Does early drug use-related police contact predict premature mortality and morbidity: A population register-based study

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Abstract

**Introduction.** The aim was to analyse whether age at first drug offense predicts premature mortality and morbidity due to substance use and violence among adolescents and young adults. **Methods.** A prospective longitudinal register-linkage study based on a total population sample from Finland including individuals born between 1987 and 1992 and aged 15–25 years during follow-up in 2002–2017 (n = 386 435). Age-specific rates of deaths and health-care admissions (morbidity) during a 5-year follow-up were calculated from the first drug offense. Cox regression models were used to estimate differences in mortality and morbidity at ages 21–25. **Results.** Of all 15- to 20-year-olds, 1.4% (n = 5540) have had a police contact. The 5-year mortality rates (per 1000 person-years) among those with first drug offense at ages 15–16 was 2.92 [95% confidence interval (CI) 1.56–6.18], and 5.26 (CI 4.00–7.07) and 5.05 (CI 4.06–6.38) at ages 17–18, and 19–20, respectively. The rates of morbidity varied between 61.20 (CI 52.43–71.76) and 87.51 (CI 82.11–93.33). Both mortality and morbidity rates were over 10 times higher than among the general population. In models adjusted for family background, first police contact at an early age (15–16) did not increase the risk of mortality at ages 21–25 compared with first police contact at ages 17–18 (hazard ratio 1.55, CI 0.77–3.09) or 19–20 (hazard ratio 1.52, CI 0.78–2.98). The results were similar for morbidity. **Discussion and Conclusions.** Adolescents with drug-related police contacts have high risk of mortality and morbidity due to substance use and violence regardless of age at first contact. [Ellonen N, Pitkainen J, Miller BL, Remes H, Aaltonen M, Oksanen A, Martikainen P. Does early drug use-related police contact predict premature mortality and morbidity: A population register-based study. Drug Alcohol Rev 2022;41:449–456]

Key words: drug use, adolescence, mortality, patient care, morbidity.

Introduction

Individuals who use drugs have an increased risk of both overall premature mortality and mortality directly related to acute and chronic drug use [1–4]. Increased risk of premature mortality is moderated by a number of factors, including the types of substances used, mental health and risky behaviour [3–5]. In addition, adolescent onset drug use has been shown to be associated with increased risk of premature mortality [6]. However, evidence of this relationship is limited and the only empirical research supporting this assumption is a study by Clark and colleagues [6], where they analysed the association between early onset drug use before age 18 and premature mortality based on a longitudinal sample of 870 adolescents with substance use disorders from clinical programs and community sources finding 21 deaths before the age of 25. Thus, it remains unclear whether the association between the age of onset and higher risk of premature mortality is linear (younger onset—higher risk). Regarding psychiatric morbidity, early drug use onset has been shown to increase the risk of drug dependence [7], the risk of schizophrenia [8], as well as psychosocial problems [9], more than later drug use onset.

Most of these studies used the age of 18 as the cutoff for early versus late onset and are unable to answer the question if the risks of mortality and morbidity increase when the age of drug onset decreases among those under 18. In addition, the methodological
designs in these studies on morbidity limit their
generalisability, since they are based on clinical sam-
ple of individuals in treatment [9] or cross-sectional
survey data with retrospective self-report measures
[7,8], of which the latter may suffer from non-response
bias and might also fail to reach marginalised
populations, such as drug users. Given the many chal-
lenges in collecting generalisable data on adolescents’
drug use, these methodological limitations are un-
derstandable. An alternative methodology, although not
without its own limitations, is to use population level
studies and administrative register data.

Administrative data might cover hard-to-reach
populations, such as heavy drug users, more com-
hensively than surveys, especially in the Finnish con-
text where each individual permanently residing in
Finland is issued a personal identification number and
included in this data. Also, administrative register data
enables prospective designs without recall bias [10]
and can bring new insights to the study of health con-
sequences of early drug use onset, as it has done for
the effects of early onset alcohol use. A Swedish longi-
dudinal register-based study [11] found there is no
clear connection between the earlier onset of alcohol
use and premature risk of death when compared to
later onset, although studies based on cross-sectional
designs suggested such effects [12]. Further, Kendler
and his colleagues [13] analysed the association
between drug use and mortality based on nationwide
register data showing a strong association between reg-
istry-ascertained drug use and premature mortality
from both non-medical and medical causes. Excess
mortality was explained with both indirect effects—
characteristics of drug-abusing persons—and direct
effects from the drug use itself. Official register data
have not been used to analyse the effect of early onset
drug use on mortality or morbidity.

