Rates, causes, and risk factors for death among justice-involved young people in Australia: a retrospective, population-based data linkage study

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Summary

Background Children and adolescents exposed to the youth justice system have poor health profiles, but little is known about their subsequent mortality. We aimed to examine mortality outcomes in a large, state-wide cohort of young people in Australia who had contact with the youth justice system.

Methods We linked youth justice records in the state of Queensland, Australia from July 1, 1993, to June 30, 2014, with adult correctional records and the National Death Index, for records up to Jan 31, 2017. We calculated all-cause and cause-specific crude mortality rates per 100 000 person-years, and age-standardised and sex-standardised mortality ratios with 95% CIs. Calculations were performed for the whole cohort and in subgroups defined by sex, Indigenous status, and youth justice history. We used survival analysis to identify demographic and criminal justice factors associated with all-cause mortality.

Findings Of 49 011 individuals in the study sample, 321 were excluded due to data linkage or data quality issues and 20 were excluded as they did not have an age or date of birth recorded, which resulted in 48 670 (99·3%) participants. 11 897 (24·4%) participants were female, 36 773 (75·6%) were male, and 13 250 (27·2%) were Indigenous. During a median of 13·5 years (IQR 8·4–18·4) of follow-up, we observed 1431 (2·9%) deaths among the 48 670 participants. Median age at end of follow-up was 28·6 years (IQR 23·6–33·6). The most common causes of death were suicide (495 [34·6%]), transport accidents (244 [17·1%]), and accidental drug poisoning (209 [14·6%]). The all-cause crude mortality rate was 218·9 deaths (95% CI 207·9–230·6) and the all-cause standard mortality ratio was 4·2 (3·9–4·4). In multivariable analyses, mortality rates were higher for males (adjusted hazard ratio [aHR] 1·5 [95% CI 1·3–1·7]); those who had been subject to community supervision (aHR 1·3 [1·1–1·5]), or detention (aHR 2·1 [1·8–2·4]) versus charge only; and those under adult correctional supervision in the community (aHR 1·9 [1·5–2·4]) versus unsupervised. More than half of the observed deaths occurred before 25 years of age, and very few (1·6%) occurred in custody.

Interpretation Justice-involved young people are at markedly increased risk of premature death from largely preventable causes. Reducing the burden of preventable death among these young people will require coordinated, multi-sectoral responses that extend beyond the criminal justice system.

Funding National Health and Medical Research Council, Australia.

Introduction

Adults released from prison are at higher risk of premature mortality than their age-matched and sex-matched community counterparts.[1] Although the risk of death is highest in the days immediately following their release from custody,[2,3] it remains elevated for at least a decade.[4,5] Consistent with the high prevalence of substance dependence, mental illness, and risk-taking behaviour in this population,[6,7] the leading preventable causes of death after release are drug overdose, suicide, injury and, in the USA, homicide.[3,4,8] There is some evidence that the increase in mortality risk is greater for younger people. An Australian study that linked correctional and mortality records for 42 015 adults found that although the crude rate of death was lower in younger (aged 18–24 years) than older (aged ≥25 years) adults released from prison, the elevation in the rate of death (compared with age-matched and sex-matched community peers) was more pronounced in younger people.[9] Similar findings have been reported in the USA,[3] Scotland,[10] and France.[11]

Young people who come into contact with the justice system are distinguished by a high prevalence of co-occurring health and psychosocial problems and developmental disabilities.[12–14] However, their mortality outcomes after contact with this system are poorly understood, and much of the only available evidence comes from the USA. One prospective study of

Lancet Public Health 2025; 10: e274–84

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Research in context

Evidence before this study

We systematically searched MEDLINE, PubMed, PsycINFO, Criminal Justice Abstracts, and Web of Science for peer-reviewed articles reporting mortality outcomes for unselected samples of people younger than 20 years who had contact with the criminal justice system. Studies published in English from database inception to May 29, 2023, were included. We identified ten studies across eight cohorts: four from the USA, two from Australia, and one each from Scotland and Estonia. Rates and causes of death varied markedly between cohorts; however, the leading cause of death across cohorts was alcohol and other drug poisoning (pooled crude mortality rate 2·7 per 1000 person-years [95% CI 0·5–5·0]). The rate of death in justice-involved young people was almost six times higher than in the matched general population (pooled standardised mortality ratio 5·7 [95% CI 3·9–7·5]). The rate of all-cause mortality was lower in females than in males (rate ratio 0·6 [0·2–0·95]); however, the standardised mortality ratio was higher for females (10·6 [95% CI 2·8–18·4]) than for males (5·9 [3·7–8·0]). Risk factors for all-cause mortality included being male, being black or Hispanic in the USA, and more extensive involvement with the criminal justice system.

Added value of this study

This is the largest study outside of the USA and one of only two studies of this scale globally to examine mortality outcomes for justice-involved young people. Unlike most previous studies, our population-based sampling frame included young people in detention, those under supervision in the community, and those who had only ever been charged with an offence. The unique addition of linkage with adult correctional records allowed us to model the effect of ongoing justice involvement on mortality risk. Our study spanned more than two decades, permitting examination of mortality outcomes well into adulthood and supporting the temporal generalisability of our findings. We found that the rate of death in the cohort was more than four times higher than in the general population. We also observed a dose–response relationship between the severity and duration of justice involvement and mortality risk. More than one-third of all deaths were due to suicide and, in marked contrast to US studies, fewer than one in 25 deaths was due to violence. Almost all observed deaths occurred in the community and among young people who had never spent time in detention.

