Death subsequent to treatment for heroin and amphetamine use: A record linkage study

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Abstract

The risk of all cause death and drug related death for a cohort (n=4425) of heroin and amphetamine dependent clients following their first admission to a specialist drug and alcohol service (Next Step) between 1985–1998 was studied using record linkage. Data from the Next Step client database were linked with the inpatient mental health information system and the registrar general's death information, data files held by the Western Australian (WA) Health Services Research Linked Database. All heroin dependents were on methadone maintenance treatment. After adjustment for age and sex the following results were obtained: heroin dependents had a greater hazard of all cause death than amphetamine dependents (HR: 1.44, p=0.02) and this effect was stronger for drug related deaths (HR: 2.35, p<0.001); clients with a psychiatric admission prior to treatment at Next Step had a greater hazard compared with those without a psychiatric history (HR: 2.19, p<0.001) and similar results appeared for drug related deaths (HR: 1.62, p=0.019); male clients had a greater hazard of all cause death (HR: 2.08, p<0.001) and this was more pronounced for drug related deaths (HR: 3.055, p<0.001). The greatest combined hazard was for a male heroin dependent client with a psychiatric history had a relative hazard of all cause death of 6.58, and a hazard of drug related death of 11.65 compared with a female amphetamine client with no psychiatric history. The Next Step research unit is involved in ongoing linkage of client records to death records to maintain surveillance of client outcomes. Record linkage provides an effective method of examining the likelihood of death among heroin and amphetamine dependents.

Introduction

The Western Australian (WA) Health Services Research Linked Database was established in 1995 with funds from the WA Lotteries Commission. It systematically and routinely links available administrative health records within a single Australian state[1]. Record linkage is a process of bringing together data from different sources that relate to the same individual. Through the linkage of routinely collected data, such as hospital admission data, death records, and so on, it is possible to build a combined data set capable of providing information suitable for answering certain questions, without the need for expensive purpose-specific data collection.[2]

A growing number of studies have been conducted utilising the WA Linked Database. The research has addressed topics in public health surveillance, patterns of care, health care outcomes and mental health outcomes. These studies have included the validation of linked administrative data on end-stage renal failure,[3] an evaluation of surgical outcomes,[4] trends in repeat prostatectomy for benign prostate disease,[5] and suicide rates in psychiatric inpatients.[6] One study has reported on first-time hospital admissions with illicit drug problems in indigenous and non-indigenous Western Australians.[7] Record linkage has been used in other countries to study psychoactive drug use in a general population sample,[8] mortality from overdose among injecting drug users recently released from prison,[9] the cause of death among patients admitted to a psychiatric hospital with substance dependence problems.[10]

This study uses record linkage to compare the mortality and survival of a cohort of heroin and amphetamine dependents treated at a specialist alcohol and drug service (Next Step) in Perth, WA.

Methods

Approval for this study was granted by Next Step and the Confidentiality of Health Information Committee (CHIC) at the Department of Health of Western Australia.

File definition & cohort selection

Data for this study were extracted from the Next Step client database. The cohort was selected on the basis of first admission to Next Step between 1985 and 1998 for a primary drug problem of heroin or amphetamine dependence. An admission to Next Step is defined as a registration to Next Step from which an episode is opened and the client may or may not commence on a treatment program. All heroin dependents

in the cohort had commenced treatment on the methadone program. The resulting cohort consisted of 4425 clients (2902 heroin clients and 1523 amphetamine clients).

The Next Step data for this cohort were then linked with the Hospital Morbidity Data System (HMDS), the Mental Health Information System (MHIS), and death records from the office of the registrar general. The HMDS records approximately 500,000 separations (discharges, transfers, and deaths) per year from all public and private hospitals in the state. The MHIS inpatient data set is also population based and covers approximately 25,000 separations per year. The MHIS data are comprised of a subset of the HMDS data selected on psychiatric diagnosis where care has been provided either in a psychiatric unit or a general ward, together with data from other authorised psychiatric facilities not collected by the HMDS. The office of the registrar general records approximately 11 000 deaths in WA per year.

Analysis

The outcome of death was explored in two ways. Death by any cause was considered, along with the subset of this outcome, death by drug related cause. Clients were followed up from their first admission date at Next Step until death or censored at the end of the study period (31 March 2001) if they were still alive at this point in time. A drug related death was defined according to the coded cause of death field in the linked mortality records. A death was considered to be drug-related according to a set of ICD–9, ICD–9-CM and ICD–10-AM codes representing illicit and some licit drug caused conditions, but excluding tobacco and alcohol.