This study investigates the association between early
drug use-related police contact and the risk for mortal-
ity and morbidity due to substance use and violence
by employing Finnish administrative register data includ-
ing all deaths (mortality) and health-care admissions
(morbidity) of mental and behavioural disorders due
to psychoactive substance use, poisoning by drugs,
medications, alcohol, intentional self-harm and
assaults based on the International Classification of
Diseases (ICD-10). Early drug use-related police con-
tact refers to the relative early age in which an adoles-
cent first comes into contact with authorities. Because
register data only includes administrative information
reported to authorities, it does not include accurate
measures of actual drug use onset. First drug use-
related police contact is thus utilised as a proxy mea-
sure of drug use onset. Although this strategy is not
without limitations, in Nordic countries police
registers describe well overall drug use [4] and
employing this measure alleviates concerns over recall
bias. Further, by investigating the linear relationship
between early drug use onset and health consequences,
targeted interventions can be better aligned towards
adolescent groups most at risk.

First, the study describes the background of adoles-
cents with early and later onset in drug-related police
contacts. Second, the study investigates whether early
onset in drug-related police contacts predicts prema-
ture mortality or morbidity due to substance use and
violence.

Methods

Participants

The study was based on a total population sample of
all children born in Finland between 1986 and 2000.
For all children and their parents, annual population
census data were linked with suspected criminal
offenses, deaths, and inpatient and specialised outpa-
tient care episodes using personal identification num-
bers. We limited our analyses to those born between
1987 and 1992 and residing in Finland at the start of
the year they turned 15 (n = 387 747). We excluded
children with missing data on mothers (n = 1037) or
parental education (n = 275). We followed the
remaining 386 435 individuals for suspected criminal
offenses of drug use from age 15 to 20. We focused on
those adolescents who had at least one police record of
drug use during this time (n = 55 450) and followed
them for mortality and health-care admissions for a 5-
year period from the first offense onwards and between
ages 21–25.

Measures

Age at first drug offense. Data on drug use-related
police contacts came from police registers and refers to
the first suspected criminal offense for unlawful use of
narcotics (criminalised in Finnish Criminal Code
50:2a8) between ages 15 and 20. In Finland, several
types of drug use is criminalised outside of medical
prescription including cannabis, stimulants and opi-
oids. The most common drug offense is for the unlaw-
ful use of narcotics. This offense indicates that an
individual was caught with a small amount of a drug
considered for personal use, not for selling purposes.
The most common drugs among adolescents and
young adults in Finland are cannabis and amphet-
amine [14,15]. The age for criminal responsibility in
Finland is 15 and offenses committed under 15 years
of age do not result in a criminal process but result in social and health interventions [16]. A criminal offense in later adolescence (<18 years) also results in automatic interventions from social services in addition to a criminal process. The age at first drug use-related offense was grouped into 15–16, 17–18 and 19–20 years in the analyses.

Premature mortality and morbidity due to substance use and violence. We included all deaths (mortality) and health-care admissions (morbidity) of mental and behavioural disorders due to psychoactive substance use, poisoning by drugs, medications, alcohol, intentional self-harm and assaults based on the ICD-10 (ICD-codes in Appendix A). Data on mortality came from the national cause-of-death register where the determination of the cause of death is based on the medical or forensic evidence and issued by a physician. Data on morbidity came from the Finnish Care Register for Health Care that covers all institutions providing hospital-level care. The register includes inpatient admissions (overnight stays) as well as outpatient care by medical specialists. The register does not cover visits to primary health care. We considered only the first admissions to care during the follow-up period.

Background factors. To account for known socio-economic differences in mortality and morbidity due to substance use and violence, as well as drug use related police contacts, we controlled for parental education. The variable was based on the highest completed degree by either biological parent and measured at child’s age 12–14 and classified into tertiary (13 years or more), secondary (11–12 years) and basic education (<10 years). Family structure at age 14 was also included as a control. The variable was based on the child’s living arrangements at age 14 and classified into: (i) two-parent family; (ii) single-parent family; and (iii) outside families. Both, parental education and family structure have shown to be associated with adolescent drug use [17]. Finally, in order to capture possible differences by gender, cohort and location, the analyses also included controls for sex, birth year and university hospital catchment area (n = 5).