Implications of all the available evidence

Justice-involved young people are at substantially increased risk of death from mostly preventable causes. Given that most of the deaths we observed occurred in the community, and among young people who had never spent time in detention, efforts to prevent deaths in custody, while important, will have a negligible effect on the burden of premature mortality in this population; and efforts to divert vulnerable children away from detention, while meritorious, will be insufficient to reduce their risk of premature death. New investments in coordinated, multi-sectoral, age-appropriate supports will be required to prevent these untimely and largely preventable deaths among vulnerable young people who encounter the youth justice system.

1829 young people in pre-trial juvenile detention in Chicago found that, after 16 years of follow-up, 111 participants (6%) had died, with 61% of deaths due to firearm homicide.[15] A retrospective study of 3645 young people previously incarcerated as juveniles in Ohio found a death rate of 5·9 times higher than in the matched general population, with the majority (56%) of deaths due to homicide.[16] A retrospective data linkage study of almost 50 000 young people, followed up after their first arrest at age 10–18 years in Indiana, showed a mortality rate 48% higher than in the demographically matched community, with almost half (48%) of the deaths due to homicide. The risk of death in this cohort was higher for those who had experienced detention or incarceration (*vs* arrest only) and increased with more prolonged involvement with the criminal justice system.[17]

The extent to which findings from the USA are generalisable to other countries, particularly those with more stringent gun control policies, is unknown. In Australia, a retrospective study linking youth justice and mortality records for 2849 young people aged 10–20 years serving their first custodial order from 1988 to 1999 observed 143 deaths during an average follow-up of 3·3 years, primarily due to drug-related causes (n=65; 45%), suicide (n=34; 24%), and unintentional injury (n=29; 20%). In that cohort, only four deaths (3%) were from homicide. The age-standardised and sex-standardised risk of death was markedly elevated for both males (standardised mortality ratio, 9·4) and females (41·3).[18] A prospective study of 515 justice-involved young people in Australia observed 19 deaths during almost 9 years of follow-up, with most deaths (n=15; 79%) from overdose, suicide, or transport accidents. The risk of death was higher for those who had been detained than for those who had only served a community-based order.[19]

This sparse literature suggests that justice-involved young people, like their adult counterparts, are at markedly increased risk of premature and preventable death. However, there have been few large, high-quality studies. We established a restrospective cohort of all young people who had contact with the youth justice system in Queensland, Australia over a 21-year period to calculate all-cause and cause-specific crude mortality rates and estimate all-cause and cause-specific standardised mortality ratios; examine the association between level of exposure to the youth justice system,

supervision status, and mortality risk; and identify demographic and criminal justice predictors of all-cause mortality.

Methods

Study design and participants

This retrospective data linkage study was undertaken in the state of Queensland, which accounts for 20% of the Australian population and 28% of children under youth justice supervision in Australia.[20] In Queensland, 10–17-year-olds charged with a criminal offence are managed under the youth justice system. Children convicted of an offence can be sentenced to a community-based order or a period of youth detention. Those charged with a serious offence can also be held in pre-trial detention. People released from youth detention or prison can still be subject to supervision in the community for a prescribed period of time. Aboriginal and Torres Strait Islander (hereafter Indigenous) children are over-represented in Australia's youth justice systems by a factor of 23 and in youth detention by a factor of 28.[20]

The cohort comprised all adolescents aged 10–18 years who were charged with at least one criminal offence as a juvenile in Queensland from July 1, 1993, to June 30, 2014.

The study was approved by the Griffith University (2016/376) and Australian Institute of Health and Welfare (AIHW; EO2016/3/280) Human Research Ethics Committees, and by Youth Justice Queensland and the Queensland Corrective Services Research and Evaluation Committee. The study was conducted in accordance with the RECORD statement.[21] Data linkage was undertaken with a waiver of consent, in accordance with relevant Queensland and Australian legislation.

Procedures

Data obtained from youth justice records spanned from July 1, 1993, to Jan 31, 2017, and included sex (male or female); date of birth; and dates of all charges, community-based orders, and detention orders. Youth justice records for the cohort were linked probabilistically with adult correctional records, covering the period from Jan 1, 1994, to Jan 31, 2017, by the Queensland Government Statistician's Office. Correctional records provided information on dates of all incarcerations and community-based orders as an adult in Queensland.

Youth justice records were also linked probabilistically with the National Death Index (NDI) by the AIHW, for deaths up to Jan 31, 2017. The NDI is a national database containing records of all deaths registered in Australia since 1980, coded using the ICD Australian Modification (ICD-AM). Deaths up to Dec 31, 1996, were coded using the ICD-9-AM and deaths from Jan 1, 1997, were coded using the ICD-10-AM. At the time of data extraction, information on causes of death was available up to Dec 31, 2015.

For both linkages, we included all known aliases for the cohort, given evidence that this improves sensitivity without adversely affecting specificity.[22] Cause-specific, national population mortality rates for 2015 were obtained from AIHW with stratification by sex, age group, and Indigenous status. The year 2015 was selected for comparison because ICD-10-AM codes for death records between Jan 1, 2016, and Jan 31, 2017, were not available at the time of data extraction.

We used youth justice records at the end of the study period to categorise participants into three mutually exclusive and collectively exhaustive categories: (1) individuals with one or more finalised charges, without a supervision order or period of detention (charge only); (2) individuals with a record of at least one community-based order, but without detention (community-based order); and (3) individuals with one or more episodes of detention during the study period (detention). We also categorised the number of youth justice charges (1–4, 5–20, >20), community-based orders (0, 1, ≥2), and detention orders (0, 1, ≥2), and admissions to adult custody in Queensland (0, 1, ≥2) experienced by each participant during follow-up.

