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Mortality among Substance-using Mothers in California: A 10-year Prospective Study

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Abstract

Aims—To examine mortality rates and causes of death among a cohort of substance-using mothers and to identify risk factors that predict mortality.

Design, setting, participants—This is a prospective study of a cohort of 4,447 substance-using mothers (pregnant or parenting) who were enrolled during 2000 to 2002 in 40 drug abuse treatment programs across California.

Methods—All mothers were assessed at baseline using the Addiction Severity Index. Mortality data were obtained from the National Death Index and causes of death were coded using ICD-10. Standardized mortality ratios (SMR) were calculated relative to women in the general population adjusted for age. Proportional hazard (Cox) regression was used to identify risk factors predicting death.

Results—By the end of 2010, 194 deaths were confirmed, corresponding to a crude mortality rate of 4.47 per 1000 person-years and SMR of 8.4 (95% CI=7.2–9.6). Drug overdose (28.8%), cardiovascular disease (10%), and alcohol or drug disorders (8.9%) were the leading causes of death. Baseline factors associated with higher mortality included older age, being white (relative to African American or Hispanic), heroin, alcohol, cocaine, or marijuana (relative to methamphetamine) as the primary drug problem, drug injection, and greater severity of employment, medical/health, and psychiatric problems.

Conclusions—Substance-using mothers have 8.4 times the mortality than that observed among US women of similar age. Greater severity of employment, medical/health, and psychiatric problems contributed to the elevated mortality.

Keywords

CalTOP; Mortality; Substance-using Mothers

Introduction

Women account for more than 30% of substance abuse treatment admissions nationwide [1]. Research in the past 20 years has revealed considerable gender differences in substance abuse behaviors and treatment needs. Compared with substance-dependent men, substance-dependent women are more likely to have coexisting psychiatric problems, lower self-esteem, and extensive histories of traumatic life events and experiences, including sexual and physical abuse [2–6]. Most substance-dependent women have limited education, are

unemployed, and rely on public assistance. Drug use by these women is often initiated by their male partners [7–9] and the women frequently continue to use drugs to cope with abusive relationships and other life stressors [9–11]. Most women in substance abuse treatment are of childbearing age. Many women have children and are typically the primary childcare provider [12–15]. Thus, pregnant or parenting women face additional challenges associated with child rearing and parenting. Few studies, however, have examined long-term outcomes among these women. Based on a large cohort of substance-using mothers prospectively followed for 10 years, this article focuses on long-term mortality, the most severe potential consequence of drug and alcohol use.

Recent Research on Mortality among Substance-using Populations

It is well known that substance abusers suffer from high mortality, generally 3 to 14 times higher than in the general population of the same age [16–18]. Many studies have assessed short-term (less than 12 months) survival outcomes following treatment and these studies have shown that drug-users are at greatest risk of fatal overdose in the 4 weeks after discharge from treatment or imprisonment [19, 22]. The elevated risk during this immediate period following release is largely explained by a decline in drug tolerance, poly-substance abuse, and the failure to properly identify those at risk.

Longer term mortality studies of drug abusers have been conducted in many countries, mostly based on registry records [20]. Most of these studies, focusing on opiate users, reported that overdose is the most prevalent cause of death (Australia, Italy, Sweden, U.S.), followed by AIDS (Italy, Sweden). A recent article [21] reported the results of a systematic review of mortality among cocaine abusers. The article reported crude mortality rates ranged from 0.53 to 6.16 per 100 person-year and standard mortality ratios (SMRs) of 4 to 8 times higher than age and gender peers in the general population. Few studies have included users of other drug types, but there is some evidence that the risk is lower for amphetamine-related mortality than for opiate-related mortality among drug users in Australia [17]. In contrast, a study [18] conducted in Stockholm found that the SMR was quite similar for opiate and amphetamine abusers (3.0 and 3.5, respectively).