Statistical methods

Rates of death and health-care admissions. We conducted a 5-year follow-up for deaths and care episodes due to substance use or violence for adolescents who had at least one police record of drug use from age 15 to 20 from the start of the year of their first police record. Adolescents were censored at emigration or death for other causes than substance use or violence. We calculated rates of mortality and morbidity per 1000 person-years by the age at first suspected criminal offense for drug use, and used Kaplan–Meier survival curves to illustrate the probability of survival during the follow-up. As there were multiple annual records per individual, we used cluster-robust standard errors while calculating the rates. For comparative purposes, and to assess whether any excess risks by age at first offense showed a difference from the general age-patterning of mortality, we also calculated age-specific rates of health-care admissions and deaths for the general population born in 1987–1992 for the 5-year period 2007–2011, using age in 2007 (15–16/17–18/19–20) as our grouping variable.

Cox proportional hazards models. To further elaborate the age-related patterns, we estimated a series of Cox proportional hazards regressions. Instead of starting the follow-up period from the year of the first police contact, we conducted a 5-year follow-up for both deaths and health-care admissions from age 21 to age 25, a design that allowed us to include the effect of age in the baseline hazard by using age as the follow-up time. This mortality analysis is subject to a modest degree of ‘survivor’ bias, since the design includes only those alive at the start of the year they turn 21 (see details in results section). The subjects were censored at outcome of interest (death or health-care admission), emigration, or at the end of the year of turning age 25.

We first present crude hazard ratios for each age group (model 0), then a model adjusted for birth year, sex and university hospital specific catchment area (model 1), and finally a model further adjusted for parental education and family structure (model 2). We use the same grouping of age at first drug use-related police contact as above. We run the models including those 21–25-year olds in the general population without police drug-related record between age 15 and 20 for comparative purposes. We repeated the above procedure using health-care admissions as the outcome event. In all the Cox models, we used cluster-robust standard errors to account for possible correlation between siblings in the data. Mother’s identification number was used to identify siblings.

Results

This work employs the innovative use of longitudinal administrative register data and was not pre-registered, therefore the results are exploratory. Of all 15- to 20-year-olds, 1.4% (5540) had a drug-related police
contact. The majority of these adolescents were males. The proportion of females was only 28% among the youngest drug user group (ages 15–16) and between 20% and 24% in other age groups. Among all age groups, the share of those whose parents had only basic education (15–19%) was significantly higher compared with the total population (7%) and a higher proportion did not live in families (6–9%) compared with the general population (1.5%). Over a third of 15- to 16-year-olds and more than 40% of older age groups had more than one police contact due to a drug offense during the 5-year follow-up since the first offense (Table 1).

Rates per 1000 person-years of premature mortality and morbidity were significantly higher among individuals with drug-related police contact compared with the general population (Table 2). Rates were clearly lower among the early onset group compared with the later onset groups, but the within each age-group rate ratios in comparison to the general population were similar. The mortality rate ratio of those with a drug-related police contact to general population was around 14 among 15- to 16-year-olds and 17- to 18-year-olds and only slightly lower (11.20) among 19- to 20-year-olds. Morbidity rate ratios were similar across age groups (12.69 among 19–20 years, 11.54 among 17–18 years and 10.84 among 15–16 years).

Table 1. Distributions of baseline variables and the number of follow-up years with at least one drug use-related offense by age at first drug use-related police contact and for the general population

| Parental education | 15–16 at first drug use offense | 17–18 at first drug use offense | 19–20 at first drug use offense | General population aged 15–20 in 2007 |
|--------------------|---------------------------------|---------------------------------|---------------------------------|-------------------------------------|
|                    | n | %> | n | % > | n | % > | n | % > |
| Parental education |   |    |   |     |   |     |   |     |
| Basic              | 118 | 19.03 | 324 | 17.44 | 451 | 14.73 | 28390 | 7.37 |
| Secondary          | 289 | 46.61 | 892 | 48.01 | 1481 | 48.37 | 162648 | 42.24 |
| Tertiary           | 213 | 34.35 | 642 | 34.55 | 1130 | 36.90 | 193982 | 50.38 |
| Family structure at age of 14 |   |    |   |     |   |     |   |     |
| Not in family      | 56 | 9.03 | 119 | 6.40 | 183 | 5.98 | 5860 | 1.52 |
| Two-parent         | 320 | 51.61 | 1043 | 56.14 | 1857 | 60.65 | 299772 | 77.86 |
| Single-parent      | 244 | 39.35 | 696 | 37.46 | 1022 | 33.38 | 79388 | 20.62 |
| Sex                |   |    |   |     |   |     |   |     |
| Male               | 448 | 72.26 | 1412 | 76.00 | 2450 | 80.01 | 196718 | 51.09 |
| Female             | 172 | 27.74 | 446 | 24.00 | 612 | 19.99 | 188302 | 48.91 |
| Number of years with at least one suspected drug use offense |   |    |   |     |   |     |   |     |
| 0                  |    |     |    |     |    |     |    |     |
| 1                  | 412 | 66.45 | 1089 | 58.61 | 1796 | 58.65 | 4950 | 1.29 |
| 2                  | 113 | 18.23 | 414 | 22.88 | 711 | 23.22 | 1165 | 0.30 |
| 3                  | 63 | 10.16 | 196 | 10.55 | 355 | 11.59 | 346 | 0.09 |
| 4                  | 28 | 4.52 | 118 | 6.35 | 150 | 4.90 | 135 | 0.04 |
| 5                  | 4 | 0.65 | 41 | 2.21 | 50 | 1.63 | 31 | 0.01 |
| Total (n)          | 620 | 100% | 1858 | 100% | 3062 | 100% | 385020 | 100% |