We created a number of time-varying variables reflecting an individual's accumulated criminal justice exposure at any given point in time during the study period. Time-varying youth justice history changed from charge only to community-based order on the date of commencement of the individual's first community-based order, and to detention on the date of commencement of the first youth detention order, for cases in which this was applicable. We also created time-varying counts of accumulated youth justice charges, community-based orders, and detention orders; adult incarceration episodes; and aggregate time spent in youth detention and in adult prison.

Additionally, we disaggregated follow-up time for each participant into four mutually exclusive and collectively exhaustive categories, based on time-varying legal status: (1) unsupervised in the community; (2) supervised in the community by youth justice (community-based order); (3) supervised in the community as an adult by corrections (adult supervision); and (4) incarcerated (youth detention and prison were aggregated for privacy reasons, due to small cell sizes).

We categorised participants based on their age at first recorded contact with the youth justice system (<14 years, 14 years or older; in line with UN recommendations),[23] sex (male, female), and Indigenous status (Indigenous, non-Indigenous). Consistent with best practice for coding Indigenous status,[24] the individual was considered Indigenous if any record (youth justice, corrections, or NDI) identified them as such.

Outcomes

Causes of death were categorised based on the underlying cause of death present in the death records. We used a modified version of coding developed by Randall and

colleagues,[25] categorising causes of death as violence, accidental drug poisoning, suicide, motor vehicle and land transport accident, other external cause, or non-external cause. The corresponding ICD-9-AM and ICD-10-AM codes are presented in the appendix (p 2).

See Online for appendix

Statistical analysis

Descriptive statistics were calculated for all participants and stratified by sex and Indigenous status. Follow-up time for each participant began on the date of their first youth justice record and continued until either death or Jan 31, 2017. We calculated all-cause and cause-specific crude mortality rates per 100 000 person-years of observation, and all-cause and cause-specific standardised mortality ratios with 95% CI. Crude mortality rates and standardised mortality ratios were calculated for the full sample, and in subgroups defined by sex and Indigenous status, and by youth justice history. In primary analyses, the reference population for standardised mortality ratios was stratified by sex and age group. In a secondary analysis, the reference population was also stratified by Indigenous status.[5]

We calculated Kaplan–Meier all-cause survival curves, with stratification by sex and Indigenous status, and by youth justice history. We used univariable Cox regression to examine the association between all-cause mortality and Indigenous status; sex; age at first contact; youth justice history; current legal status; number of youth justice charges, orders, and episodes of detention; number of admissions to adult custody; cumulative nights spent in youth detention (0, 1–84, 85–365, >365); and cumulative nights spent in adult custody (0, 1–365, >365). We constructed a multivariable Cox regression model including Indigenous status, sex, age at first contact, youth justice history, and current legal status. The remaining variables were excluded from the multivariable model to minimise collinearity. The proportional hazards assumption, which assumes stability of relative hazards over time in relation to covariates, was relaxed by using time-varying covariates related to youth justice and adult correctional history. Therefore, the covariates youth justice history; current legal status; time spent in youth detention; time spent in adult custody; and number of charges, orders, episodes of detention, and episodes of custody were treated as time-varying in all survival analyses. The association between covariates and mortality are presented as hazard ratios (HRs) with 95% CIs.

As we did not have youth justice records before 1993, we might have under-ascertained youth justice history for individuals entering the cohort up to 1999. Accordingly, in a sensitivity analysis we ran our analyses separately for those whose first youth justice record was in 1993–99 versus 2000–14.

Role of the funding source

The funder had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Of the original 49 011 individuals in the study sample, 321 were excluded due to data linkage or data quality issues (eg, multiple criminal justice records after date of death). A further 20 were excluded as they did not have an age or date of birth recorded in any records, leaving 48 670 (99·3%) participants. 11 897 (24·4%) participants were female, 36 773 (75·6%) were male, and 13 250 (27·2%) were Indigenous. A minority (13·5%) had first contact with the youth justice system before age 14 years, more commonly among Indigenous (24·3%) than non-Indigenous (9·5%) participants.

Cohort members were followed up for a median of 13·5 years (IQR 8·4–18·4), and the median age at the end of follow-up was 28·6 years (IQR 23·6–33·6, range 11–42). At the end of the study period, 28 250 (58·0%) had been charged with an offence but never detained or subjected to a community-based order, 12 878 (26·5%) had served a community-based order but had not experienced detention, and 7542 (15·5%) had experienced youth detention (table 1).

Just over one-quarter (27·4%) of participants had contact with adult corrections during the study period, a proportion that varied greatly by youth justice history (15·7%, 34·4%, and 59·5% for the charge only, community-based order, and detention groups, respectively). Compared with those in the charge only group, those with a history of community-based order or detention spent on average 12% and 31% less time, respectively, unsupervised in the community during the study period (appendix pp 2–3).

A total of 1431 participants (2·9% of the total sample) died during follow-up. The most common underlying causes of death were suicide (n=495 [34·6%]), transport accidents (n=244 [17·1%]), and accidental drug poisoning (n=209 [14·6%]). There were 122 (8·5%) deaths due to other external causes (most frequently accidental hanging and strangulation), 214 (15·0%) deaths coded as due to non-external causes, and 52 (3·6%) deaths due to violence. For 95 (6·6%) deaths, the cause had not yet been determined due to ongoing coronial processes. Most observed deaths (n=810 [56·6%]) occurred before age 25 years, and almost all (n=1408 [98·4%]) occurred in the community.