The majority of these existing studies are based on registries of poisonings, overdose, or post mortem toxicology, a practice that is likely to underestimate drug-related mortality rates. For example, many causes of death among drug users are not due to acute intoxication, but are often directly or indirectly related to drug use [22]. These studies usually have limited data on risk factors for mortality [22–24]. Few prospective long-term follow-up studies on mortality are available and even fewer include women, or report mortality separately for women. The few exceptions include the Stockholm study [18] that used registry records to track 1,705 illicit drug users over 37 years. A higher proportion of male than female drug abusers died, but the age- and gender-specific mortality rates were higher in women, mainly due to lower mortality of women than men in the general population [22]. A recent study conducted in Australia followed a cohort of 615 heroin users over the period 2001–2009, reporting a crude mortality rate of 6.43 per 1000 person years, with no gender difference, and the SMR was 4.56 (males=2.95, females=18.57) [25]. There are few studies of mortality among female drug users despite higher SMRs, few cohort studies have directly compared mortality rates across drug classes, and studies to date have included limited measures of risk factors. The present study takes advantage of a large cohort of substance-abusing mothers followed for 8 to 10 years since their admission to drug treatment programs in California, and describes their pattern of mortality and related risk factors.

This article presents findings from a study including approximately 4,500 pregnant or parenting women assessed at treatment admission between 2000 and 2002, and analyzes

their mortality data obtained from the Centers for Disease Control and Prevention (CDC) in 2010 to identify the major causes of mortality and the risk factors at baseline that are predictive of death. Given the scarcity of data assessing drug-related mortality among women with histories of substance abuse, and the limitation of short-term observations, the study findings add vital information to the knowledge base regarding survival measures for women with substance abuse problems.

Methods

Study Sample and Data Sources

The study sample includes 4,447 women who were admitted to 40 drug-treatment programs through the California Treatment Outcome Project (CalTOP) as part of the national Treatment Outcomes and Performance Pilot Studies [26–27]. CalTOP was conducted in 43 programs (3 programs were men-only) in 13 counties of California, covering wide geographic locations (e.g., the northern, central, and southern regions of California) and including both urban and rural areas. The 40 programs that served women were classified as mixed-gender and women-only based on a program survey completed for each program [28]. This cohort consisted of pregnant or parenting women (i.e., women parenting dependent children or children under age 18) who were assessed at treatment program admission between 2000 and 2002. The State of California and UCLA Institutional Review Boards reviewed and approved all study procedures.

Measures

Death and Causes of Death—Death certificates were obtained from the National Death Index, which contains records of death in the United States from 1979 through 2008, maintained by the CDC. Causes of death were coded according to the International Classification of Diseases (ICD, 10th revision). Deaths were grouped into the following categories: drug overdose (both unintentional and intentional), cancer, liver disease, cardiovascular disease, alcohol/drug disorder, respiratory disease, HIV/AIDS, hepatitis, other infectious disease, suicide, homicide, motor vehicle accident, and all other causes. Suicide deaths due to drug overdose were included in the drug overdose category, an approach that has been applied in the applicable literature.

Recent deaths (after 2008) were searched on the web-based National Death Register, which provides the date of death but not the cause of death. Thus, for all-cause mortality the date of death was available for all 194 deaths by the end of 2010, and for cause-specific mortality, cause of death was available for 180 deaths which occurred before the end of 2008.

Addiction Severity Index (ASI) [29]—The ASI is a structured interview that assesses problem severity in seven areas: alcohol use, drug use, employment, family and social relationships, legal, medical status, and mental health. A composite score was computed for each of the scales to indicate severity in that area; the range of scores is 0 to 1 with higher scores indicating greater problem severity. Also examined were individual ASI items on demographic characteristics, primary drug problem, and background histories of drug use and treatment, physical and sexual abuse, criminal involvement, and psychiatric symptoms. The ASI is the most commonly used instrument in the substance abuse field with demonstrated psychometric validity and reliability for assessing problem severity in diverse populations. ASI was administered at baseline.

