%CI 1.08–2.03) and dual diagnosis (aHR: 1.78; 95%CI 1.33–2.37) predicted a higher ED presentation rate (Table 3).

Discussion

We found that approximately half of the adults from our study population screened positive for multimorbidity prior to release from prison, and that the prevalence of multimorbidity was higher among females than males. One in four of these adults had physical multimorbidity, three in five had psychiatric morbidity, and one in five had both physical multimorbidity and psychiatric morbidity. This is consistent with previous studies highlighting the high prevalence of multimorbidity and psychiatric morbidity within this population (Calais-Ferreira et al., 2022; Fazel & Seewald, 2012). We found that the overall crude ED presentation rate after release from incarceration was 809 per 1000 person-years (95%CI 849–932), which is almost four times the population rate of ED presentation in Australia around the time of the study (Lowthian et al., 2012).

After release from prison, we found that complex multimorbidity was associated with an increased ED presentation rate. However, after the psychiatric morbidity domain was removed, this association was no longer significant. When psychiatric morbidity was disaggregated according to dual diagnosis status, mental illness and dual diagnosis were associated with higher rates of ED presentation.

To our knowledge this is the first study to investigate the relationship between physical multimorbidity, psychiatric morbidity, and ED presentation in adults released from prison. Previous research from Australia has established that this population has high rates of ED use and that mental illness and substance use disorders are the most common reasons for ED presentations (Butler et al., 2020). We found that after adjusting for covariates, physical multimorbidity was not associated with an increased rate of ED presentation, whereas both mental illness and a dual diagnosis were associated with higher rates of ED presentation. A possible explanation is that, because most participants were 40 years of age or under ($n = 791$; 75%), many of the acute clinical outcomes of physical health conditions (such as ischaemic events in uncontrolled cardiovascular disease, or severe loss of respiratory capacity in chronic obstructive airway disease) may not be present yet. In comparison, clinical presentations for individuals with poorly controlled mental health conditions are usually higher in younger populations and are often seen in the ED (Brazel et al., 2023; McGorry et al., 2023). Our findings may have been different if we have included more participants who had served longer prison

sentences, as older participants may have been at an increased risk of acute clinical outcomes associated with chronic, non-communicable diseases (Wang et al., 2013).

Collectively, our findings indicate that the individuals released from prisons in Australia - regardless of dual diagnosis status - have higher rates of ED presentation than the general Australian public (Lowthian et al., 2012). We found that having a diagnosis of a mental illness only or dual diagnosis was a major factor in increased ED presentation rates. This suggests that adults released from prison likely have unmet healthcare needs (especially regarding mental health) and that they have poorer overall health profiles than the general Australian population. These individuals would greatly benefit from accessing ongoing preventative health programs to help manage their physical and mental health after release from incarceration. Effective post-release support may not only decrease their ED presentation rate but may also reduce their recidivism rate through the benefits that good mental health can have on mitigating substance use; obtaining financial and housing support, and engaging with prosocial supports (Edwards et al., 2024; Weatherburn et al., 2021).

Ultimately our study adds to the literature describing the negative health effects that incarceration can have on individuals (Massoglia & Pridemore, 2015). Additionally, our results provide further evidence that individuals often struggle in accessing primary and preventative healthcare once released from prison (Schnittker et al., 2015), which in our study was reflected in high rates of acute and/or tertiary health care use.

Limitations

There are several limitations to this study. First, because we censored ED presentations at the time of reincarceration, the findings reflect ED presentation patterns for individuals who did not return to prison during follow-up. Among adults released from prison there is evidence of a dose-response relationship between rates of ED presentation and risk of reincarceration (de Andrade et al., 2019), and that those with higher rates of recidivism also have worse morbidity (Baillargeon et al., 2009; Fu et al., 2013). Consequently, our results likely provide a conservative estimate of the true rate of ED presentation in adults released from prison.

Our study estimated the rate of ED presentation among adults released from prison, but we did not consider the clinical characteristics of these ED presentations. Future studies with a larger sample size may be able to undertake more granular analyses to explore possible associations between clinical characteristics of people released from prison, and particular types of ED presentation, including those related to acute mental disorder.

Table 3 Univariate and multivariate analysis of factors associated with rate of ED presentation