The all-cause crude mortality rate in the full cohort was 218·9 deaths (95% CI 207·9–230·6) per 100 000 person-years. All-cause crude mortality rates were higher for Indigenous and male participants, a finding that held true for the majority of cause-specific rates (table 2). One notable exception was accidental drug-related deaths, which were most frequent among non-Indigenous males. The all-cause crude mortality rate was higher among those who had spent time in detention than among those in the community-based order and charge only groups. A similar pattern was evident for all specific causes. Nevertheless, the highest number of deaths in the cohort occurred among those

	Indigenous		Non-Indigenous		All (N=48 670)
	Female (n=3772)	Male (n=9478)	Female (n=8125)	Male (n=27 295)	
Age at first youth justice contact, years					
<14	760 (20·2%)	2455 (25·9%)	757 (9·3%)	2619 (9·6%)	6591 (13·5%)
≥14	3012 (79·9%)	7023 (74·1%)	7368 (90·7%)	24 676 (90·4%)	42 079 (86·5%)
Youth justice history*					
Charge only	1966 (52·1%)	3480 (36·7%)	5993 (73·8%)	16 811 (61·6%)	28 250 (58·0%)
Community-based order	1150 (30·5%)	3080 (32·5%)	1481 (18·2%)	7167 (26·3%)	12 878 (26·5%)
Detention	656 (17·4%)	2918 (30·8%)	651 (8·0%)	3317 (12·2%)	7542 (15·5%)
Number of youth justice charges*					
1–4	2807 (74·4%)	5854 (61·8%)	7438 (91·5%)	23 372 (85·6%)	39 471 (81·1%)
5–20	902 (23·9%)	3234 (34·1%)	652 (8·0%)	3675 (13·5%)	8463 (17·4%)
>20	63 (1·7%)	390 (4·1%)	35 (0·4%)	248 (0·9%)	736 (1·5%)
Number of youth justice orders*					
0	2027 (53·7%)	3630 (38·3%)	6150 (75·7%)	17 205 (63·0%)	29 012 (59·6%)
1	639 (16·9%)	1494 (15·8%)	1017 (12·5%)	4204 (15·4%)	7354 (15·1%)
≥2	1106 (29·3%)	4354 (45·9%)	958 (11·8%)	5886 (21·6%)	12 304 (25·3%)
Number of youth justice detention episodes*					
0	3116 (82·6%)	6560 (69·2%)	7474 (92·0%)	23 978 (87·9%)	41128 (84·5%)
1	296 (7·9%)	925 (9·8%)	381 (4·7%)	1633 (6·0%)	3235 (6·7%)
≥2	360 (9·5%)	1993 (21·0%)	270 (3·3%)	1684 (6·2%)	4307 (8·9%)
Number of adult custody admissions*					
0	2943 (78·0%)	4433 (46·8%)	7390 (91·0%)	20 562 (75·3%)	35 328 (72·6%)
1	291 (7·7%)	1139 (12·0%)	296 (3·6%)	2257 (8·3%)	3983 (8·2%)
≥2	538 (14·3%)	3906 (41·2%)	439 (5·4%)	4476 (16·4%)	9359 (19·2%)
Died during follow-up					
No	3685 (97·7%)	9157 (96·6%)	7978 (98·2%)	26 419 (96·8%)	47 239 (97·1%)
Yes	87 (2·3%)	321 (3·4%)	147 (1·8%)	876 (3·2%)	1431 (2·9%)
Age at death†, years					
≤19	32/84 (38·1%)	107/321 (33·3%)	49/147 (33·3%)	227/876 (25·9%)	415/1431 (29·0%)
20–24	29/84 (34·5%)	78/321 (24·3%)	32/147 (21·8%)	256/876 (29·2%)	395/1431 (27·6%)
25–29	14/84 (16·7%)	63/321 (19·6%)	34/147 (23·1%)	201/876 (22·9%)	312/1431 (21·8%)
≥30	12/84 (14·3%)	73/321 (22·7%)	32/147 (21·8%)	192/876 (21·9%)	309/1431 (21·6%)

Data are n (%) or n/N (%). *At end of the study period (static variable). †Percentages for age at death are only for those who died during the study period.

Table 1: **Characteristics of participants by Indigenous status and sex**

in the charge only (661 [46·2%]) and community-based order (430 [30·0%]) groups (table 3).

The all-cause, age-standardised, and sex-standardised mortality ratio in the cohort was 4·2 (95% CI 3·9–4·4). The all-cause standardised mortality ratio was highest for Indigenous females (7·2 [5·8–8·9]) and lowest for non-Indigenous males (3·8 [3·6–4·1]). The highest cause-specific standardised mortality ratio in the full cohort (8·2 [95% CI 7·1–9·4]), and among Indigenous females (22·3 [12·7–39·3]), non-Indigenous females (20·5 [14·1–29·7]), and non-Indigenous males (8·2 [7·0–9·6]), was for accidental drug-related deaths. Among Indigenous males, the highest cause-specific standardised mortality ratio was for deaths due to violence (7·5 [95% CI 4·8–12·0]). Individuals in the cohort died from causes classified as non-external at a rate twice that of the age-standardised and sex-standardised reference population (2·0 [95% CI 1·7–2·3]). For both males and females, most cause-specific standardised mortality ratios were higher among Indigenous than non-Indigenous participants (table 2). The all-cause standardised mortality ratio was higher among those who had spent time in detention (6·4 [95% CI 5·7–7·1]) than among those in the community-based order (4·3 [3·9–4·7]) and charge only (3·5 [3·2–3·7]) groups. This pattern was evident across all examined causes of death (table 3).