*During a 5-year follow-up from the year of the first drug use offense, or 2007–2011 for the general population.*
As mentioned in the Methods section, the Cox proportional hazards models here are subject to a modest survivor bias, since we only included individuals alive and residing in Finland at age 21. From the sample of individuals with a drug use-related police contact used in calculations of rates above, 75 (1.35%) individuals died (66 due to substance use or violence) and 24 (0.43%) emigrated before the age of 21. From the general population sample, 997 (0.26%) individuals exited because of death (of which 532 due to substance use or violence) (Note: Of those 75 individuals with police contact who died before the follow-up, 17% were age 15–16, 47% were age 17–18 and 36% were age 19–20.) and 4364 (1.1%) because of emigration before age 21. The survivor bias should be rather limited, given the low number of individuals exiting before age 21.

Discussion and Conclusions

In this paper we analysed whether early onset of drug use-related police contacts predicts premature morbidity or mortality. Results show high rates of mortality and morbidity due to substance use and violence among individuals with drug use-related police contact regardless of age at first contact. The majority of adolescents with drug use-related police contacts were...
mortality at age of 14. CI, confidence interval; HR, hazard ratio.

When comparing adolescents according to age at first police contact (15–16, 17–18 and 19–20), the mortality rate as well as morbidity rate were higher in groups with later drug use-related police contacts compared with the youngest age group, and the probability of survival during the 5-year follow-up period was slightly higher among the youngest group in both mortality and morbidity. Compared with older age groups, the mortality rate among the youngest age group was especially low in the beginning of the 5-year following period, but increased during the follow-up period. These findings suggest that adolescents with early police contact could have a lower risk of premature mortality and morbidity. However, there was no statistically significant association between the age of drug use-related police contacts and the hazard of mortality or morbidity at ages 21–25. When compared to general population, adolescents with drug use-related police contact had about 10–14 times higher rates of mortality and morbidity due to substance use and violence but within each age-group the rate ratios in comparison to the general population were similar.

Differences in mortality rates between user groups are at least partly explained by age in general and not by age of the first police contact, as differences in mortality and morbidity rates between age groups 15–16, 17–18 and 19–20 are evident also in the general population. When these age differences are taken into account, mortality rate was slightly higher among those with early onset compared with those with later onset. For morbidity, adolescents with later onset had higher rates of hospitalisation due to substance use or violence when comparing either different user groups or police contacted users to the general population. In all comparisons regardless of the age at onset, mortality and morbidity are over 10 times higher among adolescents with a police contact for drug use compared with the general population showing that overall risk of severe health consequences in all groups of drug use onset is high.

The findings challenge earlier results [6] suggesting that early drug use onset increases the risk of premature mortality, which could suggest that longitudinal population-level register data provides additional insight into the phenomena compared with samples derived from clinical programs. Earlier studies used the age of 18 as the cutoff for early vs. late onset, when our study includes more detailed age categories of onset. This could mean that drug use may be less problematic in early adolescence compared with later adolescence and that 15–16 years olds may still be influenced more by parents social characteristics. Alternatively, earlier drug use may be more random as users may stop or substitute legal substances. The finding, that a smaller proportion of adolescents in the younger age group had multiple police contacts due to drug use compared with adolescents in the older age groups, supports this view. Along with parents, child protective services can influence younger adolescents more than older ones. Overall, there seems to be no evidence of a linear influence (younger onset—higher risk) as suggested in earlier work [6].