Explanatory effects included in the final model were age, sex, primary drug, and mental health history. Age and sex are self-explanatory. Primary drug was defined as either amphetamines or heroin according to the main drug of treatment at Next Step. A small number (n=123) were treated for a primary drug dependency of both heroin and amphetamines. Clients who were treated for both were coded as having a primary drug problem of heroin as they would have been on the methadone program at some point during the study period. Psychiatric history was coded as a binary variable, according to whether a client had a psychiatric admission at any time in the five year period preceding their first Next Step admission. A psychiatric admission was defined as any admission to a psychiatric facility in which clinical care was provided and where a psychiatric diagnosis was recorded. A five-year period was chosen on the basis of available data. Other variables considered but not included in the final model were the year of first admission and the number of other drug admissions at Next Step.

Results

Cohort characteristics

The cohort consisted of a rather young group of clients with a right skewed age distribution about the median of 27 years. Sex was not evenly distributed with around two thirds of the clients being male. Heroin was the primary drug of use for approximately two thirds of the cohort; the primary drug of use for the others was amphetamines. Approximately 17% of the cohort had been admitted to psychiatric services some time in the five years prior to their first Next Step admission. Of these approximately 40.0% of both heroin and amphetamine dependents had at least one admission, and the most common psychiatric diagnosis was self-inflicted injury or poisoning.

Mortality

Overall 6.1 % of the cohort died from any cause and 3.2% died from drug related causes. The distribution of independent effects is illustrated in Table 1. Among male clients 7.3% had an all cause death while 4.1% had a drug related death. Among females there were proportionally fewer deaths with 3.8% all cause deaths and 1.5% drug related deaths. There were proportionally more deaths among heroin dependents than amphetamine dependents, with 7.0% dying from any cause and 4.0% dying specifically from drug related causes. Among amphetamine dependents 4.3% died from any cause and 1.6% died from drug related causes.

Those who had an admission to psychiatric services prior to admission the Next Step were over represented among the deaths with 10.0% dying of any cause and 4.0% dying of a drug related cause. Among those who did not have a psychiatric diagnosis in the five years preceding their first Next Step admission 5.3% died of any cause and 3.0% died of drug related causes.

Independent	All cause deaths				Drug related deaths				Total
	No death		Death		No death		Death		
No MH diag	3490	94.7%	194	5.3%	3574	97.0%	110	3.0%	3684
MH diag	667	90.0%	74	10.0%	711	96.0%	30	4.0%	741
Male	2621	92.7%	207	7.3%	2712	95.9%	116	4.1%	2828
Female	1536	96.2%	61	3.8%	1573	98.5%	24	1.5%	1597
Heroin	2699	93.0%	203	7.0%	2787	96.0%	115	4.0%	2902
Amphets	1458	95.7%	65	4.3%	1498	98.4%	25	1.6%	1523
Total	4157	93.9%	268	6.1%	4285	96.8%	140	3.2%	4425

Figure 1 Distribution of independent effects by cause of death

The following Kaplan Meier Survival Curves show the overall effect of mental health history for each of the two death outcomes. The effect displayed is prior to any adjustment of confounding effects.
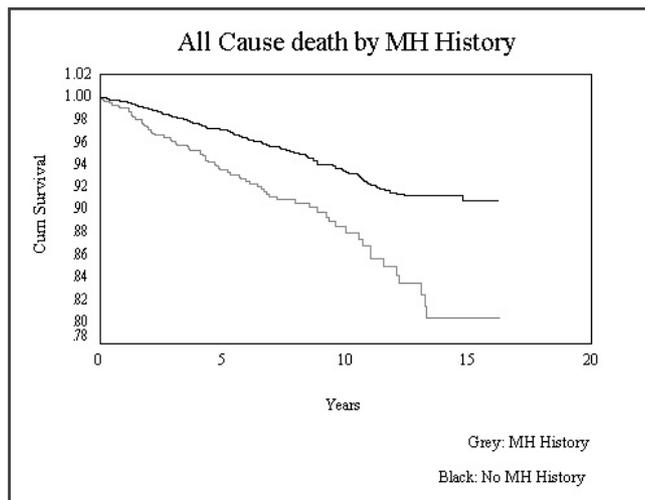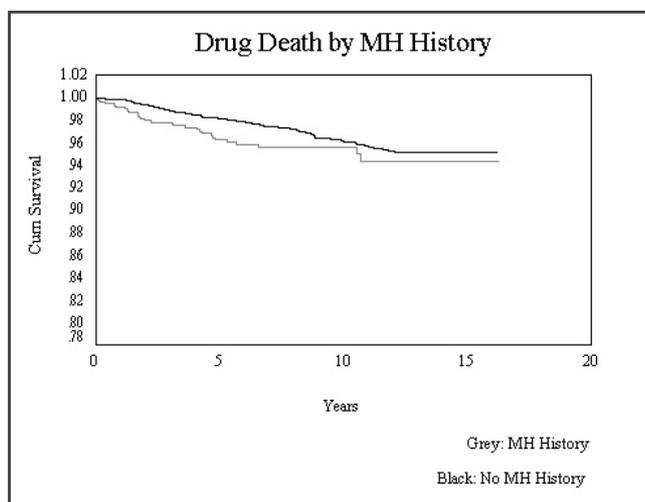
Figure 2

Figure 3

The cumulative survival function represents the probability of survival for a client at any given point in time. In general we can see that the curves for all cause death are somewhat divergent, while the curves for the drug related death model closely follow each other. As a specific example of this generalisation we can see that the all cause death curve shows that the probability of survival through ten years of follow up is around 0.94 for clients without a mental health history and 0.89 for clients with a mental health history. The drug related death model shows that the probability of survival through ten years of follow up is around 0.96 for both clients without and with a mental health history.