Survival rate for males was consistently lower than for females (figure 1). There were marked differences in survival rate by youth justice history. Using a time-varying version of youth justice history, individuals in the charge only group had a lower rate of death than those in the community-based order and detention groups (figure 2).

In univariable Cox regression models, several factors were associated with a higher all-cause mortality rate. These included being male; having a history of youth

	Crude mortality rates					Standardised mortality ratios*				
	Indigenous		Non-Indigenous		All (N=48 670)	Indigenous		Non-Indigenous		All (N=48 670)
	Female (n=3772)	Male (n=9478)	Female (n=8125)	Male (n=27 295)		Female (n=3772)	Male (n=9478)	Female (n=8125)	Male (n=27 295)	
All cause†										
Number of deaths	87	321	147	876	1431	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	188·3 (152·6–232·4)	252·4 (226·3–281·6)	140·4 (119·4–165·0)	233·2 (218·3–249·2)	218·9 (207·9–230·6)	7·2 (5·8–8·9)	4·4 (3·9–4·9)	5·1 (4·4–6·0)	3·8 (3·6–4·1)	4·2 (3·9–4·4)
Violence										
Number of deaths‡	6	18	<5	24	52	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	13·0 (5·8–28·9)	14·2 (8·9–22·5)	3·8 (1·4–10·2)	6·4 (4·3–9·5)	8·0 (6·1–10·4)	16·1 (7·2–35·8)	7·5 (4·8–12·0)	4·7 (1·8–12·5)	3·2 (2·1–4·7)	4·6 (3·5–6·1)
Accidental drug poisoning										
Number of deaths	12	20	28	149	209	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	26·0 (14·8–45·7)	15·7 (10·1–24·4)	26·7 (18·5–38·7)	39·7 (33·8–46·6)	32·0 (27·9–36·6)	22·3 (12·7–39·3)	3·6 (2·3–5·6)	20·5 (14·1–29·7)	8·2 (7·0–9·6)	8·2 (7·1–9·4)
Suicide										
Number of deaths	34	127	44	290	495	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	73·6 (52·6–103·0)	99·9 (83·9–118·8)	42·0 (31·3–56·5)	77·2 (68·8–86·6)	75·7 (69·3–82·7)	9·7 (7·0–13·6)	5·3 (4·4–6·3)	5·4 (4·1–7·3)	3·8 (3·4–4·3)	4·4 (4·1–4·8)
Motor vehicle and land transport accidents										
Number of deaths	9	53	14	168	244	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	19·5 (10·1–37·4)	41·7 (31·8–54·6)	13·4 (7·9–22·6)	44·7 (38·5–52·0)	37·3 (32·9–42·3)	4·8 (2·5–9·3)	4·4 (3·4–5·8)	3·3 (2·0–5·6)	4·5 (3·9–5·3)	4·4 (3·9–5·0)
Other external cause										
Number of deaths	8	27	12	75	122	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	17·3 (8·7–34·6)	21·2 (14·6–31·0)	11·5 (6·5–20·2)	20·0 (15·9–25·0)	18·7 (15·6–22·3)	14·1 (7·1–28·3)	3·5 (2·4–5·1)	8·8 (5·0–15·5)	3·1 (2·5–3·9)	3·6 (3·1–4·4)
Non-external cause										
Number of deaths	13	54	34	113	214	..	..	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	28·1 (16·3–48·5)	42·5 (32·5–55·4)	32·5 (23·2–45·4)	30·1 (25·0–36·2)	32·7 (28·6–37·4)	2·5 (1·4–4·3)	2·5 (1·9–3·2)	2·7 (1·9–3·7)	1·7 (1·4–2·0)	2·0 (1·7–2·3)

*Reference population is the general population of the same age group and sex. Standardised mortality ratios with the reference population also stratified by Indigenous status are in the appendix (p 3). †Causes do not sum to total, as there were 95 deaths for which the cause had not yet been determined. ‡Cells <5 and associated marginal cell values suppressed in accordance with privacy requirements.

Table 2: **Crude mortality rates and standardised mortality ratios according to sex, Indigenous status, and cause of death**

justice supervision or detention; currently being under youth justice or adult correctional supervision in the community; having a greater number of youth justice charges, orders, or detention episodes; being incarcerated as an adult; and spending more aggregate time in youth detention or adult prison. The mortality rate while incarcerated was significantly lower than while unsupervised in the community (HR 0·3 [95% CI 0·2–0·5]). In a multivariable analysis, the rate of death was higher for males; those who had been subject to a community-based order or youth detention; and those under adult correctional supervision in the community (table 4). The rate of death was markedly lower during periods of incarceration (HR 0·2 [95% CI 0·2–0·4]; table 4).