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Table 3. Hazard ratios and 95% confidence intervals of mortality and morbidity at ages 21–25 by age at first offense for drug use

| Age at the first offense | Person years | Events, n | Censored, n | Mean time at risk, years | Model 0 | Model 1 | Model 2 |
|-------------------------|--------------|-----------|-------------|-------------------------|---------|---------|---------|
| **Mortality**           |              |           |             | HR 95% CI                | HR 95% CI| HR 95% CI| HR 95% CI|
| Drug use 15–16 (ref.)   | 2965         | 10 8      |             | 4.92 1                   | 1 1     | 1 1     |
| Drug use 17–18          | 8897         | 44 12     |             | 4.92 1.47 0.74–2.92     | 1.51 0.76–3.01 | 1.55 0.77–3.09 |
| Drug use 19–20          | 14 867       | 72 36     |             | 4.91 1.44 0.74–2.78     | 1.43 0.73–2.78 | 1.52 0.78–2.98 |
| No offense below age 21 | 1 862 189    | 658 5797  |             | 4.96 0.1 0.06–0.20      | 0.13 0.07–0.24 | 0.16 0.09–0.31 |
| Total                   | 1 888 918    | 784 5853  |             | 4.96                    |         |         |         |
| **Morbidity**           |              |           |             | HR 95% CI                | HR 95% CI| HR 95% CI| HR 95% CI|
| Drug use 15–16 (ref.)   | 2435         | 181 13    |             | 4.04 1                   | 1 1     | 1 1     |
| Drug use 17–18          | 7131         | 558 36    |             | 3.95 1.05 0.89–1.25     | 1.04 0.87–1.23 | 1.08 0.90–1.28 |
| Drug use 19–20          | 11 851       | 972 61    |             | 3.92 1.1 0.94–1.29      | 1.07 0.91–1.26 | 1.16 0.99–1.40 |
| No offense below age 21 | 1 829 536    | 12 143 61 |             | 4.87 0.09 0.08–0.11     | 0.1 0.08–0.11 | 0.12 0.11–0.15 |
| Total                   | 1 850 952    | 13 854 629|             | 4.86                    |         |         |         |

Model 0: crude, Model 1: adjusted for sex, birth year and hospital district, Model 2: Model 1 + parental education, family structure at age of 14. CI, confidence interval; HR, hazard ratio.
However, it should be taken into account that the measure used here—drug-related police contacts—is limited in measuring drug use onset. The first time one gets caught by the police for using drugs is likely not the first time they actually use drugs (or could be diagnosed with a substance use disorder). It is argued that in Nordic countries police records separate quite well heavy drug users from more occasional or recreational users, while the majority of those with high consumption of illegal drugs have a high probability of getting caught or committing other crimes [4]. This study focuses on all types of unlawful drug use, including the occasional party use, which likely increases the gap between registered use and actual use for occasional users compared with heavy drug users suggesting that register data derived from authority contacts may emphasise the effects of getting caught rather than the actual effects of drug using. This should be studied further to better understand how well register data can capture actual use rates. Even with this limitation, population-level analysis brings a novel approach to the discussion without the generalizability problems found in alternative research strategies.

In addition, societal context has an influence on the wellbeing of drug users. In Finland, underaged police contact means automatic intervention by social services in addition to the criminal process (or only intervention, if the child is under 15 [16]). For offenders over 18, this does not occur. Therefore, it is possible that some of the findings in this study might be explained by an earlier contact with social services. Although assessing interventions and the role of health and social services in the promotion of drug users wellbeing is beyond the scope of this study, the study suggests that early police contact at least in the Finnish context could be beneficial.

Some limitations need to be taken into account when interpreting the findings. First, detailed information on the characteristics of drug use, including the type, start dates, if the use was one-time or ongoing, and how serious or heavy (dosage and frequency) of the use was not available in the register data. In addition, administrative register data include only individuals with a treatment or police contact, excluding some drug users, although the latter proportion has been evaluated to be rather small in Nordic welfare states [4,10]. Despite these limitations, administrative data have major strength for this type of study, including large sample size and a long follow-up, and no recall or non-response biases. Therefore, it is safe to conclude that many adolescents with drug use-related police contacts come from potentially challenging societal background and they have high risk of mortality and morbidity regardless of the age of drug onset.

Conflict of Interest

The authors have no conflicts of interest.

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Appendix

Coding of deaths and inpatient and specialised outpatient care due to substance use or violence followed the 10th revision of the International Classification of Diseases (ICD). Substance use-related admissions were identified using both main and subsidiary diagnoses.

- Mental and behavioural disorders due to psychoactive substance use
  ICD-10: F10–F16, F18–F19

- Poisoning by drugs, medicaments and alcohol
  ICD-10: T36–T51, X44–45, X40–X45

- Intentional self-harm
  ICD-10: X60–X84, Y870, Y87

- Assaults
  ICD-10: X85–Y09, Y871