Suicide and other-cause mortality among heroin users in Taiwan: A prospective study

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HIGHLIGHTS

• Heroin users have a higher all-cause mortality rate and suicide rate.
• Females had higher standardized mortality ratio for suicide and total mortality.
• Younger age was related to a higher rate of overdose death.

ARTICLE INFO

ABSTRACT

Aims: The present study investigates one-year incidence of mortality from suicide and other causes among heroin users in Taiwan.
Design: A prospective national register-based cohort study.
Setting: All heroin users who attended the methadone maintenance treatment (MMT) programs in all treatment centers in Taiwan.
Participants: The sample comprised 10,842 heroin users attending MMT. Between Jan 2006 and Dec 2007, cases were identified through the multiple-center register system and followed until Dec 2008 for date and cause of death on the Taiwan national mortality database.
Measurements: Standardized mortality ratios within one year of starting MMT were calculated as a ratio of actual versus expected numbers of deaths in the general population in Taiwan. Cox regression models were fitted to estimate the effects of gender, age, education and marital status as well as heroin related behaviors.
Findings: In total, 256 cases died, 67 through suicide. The mortality rate (per 100 person-years) in the first year of all-cause and suicide was 1.71 and 0.45 respectively, representing 7.5- and 18.4-fold age- and gender-standardized mortality ratio (SMR) compared to the general population. Besides, the mortality rate in the first year of overdoses, murder, HIV, somatic was 0.19, 0.02, 0.07, and 0.75 respectively, representing 68.4-, 27.7-, 76.8-, and 4.3-fold SMR increases to the general population. Older age and unemployment were independent risk factors for mortality. Females had higher standardized mortality ratio than males for suicide and all-cause mortality.
Conclusions: Results showed higher risk of suicide and other-cause mortality among heroin users in MMT than general population. Suicide is an important contributor to overall excess mortality among heroin users in MMT, and especially among women. Suicide prevention and physical health monitoring are important components of MMT programs.

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1. Introduction

Heroin use is linked to premature death. An updated meta-analysis has reported the mortality rates estimated are between 0.38 and 7.76 per 100 person-years (PY), with a pooled mortality rate of 2.09 PY (Degenhardt et al., 2011). The rates are six to thirty times higher than in the general population (Darke, Degenhardt, & Mattick, 2007). The

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main causes of mortality are drug overdoses, trauma including suicide and homicide, and somatic causes including blood-borne infections (Clausen, Waal, Thoresen, & Gossop, 2009). Substance use is an independent indicator for suicide after controlling for depression, personality and life events (Cheng, Chen, Chen, & Jenkins, 2000), and the standardized mortality ratio (SMR) of suicide for heroin users is 14 times that expected of matched peers (Darke & Ross, 2002). In a national sample of drug abusers entering treatment services throughout England, it was found that more than a quarter of the patients reported suicidal thoughts before treatment (Gossop et al., 1998). It was also shown that 10.9% of heroin users attempted suicide within one month before attending the methadone maintenance treatment (MMT) (Chen et al., 2010).

Most studies of the problems and treatment responses of dependent opioid users have been conducted in Western countries (Degenhardt et al., 2011) and it is unclear whether such findings can be generalized to other sociocultural settings. In particular, only four studies of mortality among heroin dependent users have reported findings from Asia (Azim et al., 2008, 2009; Quan et al., 2007; Zhang et al., 2005). These found mortality rates that were higher than in most Western countries. However, the possible links between heroin dependence and mortality among Asian heroin users remain poorly understood since previous studies are limited by small sample size and selection bias. The present study investigates the incidence of suicide, overdoses, and all-cause mortality among more than 10,000 heroin users after attending the methadone maintenance treatment (MMT) in Taiwan.

2. Methods

Information including demographic factors and drug related behaviors was collected on all patients who attended MMT in any treatment center. This data was registered on a computerized MMT register system at the Centre for Disease Control, Department of Health, Taiwan (Taiwan CDC). The study sample comprised 10,842 cases identified through the multiple-center MMT register system between January 2006 and December 2007, and followed until December 2008 for date and cause of death on the Taiwan national mortality database. Both data was linked with anonymity for the researchers. The proposal is agreed by the ethical committee in Taoyuan Psychiatric Hospital. The proposal is agreed by the ethical committee in Taoyuan Psychiatric Hospital.