To examine the effect of stratifying by Indigeneity in the reference population, we also standardised mortality

	Crude mortality rates			Standardised mortality ratios*		
	Charge only (n=28 260)†	Community-based order (n=12 887)	Detention (n=7543)	Charge only (n=28 260)	Community-based order (n=12 887)	Detention (n=7543)
All cause‡						
Number of deaths	661	430	340	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	180·7 (167·4–195·0)	232·1 (211·2–255·1)	331·4 (298·0–368·5)	3·5 (3·2–3·7)	4·3 (3·9–4·7)	6·4 (5·7–7·1)
Violence						
Number of deaths	22	17	13	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	6·0 (4·0–9·1)	9·2 (5·7–14·8)	12·7 (7·4–21·8)	3·5 (2·3–5·4)	5·2 (3·2–8·3)	7·6 (4·4–13·1)
Accidental drug poisoning						
Number of deaths	87	65	57	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	23·8 (19·3–29·3)	35·1 (27·5–44·7)	55·6 (42·9–72·0)	6·2 (5·1–7·7)	8·4 (6·6–10·7)	14·6 (11·3–18·9)
Suicide						
Number of deaths	233	137	125	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	63·7 (56·0–72·4)	73·9 (62·5–87·4)	121·8 (102·2–145·2)	3·8 (3·3–4·3)	4·2 (3·5–5·0)	7·2 (6·1–8·6)
Motor vehicle and land transport accidents						
Number of deaths	124	76	44	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	33·9 (28·4–40·4)	41·0 (32·8–51·4)	42·9 (31·9–57·6)	4·1 (3·4–4·9)	4·7 (3·8–5·9)	5·1 (3·8–6·8)
Other external cause						
Number of deaths	5	35	32	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	15·0 (11·5–19·6)	18·9 (13·6–26·3)	31·2 (22·1–44·1)	3·0 (2·3–3·9)	3·5 (2·5–4·9)	6·0 (4·2–8·4)
Non-external cause						
Number of deaths	101	67	46	..	..	..
Crude mortality rate per 100 000 person-years or standardised mortality ratio (95% CI)	27·6 (22·7–33·6)	36·2 (28·5–45·9)	44·8 (33·6–59·9)	1·7 (1·4–2·1)	2·1 (1·7–2·7)	2·8 (2·1–3·7)

Rates are calculated with all person-time assigned to the group the participant was assigned to at the end of follow-up. *Reference population is the general population of the same age group and sex. Standardised mortality ratios with the reference population also stratified by Indigenous status are in the appendix (p 3). †n is the total number of people in each group at the end of follow-up. ‡Also includes 95 deaths for which the cause had not yet been determined.

Table 3: **Crude mortality rates and standardised mortality ratios according to youth justice history**

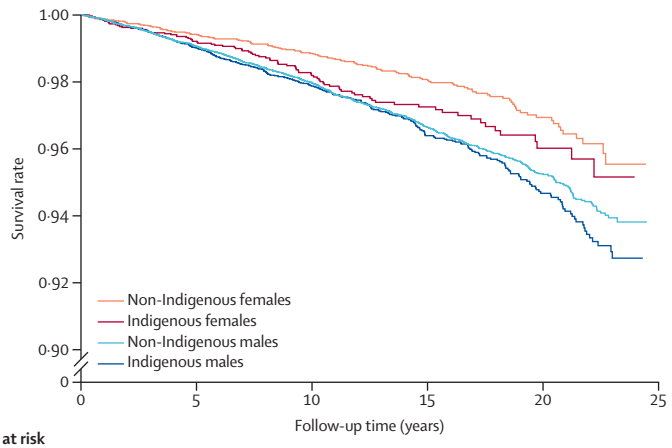
ratios by sex, age, and Indigenous status. Compared with the analyses standardising by sex and age only, this markedly attenuated standardised mortality ratios for Indigenous participants, but not for non-Indigenous participants (appendix pp 3–4). Results of the sensitivity analysis comparing individuals who entered the cohort in 1993–99 versus 2000–14 are shown in the appendix (pp 5–6).

Discussion

In this study of mortality outcomes in 48 670 young people who had contact with the youth justice system in Australia over more than two decades, the rate of all-cause mortality was 4·2 times higher than that of the age-matched and sex-matched general population. The leading causes of death were suicide, transport accidents, and accidental drug poisoning. Most of these largely preventable deaths occurred before age 25 years.

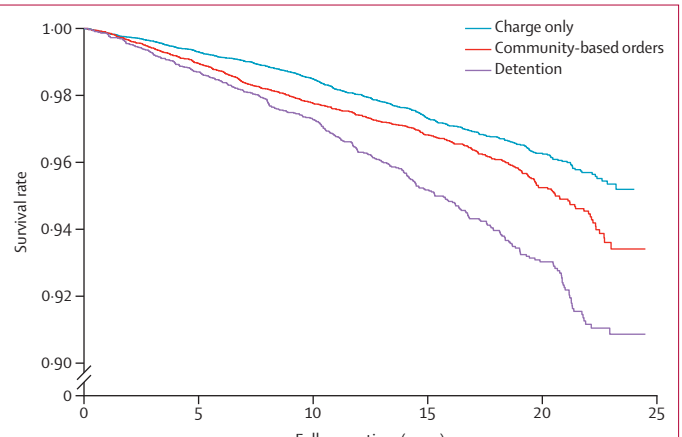
Although most deaths were among non-Indigenous males, the greatest elevation in rate of death was observed among Indigenous females, among whom the rate of all-cause death was more than seven times that of the general population. Compared with their community peers, the rate of death among Indigenous females was 10 times higher due to suicide, 16 times higher due to violence, and 22 times higher due to drug-related causes. Efforts to improve health outcomes for justice-involved young people, particularly for those who have been detained, must be gender responsive, culturally responsive and, in the Australian context, led by Indigenous communities and organisations.[26]

We observed a clear dose–response relationship between the level of exposure to the youth justice system and rate of death. Compared with those who had only ever been charged with an offence, the unadjusted rate of death was 30% higher among those who had experienced community supervision, and 90% higher among those who had experienced detention. This dose–response relationship was also evident with respect to the number and total duration of exposures to the criminal justice