	Unadjusted HR (95% CI)	Adjusted HR (95% CI)	
		<i>Multimorbidity including psychiatric morbidity</i>	<i>Physical multimorbidity excluding psychiatric morbidity</i>
CIRS score			
No multimorbidity (0–1)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Moderate multimorbidity (2)	1.40 (1.08–1.81)	1.23 (0.94–1.63)	1.26 (0.94–1.70)
Complex multimorbidity (3+)	1.59 (1.22–2.07)	1.65 (1.26–2.16)	1.31 (0.95–1.81)
Mental health status			
No mental disorder	1.00 (ref)	-	1.00 (ref)
SUD only	1.44 (1.06–1.96)	-	1.11 (0.80–1.55)
Mental illness only	1.74 (1.27–2.39)	-	1.48 (1.08–2.03)
Dual diagnosis	2.51 (1.94–3.26)	-	1.78 (1.33–2.37)
Age			
18–24	1.00 (ref)	1.00 (ref)	1.00 (ref)
25–40	1.08 (0.82–1.42)	1.03 (0.75–1.40)	1.01 (0.75–1.37)
41+	0.75 (0.55–1.02)	0.69 (0.50–0.94)	0.71 (0.52–0.98)
Sex			
Male	1.00 (ref)	1.00 (ref)	1.00 (ref)
Female	1.32 (1.04–1.68)	1.21 (0.92–1.58)	1.17 (0.89–1.53)
Indigenous			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	1.25 (0.95–1.65)	0.85 (0.60–1.21)	0.92 (0.66–1.30)
Years of education			
≤10 years	1.00 (ref)	1.00 (ref)	1.00 (ref)
> 10 years	0.78 (0.62–0.96)	0.96 (0.73–1.25)	0.96 (0.73–1.26)
Stable relationship ^{&}			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	0.78 (0.63–0.97)	0.86 (0.67–1.09)	0.90 (0.70–1.14)
Social visit ^{&}			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	0.71 (0.57–0.89)	0.97 (0.75–1.25)	0.98 (0.76–1.26)
Stable accommodation ^{&}			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	0.76 (0.57–1.01)	0.97 (0.73–1.30)	0.94 (0.71–1.27)
Employment ^{&}			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	0.70 (0.56–0.87)	0.83 (0.66–1.05)	0.86 (0.68–1.10)
Intellectual disability			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	1.27 (0.79–2.04)	1.36 (0.78–2.37)	1.31 (0.74–2.32)
High risk of harmful substance use			
Alcohol - No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Alcohol - Yes	1.67 (1.26–2.21)	1.39 (1.02–1.91)	1.28 (0.94–1.75)
Methamphetamine - No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Methamphetamine - Yes	1.42 (0.99–2.03)	1.09 (0.76–1.56)	1.06 (0.74–1.53)
Heroin - No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Heroin - Yes	1.25 (0.91–1.73)	1.01 (0.70–1.47)	0.99 (0.68–1.44)
PAM score	0.99 (0.97–1.01)	1.01 (0.99–1.03)	1.01 (0.99–1.04)
ESSI score	0.98 (0.97–0.99)	0.98 (0.97–1.00)	0.98 (0.97–1.00)
History of juvenile detention			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	1.49 (1.13–1.97)	1.33 (0.95–1.87)	1.30 (0.92–1.84)
Adult prison sentence			

Table 3 (continued)

	Unadjusted HR (95% CI)	Adjusted HR (95% CI)	
		Multimorbidity including psychiatric morbidity	Physical multimorbidity excluding psychiatric morbidity
First	1.00 (ref)	1.00 (ref)	1.00 (ref)
Repeat	1.62 (1.27–2.06)	1.24 (0.92–1.67)	1.20 (0.90–1.61)
Release on parole			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	1.00 (0.80–1.24)	1.03 (0.80–1.31)	1.00 (0.78–1.29)
Days for current prison sentence			
< 90	1.00 (ref)	1.00 (ref)	1.00 (ref)
90–365	0.81 (0.64–1.04)	0.82 (0.63–1.06)	0.84 (0.65–1.09)
> 365 days	0.76 (0.56–1.02)	0.74 (0.53–1.03)	0.78 (0.56–1.08)
Passports intervention			
No	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	1.01 (0.81–1.26)	0.96 (0.76–1.21)	0.97 (0.77–1.22)

CIRS: Cumulative Illness Rating Scale; ED: Emergency department; [‡] variables which relate to a time period prior to index incarcerated as described in methods

Conclusion

This study found that approximately half of adults released from prisons in Queensland, Australia have multimorbidity. We found that psychiatric morbidity increased the likelihood of ED presentation independently of physical multimorbidity. There are clearly substantial unmet healthcare needs in this population. There should be increased efforts to target individuals with complex multimorbidity prior to release from prison, and in the weeks and months after release from custody, to facilitate access to appropriate preventative health programs.

Abbreviations

ED	Emergency department
ASSIT	Alcohol, Smoking and Substance Involvement Screening Test
PAM	Patient Activation Measure
ESSI	ENRICH Social Support Inventory
ID	Intellectual disability
ICPC-2	International Classification of Primary Care
CIRS	Cumulative Illness Rating Scale
SUD	substance use disorder
HASI	Hayes Ability Screening Index
AIHW	The Australian Institute of health and Welfare
NDI	National Death Index
QCS	Queensland Corrective Services

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Author contributions

E.C interpreted the data for the study and was the primary author for the manuscript and prepared Fig. 1. J.Y performed the data analysis for the study and was a major contributor in writing the manuscript and prepared Tables 1, 2 and 3. R.B and S.K provided guidance and editorial assistance regarding the writing of the manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The Passports study was approved by The University of Queensland's Behavioural and Social Sciences Ethical Review Committee (#200700607), the Queensland Corrective Services (QCS) Research Committee, the Commonwealth Department of Human Services (DHS-2011/CO08902), Queensland Health Human Research Ethics Committee (HREC/11/QHC/40), and the Australian Institute of Health and Welfare Ethics Committee (EC-2012/4/58). All research was conducted in accordance with the World Medical Association's Declaration of Helsinki.

Competing interests

The authors declare no competing interests.

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