Mental Health Diagnoses—Information regarding mental health diagnoses was obtained from the California Department of Mental Health (DMH). DMH maintains the Client and Service Information (CSI), a database with psychiatric diagnoses and 3 years of service

records for clients treated in mental health facilities that received DMH funds. DMH records for all CalTOP clients were requested, and therefore psychiatric diagnoses were available for those clients who had DMH records.

Analytic Strategies

The crude death rate was expressed as the number of deaths per 1000 person-years. These rates were determined using time of death or follow-up (the end of 2010), whichever came first. Standardized mortality ratios (SMRs) and their 95% confidence intervals (CI) were used to compare the overall mortality of substance-using mothers with women of the same age in the general US population. Proportional hazard (Cox) regression was used to investigate predictors of time to death since baseline (i.e., intake into the CalTOP study and index treatment). Selection of variables for inclusion in the model was informed by the extant literature and also by descriptive analyses of demographic and background characteristics. Several items measured similar constructs and were also highly correlated and thus to minimize potential problems due to multicollinearity, only one item was chosen for model inclusion. Chi-square or t-tests were used to compare characteristics at baseline between alive and deceased women.

Results

Death Rates and Causes of Death

There were 194 confirmed deaths (4.39% of the total sample of 4,447) over the 8- to 10-year follow-up period, which corresponds to a crude mortality rate of 4.47 per 1,000 person-years. The SMR was 8.4 (95% CI 7.2–9.6), representing a more than eightfold increase of mortality risk compared to women of a similar age in the general population. The mean age of these women at death was 41.6 (SD=7.4).

Of the 180 with death certificates, the most common cause of death was drug overdose (52 cases, or 28.8%), followed by cardiovascular disease (10.0%), alcohol/drug disorders (8.9%), cancer (8.3%), liver disease and motor vehicle accidents (6.1% each), and homicide (4.4%). Additionally, there were 2 deaths due to hepatitis and 4 deaths due to HIV/AIDS.

Included in the 52 deaths attributed to drug overdose were 42 casualties due to accidental poisoning and drug exposure, as well as 5 intentional drug-related suicides and 5 deaths due to undetermined intent. In contrast, deaths caused by alcohol/drug disorders were mostly related to mental and behavioral disorders due to alcohol or psychoactive substance use.

Characteristics of Alive and Deceased

We compared baseline characteristics between alive and deceased women (Table 1). The mean age at baseline for the deceased women was significantly older than that of the surviving women (37.2 ± 7.1 versus 32.8 ± 7.5 , $p < 0.01$). Compared to those still living, more white and fewer Hispanic women were deceased. Those who died were more likely to have some college education, less likely to have been married, and more likely to have fewer children and to have been receiving public assistance.

Relative to the group of surviving women, women in the deceased group were more likely to have reported primary drug problem to be alcohol (35.8% vs. 20.7%), heroin (27.5% vs. 13.1%), and cocaine (14.0% vs. 11.4%), and less likely to be methamphetamine (14.5% vs. 42.5%) or marijuana (6.7% vs. 10.0%). Deceased women also had used the reported primary drug significantly longer (18.5 ± 9.0 years) than those still living (14.7 ± 8.0). More deceased women had used drugs by injection (36.6% vs. 20.7%), and deceased women also had reported significantly more prior treatments for alcohol (1.76 vs. 0.77) and for drugs (3.32

vs. 1.73) than surviving women. There was no difference between the two groups of women with regard to the program type (i.e., mixed-gender or women-only) of the initial treatment under the CalTOP project.

At baseline, women in the deceased group had statistically higher ASI severity scores with respect to alcohol, employment, family, medical, and psychiatric problems (See Table 2). Despite comparable rates of criminality and legal system involvement, the deceased sample had a greater rate of psychiatric medication use in the past 30 days (23.7 versus 17.7, $p < 0.01$) with clinically apparent symptoms including depression, anxiety, and hallucinations. Prior history of psychiatric treatment consisting of both inpatient and outpatient services was also significantly higher in the deceased group. Based on the DMH records concerning psychiatric diagnoses, relative to the alive, the deceased sample demonstrated a significantly higher percent of depressive disorder (14.3% vs. 19.6%, $p < 0.05$) and bipolar disorder (6.0% vs. 9.8%, $p < 0.05$).