Number at risk (number of deaths)						
Non-Indigenous females	8125 (46)	7429 (36)	5111 (33)	3136 (23)	1182 (9)	0
Indigenous females	3772 (29)	3414 (28)	2234 (18)	1263 (10)	447 (2)	0
Non-Indigenous males	27 295 (251)	25 290 (245)	18 772 (214)	12 364 (124)	4872 (42)	0
Indigenous males	9478 (92)	8800 (88)	6259 (74)	3860 (46)	1688 (21)	0

Figure 1: **Survival rate according to sex and Indigenous status**



Number at risk (number of deaths)						
Charge only	47 326 (207)	25 874 (178)	18 059 (174)	10 962 (78)	4010 (24)	0
Community-based orders	69 (128)	12 121 (132)	9396 (76)	6457 (70)	2600 (24)	0
Detention	1274 (83)	6938 (87)	4921 (89)	3204 (55)	1579 (26)	0

Figure 2: **Survival rate according to extent of youth justice system contact**

system. These findings are consistent with a recent US study,[17] although the rate of death in that study was elevated by 48%, compared with 320% in our cohort.

There is abundant evidence that justice-involved young people have a high prevalence of important risk factors for premature death including poverty, homelessness, mental illness, substance use disorder, risk-taking behaviour, and inadequate access to quality and age-appropriate health care.[14,27,28] Although we cannot exclude the possibility of a causal relationship between criminal justice system exposure and risk of death, it seems likely that contact with these systems serves primarily as a marker of pre-existing risk, with more frequent and more serious contact signifying greater pre-existing risk.[29] Consistent with this interpretation, in our study, almost half of the observed deaths were among young people who had never been convicted of an offence, but who nevertheless had a rate of death that was 250% higher than among their age-matched and sex-matched community peers. Therefore, preventing the incarceration of vulnerable children, although inherently meritorious, will do little to mitigate their risk of preventable death. Meaningful efforts to address the health, psychosocial, and disability needs of these children and young people are essential, irrespective of their involvement in the criminal justice system.[30]

More than one in four young people in our study was later incarcerated as an adult during the study period. This was most common among those who had experienced youth detention. Time spent in custody was associated with a reduced rate of death, although this protective effect was time-limited (and associated with a markedly increased rate of death over the longer term). These findings are consistent with a Canadian study that documented a time-limited protective effect of incarceration on the risk of non-fatal overdose.[31] Preventing deaths in custody is an important policy priority in Australia and elsewhere.[32] Although efforts to prevent deaths in custody are essential, more than 98% of deaths in our cohort occurred in the community; 89% occurred while the individual was not under any form of criminal justice supervision. Preventing premature deaths in these vulnerable young people will require coordinated, multi-sectoral investments in care that extend beyond, and are not constrained by, the criminal justice system.

More than one-third of deaths in this cohort was due to suicide, highlighting the burden of mental health problems among justice-involved young people.[33] Efforts to prevent self-harm and suicidal behaviour in youth detention, as part of a comprehensive approach to optimising mental health and wellbeing, are crucial. As mental health problems often persist for years after release,[34,35] sustained engagement with mental health care will be required to reduce the burden of suicide. Mental health care across the lifespan for this group should be responsive, patient-focused, and available at an intensity that is responsive to the time-varying clinical need of the individual.

Much has been written about the risk of acute drug-related deaths after incarceration, largely focused on opioid use among adults.[2,36] In our study fewer than 15% of deaths were due to drug-related causes, similar to findings from two previous US studies,[16,17] but markedly lower than in two previous Australian studies.[18,19]

Substance use is highly prevalent among justice-involved young people, and is associated with a range of acute and long-term harms including overdose,[37] blood-borne viral infection,[38] and sexual victimisation.[28] Increased accessibility of drug treatment services that are non-punitive, developmentally appropriate, culturally responsive, and able to accommodate the very large number of young people with co-occurring mental illness[33] or cognitive disability[39] will be necessary to reduce the burden of drug-related harms.

Young people in our study died from transport accidents at a rate more than four times higher than their community peers. More common than drug-related deaths, these transport deaths have received little attention from researchers or policy makers. It is well established that young men from socioeconomically disadvantaged areas are at increased risk of road traffic deaths,[40] which are also more common in rural and remote areas.[41] Justice-involved young people in Australia are predominantly male and disproportionately come from disadvantaged and rural areas.[42] As such, although the remarkably high rate of transport deaths in this population has not previously been documented, it is perhaps not surprising. It is nevertheless deserving of further research, including examination of coronial and police records, to inform targeted prevention.

Fewer than 1 in 27 deaths in our study was due to violence, although the rate of violent death in the cohort was 4·6 times that in the matched general population. In previous work examining coronial records for this cohort[43] we found that most violent deaths involved a knife or blunt instrument, with only a small number of deaths involving a firearm. This starkly contrasts with studies from the USA where 48–68% of deaths were due to violence, primarily gun violence. Much has been written about the impact of gun control legislation on homicide rates at the population level.[44] In this context, our findings highlight the potentially profound impact of such legislation on the risk of gun-related violence among marginalised groups such as justice-involved young people.