Death model

Sex, primary drug and previous psychiatric history were the three main predictors of death for any cause, and for drug related death after controlling for age. All of these effects in both models were significant (p< 0.05). See Table 2.

In the any cause death model, male clients had twice the hazard of death for any cause compared with female clients (HR: 2.08). Heroin users were at a greater risk than amphetamine users (HR: 1.44) and psychiatric history was the strongest predictor as those with a previous history had more than double the hazard of death for any cause (HR: 2.19).

In the drug related death model, the effect of having a psychiatric history is somewhat reduced (HR: 1.62), but the effect of sex becomes markedly greater with male clients having a hazard of death three times greater (HR: 3.06) than female clients. The effect of primary drug was also greater with the hazard for heroin dependents of having a drug related death 2.35 times that of amphetamine dependents.

	Death - any cause				Death - drug related			
	95% CI for HR				95% CI for HR			
	HR	Lower	Upper	p	HR	Lower	Upper	p
Age	1.01	0.99	1.03	0.39	1.00	0.98	1.03	0.84
Male	2.08	1.56	2.78	0.00	3.06	1.96	4.76	0.00
Female	1.00				1.00			
Heroin	1.44	1.06	1.96	0.02	2.35	1.48	3.74	0.00
Amphetamines	1.00				1.00			
Psych history	2.19	1.67	2.81	0.000	1.62	1.08	2.43	0.019
No psych history	1.00				1.00			

Figure 4

The combined effects for the three main predictors of any cause death and drug related death were also examined. The greatest relative hazards for a death from any cause were for a male heroin dependent with a psychiatric history (HR: 6.58) and a male amphetamine dependent with a psychiatric history (HR: 4.56) compared to a female amphetamine dependent with no psychiatric history (baseline client of lowest risk).

The combined effects were greater for the outcome of drug related death with a male heroin dependent with a psychiatric history 11.65 times more likely to die compared with the baseline female client. However, in contrast to the all cause death model, the combined effects of being a male heroin dependent with no psychiatric history (HR: 7.18) were greater than the combined effects of being a male amphetamine dependent with a psychiatric history (HR: 4.96).

Discussion

Of the 4425 heroin and amphetamine dependent clients in the cohort approximately 10.0% died during the study period (6.1% from any cause; 3.2% from drug related causes). Being male, heroin dependent, and having a psychiatric history were associated with a high hazard of both all cause deaths and drug related deaths. Males had double the risk of any cause death and treble the risk for a drug related death after controlling for known confounders. In a recent epidemiological study conducted in WA it was found that the number of male deaths from a drug-related cause (other than tobacco and alcohol) increased significantly from 1985 to 1996. [11] The increase in

age-standardised rates was reported to be 6.2% per year. This period, 1985–1996, closely approximates that of the current study, however this study was not able to provide information on death rates.

Among other items that were considered in deriving the final model was a measure of readmissions to Next Step for primary and other drug use. This measure was found neither to have a noteworthy effect, nor to be statistically significant. This suggests that categorising clients as amphetamine or heroin dependents based on their primary drug of use on first admission to Next Step did not result in significant confounding. Consequently it was felt reasonable to remove this variable from the model.

Heroin dependents were shown to have a higher hazard of death compared to amphetamine dependents. All the heroin dependents in this study were either receiving methadone treatment or had received methadone treatment. A number of studies have reported on the association of methadone with fatal outcomes.[12–17] Deaths related to amphetamine use are reportedly less common [18] (Kamieniecki et al 1998), however amphetamine dependents have been shown to have a relatively high risk of admission to psychiatric services (Bartu).[19] Having a psychiatric history has been demonstrated to considerably increase the hazard of death for both heroin and amphetamine dependents. The findings presented in this paper emphasise the importance of including comorbidity, that is psychiatric history, in any study on the outcomes of treatment of heroin and amphetamine dependents.

This paper has provided an example of how linkage of administrative health records can be used to identify clients at risk of a death subsequent to treatment at specialist drug and alcohol services. The analysis of linked health data of this kind allows the treatment outcome to be assessed and the information required to be obtained in a non-intrusive and representative way. The study is part of a much larger record linkage investigation of health services utilisation and other outcomes of clients treated at specialist drug and alcohol services.

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