Risk Factors Predicting Mortality

In addition to demographics (e.g., age, race/ethnicity, and marital status), we considered drug-related factors (e.g., primary drug type, drug injection) and ASI problem severity in seven domains, and simultaneously tested the predicting values for mortality using a Cox proportional hazard model. The results (see Table 3) showed that older age, drug type (i.e., heroin, alcohol, cocaine, and marijuana, relative to methamphetamine), drug injection, and greater severity of employment, medical, and psychiatric problems were all related to high risk of mortality. On the other hand, racial/ethnic minorities, including African American and Hispanic women, had a lower mortality risk (Hazard Ratios of 0.59 and 0.66, respectively) relative to white women.

Discussion

The study demonstrates that risk of death increased eightfold among the substance-using sample of women compared with those in the general population. Even though the crude mortality of 4.47 per 1000 person-years appears to be at the low end of mortality rates reported in the literature, the SMR observed in this study indicates an increase of 8.4 times the mortality observed among US women of similar ages. These women died at a relatively young age (mean of 41.6), and many of these deaths (e.g., overdose, drug and alcohol disorder) may have been preventable.

The limited number of suicides, a major cause of death for drug users, among this sample is surprising (although 5 drug-related suicide deaths and 5 with undetermined intent were classified under overdose category). In general, men are at 3 times the hazard of drug-caused death compared to women [30]. Also, while women attempt suicide more often than men, men are more likely to succeed [31]. In addition, pregnant women are at a significantly lower suicide risk than women of childbearing age who are not pregnant [32]. Although postpartum depression is associated with a higher than normal suicide rate, motherhood may protect against suicide [33].

An important and unique contribution of the present study is the examination of a comprehensive set of potential risk factors. In addition to demographics, the study identified baseline predictors of mortality in key areas of life domains (e.g., primary drug, employment, medical problems, psychiatric problems) that have not been simultaneously examined in previous research. Baseline predictors are of potentially great clinical importance as they can be taken into consideration in treatment delivery [25].

Compared to surviving women, deceased women were generally older, of ethnic majority (white), and had higher educational levels. Adverse health outcomes are generally associated with a lower socio-economic status and racial/ethnic minority status [34–37]. It is unclear why this general pattern was not apparent in the present sample, which should be examined in future studies.

More deceased women reported their primary drug type being heroin, alcohol, or cocaine (but less methamphetamine), and used drugs by injection. These women also used the primary drug for more years, and had greater numbers of prior alcohol or drug treatments. The finding of elevated risks for mortality associated with heroin use (HR=3.62) and injection behavior (HR=1.55), relative to methamphetamine use is consistent with the literature. Notably, however, a similar elevated mortality risk was also observed with alcohol (HR=3.76), cocaine (HR=3.56), and even marijuana (HR=2.45). Yet prevailing perceptions among the general public have been that alcohol and marijuana are relatively “harmless” drugs compared to other drug types. A cautionary note regarding causal attributions to particular drug classes is warranted given that polydrug use is common among such samples. Nevertheless, few studies have examined cause-specific mortality across drug classes. Among the few that compared across drugs, none included illegal drugs and alcohol, nor provided specific findings on women. Thus, while this last finding is somewhat surprising, future research is needed to confirm or replicate.

A novel study finding is that the elevated mortality risk associated with employment and psychiatric problems among these women is of consequence. Only 18.6% to 22.5% of these substance-using women were employed at treatment admission, and the group of deceased women further reported significantly greater employment problem severity than the group of surviving women. Research indicates that employment not only contributes to the accumulation of social capital [38–41] and perceived quality of life [42–43], but it can also enhance physical and mental well-being and overall quality of life [44–50]. The absence of employment, and its attendant benefits, in the lives of these women may be a significant underlying determinant of premature mortality.