Using indirect standardization, annual age- and gender-specific mortality rates from Taiwanese national mortality statistics in 2007 were applied to the study sample to compute the expected numbers of deaths. Each person's first presentation within the study period was used in the calculation of risk over time. Since the register system started when MMT launched in Taiwan, it represented the first time ever on a methadone program for the heroin users. The standardized mortality ratio (SMR) within one year of starting MMT in the study sample was calculated as a ratio of actual deaths in heroin users versus the annual expected numbers of deaths derived from general population in Taiwan. Standardized mortality ratios were described as simple ratios rather

than according to the convention of 100 = no difference, because of the large size of the effects. The Crude mortality rate (CMR) was a measure of the number of deaths against the person years of follow-up (PYFU) observed. PYFU is a summation of all participants' follow-up periods. CMR was expressed here as the number of deaths per 100 PY.

Information regarding the personal identification of all individuals (national identifier number, name, gender, location of residency and date of birth) recruited during the study period was checked against the databases of the national death register system. Within this system, all deaths from unnatural causes (suicide, overdoses and homicide) are decided on by a death verdict jointly assigned by a prosecutor and a coroner, whose main concern is the possibility of homicide. In a previous study in Taiwan, only 2 out of 117 suicides were judged to have been misclassified by coroners and prosecutors as accidental deaths (Cheng, 1995).

The risks of suicide, overdoses, death by somatic causes, and all-cause mortality (which included all unnatural deaths and deaths by natural causes) were calculated. Each person's first presentation within the study period was used in the calculation of risk over time.

All individuals traced until December 2008 by the national death register system for any length of time from their first presentation were entered into a survival analysis. The risks of suicide, of mortality excluding suicide and other-cause mortality during the follow-up period were calculated using survival curve. In the survival analysis, the time function was calculated as the number of months from the index episode of attending MMT to December 2008 (end of follow-up) for those who survived until then or until the date of death if this preceded the end of the follow-up interval. Cox regression models were fitted to estimate the effects of gender, age, education and marital status as well as heroin related behaviors (onset age, injection, comorbid substance) on survival. Hazard ratios with 95% confidence intervals were calculated. Analyses were carried out using the Statistical Package for the Social Sciences version 15.0 for Windows.

3. Results

A total of 10,842 cases of heroin users after seeking MMT were registered between Jan 2006 and Dec 2007. Follow-up information was available for all individuals until December 2008. The predominant route of heroin administration was by injection (91.3%, n = 9874). The use of amphetamines was also reported by 48.4% (n = 5229). The mean age of the sample was 36.8 years (range 16–78 years, SD = 8.4); 86.9% were males; 61.9% had fewer than nine years of education; over half were single and a quarter were married; 44.2% were unemployed.

In total, 256 (2.4%) of the sample died during the study period: 67 of these died through suicide (0.6%) and 28 (0.3%) due to overdoses. Among the causes of mortality, 112 (43.8%) of the deaths were due to somatic causes, 67 (26.2%) to suicide, 29 (11.3%) to overdoses, 10 (3.9%) to HIV, and 3 (1.2%) to murder. The incidence rate of all-cause mortality was 1.71 per 100 person-years (PY) and represented 7.5-fold age- and gender-standardized mortality ratio increases compared to

Table 1
Mortality rate per 100 person-years by age-group (N = 10,842).

Cause of death	Deaths				Crude mortality rate[a] (Person-years %)				SMR[b] (95% CI)
	<35	35–49	50+	Total	<35	35–49	50+	total	
Suicide	21	39	7	67	0.32	0.53	0.63	0.45	18.4 (13.2–24.8)
Overdoses	17	10	2	29	0.26	0.14	0.18	0.19	68.4 (41.1–106.8)
Murder	0	3	0	3	0.00	0.04	0.00	0.02	27.7 (5.6–80.9)
HIV	4	4	2	10	0.06	0.05	0.18	0.07	76.8 (28.0–167.2)
Somatic	23	65	24	112	0.35	0.88	2.15	0.75	4.3 (3.3–5.4)
All cause	81	137	38	256	1.24	1.86	3.40	1.71	7.5 (6.4–8.7)

[a] Follow-up year of cases were 6514.98, 7348.32 and 1117.29 years for ages <35, 35–49 and 50+, respectively.
[b] Standardized mortality ratios, standard population: overall Taiwan in 2007.