Our study is one of the largest studies of mortality among justice-involved young people. Its strengths include a state-wide, whole-of-population sampling frame, large sample size (nearly 50 000), long study period (over 20 years), gold-standard data linkage methods, unique inclusion of adult correctional records, and linkage with a national death register to identify deaths outside the state. Our study has four main limitations. First, as administrative data are not collected for research purposes, they provide limited information about health needs, health behaviours, or psychosocial circumstances. Qualitative studies and expanded data linkage capturing health and social service use would shed further light on service access that could inform opportunities for intervention. Second, we defined cause of death based on a single underlying cause, yet many deaths have multiple contributing causes. More detailed analysis of deaths due to specific causes might shed further light on opportunities for prevention. Third, due to delays with coronial processes we did not have cause of death information for 95 deaths (6·6% of all deaths).

	Deaths	Person-years	Univariable HR (95% CI)	Multivariable HR (95% CI)
Indigenous status				
Non-Indigenous	1023	480 297	1 (ref)	1 (ref)
Indigenous	408	173 354	1·1 (1·0–1·2)	1·0 (0·9–1·2)
Sex				
Female	234	150 901	1 (ref)	1 (ref)
Male	1197	502 750	1·5 (1·3–1·7)	1·5 (1·3–1·7)
Age at first youth justice contact, years				
<14	200	92 234	1 (ref)	1 (ref)
≥14	1231	561 417	1·0 (0·9–1·2)	1·2 (1·0–1·4)
Youth justice history*				
Charge only	661	376 168	1 (ref)	1 (ref)
Community-based order	430	181 362	1·3 (1·1–1·5)	1·3 (1·1–1·5)
Detention	340	96 122	1·9 (1·7–2·2)	2·1 (1·8–2·4)
Legal status*				
In prison or detention	23	29 828	0·3 (0·2–0·5)	0·2 (0·2–0·4)
Community unsupervised	1279	585 125	1 (ref)	1 (ref)
On youth justice order	64	27 247	1·5 (1·1–1·9)	1·0 (0·8–1·4)
On adult supervision order	65	11 452	2·4 (1·9–3·1)	1·9 (1·5–2·4)
Number of youth justice charges*				
1–4	1092	544 791	1 (ref)	..
5–20	309	104 352	1·4 (1·3–1·6)	..
>20	30	4508	3·2 (2·2–4·5)	..
Number of youth justice orders*				
0	685	387 057	1 (ref)	..
1	471	187 712	1·4 (1·2–1·5)	..
≥2	275	78 883	1·8 (1·6–2·1)	..
Number of youth justice detention episodes*				
0	1091	557 529	1 (ref)	..
1	124	42 585	1·5 (1·2–1·8)	..
≥2	216	53 536	2·0 (1·7–2·3)	..
Number of adult custody admissions*				
0	943	531 570	1 (ref)	..
1	133	43 252	1·6 (1·4–2·0)	..
≥2	355	78 829	2·3 (2·0–2·6)	..
Time in youth justice detention*				
None	1091	556 532	1 (ref)	..
Up to 12 weeks	199	62 947	1·6 (1·4–1·8)	..
>12 weeks, up to 1 year	113	24 600	2·2 (1·8–2·7)	..
>1 year	28	8573	1·5 (1·0–2·2)	..
Time in adult custody*				
None†	943	531 570	1 (ref)	..
Up to 1 year	265	68 705	2·0 (1·8–2·3)	..
>1 year	223	53 376	2·1 (1·8–2·5)	..

HR=hazard ratio. *Time-varying variable. †Some with at least one episode of custody might not have accrued any duration (nights) as they were released on their day of admission for all admissions.

Table 4: **Cox regressions for predictors of all-cause mortality**

Given the nature of coronial investigations, it is likely that most of these deaths were due to unnatural (external) causes. Fourth, our findings pertain to one Australian jurisdiction during a specific period. Heterogeneity in rates and causes of death between jurisdictions and over time suggests a need for caution in applying our findings to other settings.

In conclusion, this study observed a remarkably elevated risk of preventable death in young people exposed to the youth justice system. Although the rate of death was greatest for those who experienced youth detention, the rate of death for those only charged with an offence was also elevated, and most deaths occurred in the community. Accordingly, efforts to prevent these deaths cannot be the sole responsibility of criminal justice agencies but will require wider responses to address the complex health and psychosocial challenges experienced by this cohort. In countries with advanced data linkage infrastructure, such as Australia, routine linkage of youth justice and death records would provide a mechanism for timely monitoring of mortality trends over time, both informing and providing a platform for evaluation of policy responses.

Contributors

SAK conceived the study and wrote the first draft of the manuscript. JTY was responsible for data cleaning. LC-F was responsible for data analysis. All authors helped revise the manuscript and approved the final version. JTY and LC-F accessed and verified the data. SAK was responsible for the decision to submit the manuscript. All authors confirm they had access to all the data in the study and accept responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

The datasets generated or analysed for this study are not publicly available, and the participants of this study did not agree for their data to be shared publicly. Access to these administrative data is contingent on approvals from relevant ethics committees and data custodians. Queries can be directed to the corresponding author.

Acknowledgments

We wish to acknowledge the late Professor George Patton for valuable comments on an earlier draft of this manuscript. We also acknowledge the Queensland Department of Youth Justice and Queensland Corrective Services for providing access to administrative data for this study. This study was funded by the Australian National Health and Medical Research Council (NHMRC GNT1098807). SMS is supported by the National Health and Medical Research Council (GNT1196999) and the Geoff and Helen Handbury Chair of Adolescent Health, University of Melbourne. RB receives salary and research support from an NHMRC Emerging Leadership-2 Investigator Grant (EL2; GNT2008073). LC-F receives salary from a Suicide Prevention Australia Postdoctoral Fellowship. MJS is supported by a National Health and Medical Research Council Investigator Grant (GNT2025205).

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