More deceased women reported various psychiatric symptoms (e.g., depression, anxiety, or hallucinations), and also received more inpatient psychiatric treatment previously. The DHM records also showed that the deceased sample demonstrated a significantly higher percent of depressive disorder and bipolar disorder (although these disorders were not significant when they were considered in the multivariate analyses). These women could have used drugs and alcohol to cope with their problems and stress, which either led to overdose (including intentional drug-related suicides) or compromised health leading to eventual death. Differential exposure to chronic and acute stressors over the life course may contribute to “stress proliferation” [51], a process that places those exposed to serious adversity at risk for later exposure to additional adversities. Such stress proliferation is thought to contribute to inequalities in health outcomes. Emerging evidence suggests that stressful life experiences and exposures result in “biological signatures” and that add up and “get under the skin” [52], resulting in increased morbidity and mortality [53]. The group of deceased women had been served by treatment systems several times yet still encountered premature death. Providers who serve substance-using women should pay special attention to the unique needs of women in order to help them avoid premature death.

Our sample of deceased women died at young ages. There are adverse collateral consequences of their premature death related to welfare of the minor children they left behind. Studies have shown that children remaining from sudden death of a parent are at risk for psychological problems and future problem behaviors [54–55]. They are also likely to be

left in the care of family or foster system – where a multitude of problems exist within those systems compounding their grief and loss [56].

Strengths of this study include the large, ethnically diverse sample size, and the use of community-based treatment seekers. The inclusion of numerous treatment programs across California also increases the ability to generalize of our findings. It is important to note that the counties and treatment programs that participated in CalTOP were not randomly selected. However, we do not believe this has any significant bearing on our findings as our sample characteristics resemble those of the statewide treatment population in terms of ethnicity, age, employment status, primary drug type, and legal status [26].

In conclusion, the present study provides vital information regarding mortality risk factors for women substance-users. Despite increasing awareness, mortality rates from unintentional poisoning (due to both prescription and illegal drugs) continue to rise in the U.S. Between 1999 and 2006, death due to accidental poisoning increased 108.5% while intentional and undetermined death rates remained stable [57]. Data from CDC projects report that accidents (unintentional injury) and suicide (intentional self-harm) are the 5th and 11th overall leading causes of death, respectively [58]. Poisoning, or drug overdose, contributes largely to these statistics, representing the greatest number of non-transport accidents and is positively associated with rates of suicides [58–59]. Although the quick rise in deaths due to unintentional poisonings was higher in men, the increase in overall rate was greater amongst women [60]. Consistent with these reports, the present study findings demonstrate that mortality is an especially troublesome problem for pregnant and parenting mothers who have substance use problems. Furthermore, the study reveals the importance of addressing the multiple problems faced by substance-using mothers. Addressing these women’s problems and risks, particularly in terms of employment, health, and psychiatric health, could prevent many premature deaths.

Acknowledgments

Declaration of Interest:

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Table 1
Demographics and Background Characteristics at Baseline

	Alive (n=4,253)	Deceased (n=194)	Total (n=4,447)
Age, % **			
<=24	16.5	5.7	16.0
25–34	40.8	27.3	40.2
35–44	37.1	51.0	37.7
45+	5.6	16.0	6.1
Age, mean (SD) **	32.8 (7.5)	37.2 (7.1)	33.0 (7.6)
Race/Ethnicity, % *			
White	54.8	63.9	55.2
African American	16.2	17.0	16.3
Hispanic	22.3	15.0	22.0
Other	6.7	4.1	6.5
Education, % *			
Less than High School	41.6	36.1	41.3
High School	40.9	39.7	40.8
College	17.6	24.2	17.9
Never married, % *	40.2	30.4	39.7
Number of children, mean (SD) *	2.5 (1.7)	2.2 (1.4)	2.4 (1.7)
Employed, %	22.5	18.6	22.4
Pregnant at intake, % **	9.4	3.1	9.2
On public assistance, %	37.1	43.8	37.4
Physical abuse	68.9	70.1	69.0
Sexual abuse	49.3	55.7	49.6
Primary drug problem, % **			
Methamphetamine	42.5	14.5	41.3
Heroin	13.1	27.5	13.8
Alcohol	20.7	35.8	21.3
Cocaine	11.4	14.0	11.5
Marijuana	10.0	6.7	9.8
Other drugs	2.3	1.6	2.3
Year of using primary drug **	14.7 (8.0)	18.5 (9.0)	14.9 (8.1)
IV drug injection, % **	20.7	36.6	21.4
# of prior alcohol treatments (SD) **	0.77 (2.48)	1.76 (4.10)	0.82 (2.58)
# of prior drug treatments (SD) **	1.73 (3.22)	3.32 (5.73)	1.80 (3.38)
CalTOP program type			
Mixed-gender	83.0	82.0	82.9
Women-only	17.0	18.0	17.1

* p < 0.05,

**
p < 0.01

Table 2

Client ASI Scores, Criminal Involvement, and Psychiatric Problems at Baseline

	Alive Sample (n=4,253)	Deceased Sample (n=194)	Total Sample (n=4,447)
<u>ASI scores, mean (SD)</u>			
Alcohol **	0.15 (0.24)	0.25 (0.31)	0.16 (0.24)
Drug	0.13 (0.12)	0.15 (0.15)	0.13 (0.12)
Employment **	0.73 (0.29)	0.79 (0.26)	0.74 (0.29)
Family **	0.22 (0.24)	0.27 (0.25)	0.22 (0.24)
Legal	0.16 (0.20)	0.17 (0.21)	0.16 (0.20)
Medical **	0.20 (0.31)	0.33 (0.37)	0.21 (0.32)
Psychiatric **	0.25 (0.24)	0.32 (0.25)	0.25 (0.25)
<u>Criminality involvement, %</u>			
Ever arrested	77.9	81.4	78.1
Crime involved in the past 30 days	57.3	52.6	57.1
<u>Psychiatric symptoms, %</u>			
Received pension for psychiatric problems	4.5	5.7	4.6
Psychiatric medications in past 30 days	17.7	23.7 *	17.9
Psychiatric symptoms in past 30 days			
Serious depression **	38.3	49.0	38.7
Serious anxiety **	43.7	55.7	44.2
Hallucinations **	5.8	10.3	6.0
Trouble understanding, concentrating, or remembering *	31.8	40.2	32.2
Trouble controlling violent behavior *	12.5	7.7	12.3
Serious thoughts of suicide	7.9	8.8	7.9
Attempted suicide	1.9	2.6	2.0
Prior inpatient psychiatric treatment, % **	23.7	32.5	24.1
Prior outpatient psychiatric treatment, % **	37.5	49.0	38.0

*
p < 0.05,**
p < 0.01

Table 3

Cox Proportional Hazard Model Predicting Mortality

	Hazard Ratios	(95% Confidence Interval)
Age**	1.05	(1.03 – 1.08)
Race/Ethnicity (ref=white)		
African American *	0.59	(0.38 – 0.94)
Hispanic *	0.66	(0.43 – 0.99)
Other	0.54	(0.26 – 1.11)
Never married	1.05	(0.75 – 1.47)
Primary drug problem (ref=methamphetamine)		
Heroin**	3.62	(2.16 – 6.06)
Alcohol**	3.76	(2.32 – 6.10)
Cocaine**	3.56	(1.95 – 6.48)
Marijuana**	2.45	(1.26 – 4.76)
Other drugs	2.68	(0.93 – 7.72)
Drug injection *	1.55	(1.07 – 2.23)
Addiction severity (ref=lower severity)		
Alcohol	0.98	(0.70 – 1.36)
Drug	0.86	(0.62 – 1.18)
Employment *	1.48	(1.10 – 1.99)
Family	1.03	(0.76 – 1.39)
Legal	1.07	(0.80 – 1.42)
Medical *	1.37	(1.02 – 1.84)
Psychiatric*	1.45	(1.05 – 2.01)

* p < 0.05.

** p < 0.01