



## Brief article

## Mortality rate among crack/cocaine-dependent patients: A 12-year prospective cohort study conducted in Brazil

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**Abstract**

Mortality is a significant outcome among Brazilian crack/cocaine-dependent patients yet not well understood and is under investigated. This study examined a range of mortality indicators within a cohort of 131 crack/cocaine-dependent patients admitted into treatment and meeting criteria for dependence of crack (*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*). After 12 years of treatment discharge, 107 individuals were reassessed and 27 death cases were confirmed by official records, wherein in its majority were caused by homicide ( $n = 16$ ). In this group, survival rate was 0.77 (95% confidence interval [CI] = 0.74–0.81) and previous history of IV cocaine use was identified as a predictor of mortality (2.5, 95% CI = 1.08–5.79). High mortality rates among Brazilian crack/cocaine-dependent patients, exposure to violence, and HIV/AIDS were topics discussed in this study. This research highlights the importance of ongoing programs to manage crack/cocaine use along with other treatment features within this population. © 2011 Elsevier Inc. All rights reserved.

**Keywords:** Crack cocaine; Prospective cohort study; Mortality; Treatment; Survival analysis

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**1. Introduction**

Crack/cocaine is a highly addictive and powerful stimulant substance that has been abused for decades. Although crack/cocaine is a complex and steady phenomenon in our global society (Fischer & Coghlan, 2007; Gossop, Marsden, Stewart, & Kidd, 2003), long-term follow-up investigations are scarce (Falck, Wang, & Carlson, 2007, 2008; Hser et al., 2006).

Studies found in the literature are limited to short-term outcomes related to risk and social segregation, such as criminal involvement (Borders et al., 2008; Fischer et al., 2006; Harocopos, Dennis, Turnbull, Parsons, & Hough, 2003), unemployment and low-income status (Buster et al., 2009; Paquette, Roy, Petit, & Boivin, 2010; Siegal, Falck,

Wang, & Carlson, 2002), severe health problems (Borders et al., 2009; Falck, Wang, Siegal, & Carlson, 2000), and sexual risk behaviors (Hser, Joshi, Anglin, & Fletcher, 1999; Santibanez et al., 2005; Wechsberg et al., 2010, in press). Furthermore, there are a few studies on recovery processes (Gossop, Marsden, Stewart, & Kidd, 2002; Henskens, Garretsen, Bongers, Van Dijk, & Sturmans, 2008; Siegal, Li, Rapp, & Saha, 2001; Siegal, Li, & Rapp, 2002; Marsden et al., 2009; McKay et al., 2005; Wechsberg, Zule, Riehm, Luseno, & Lam, 2007).

Nonetheless, mortality rate is one relevant outcome that has not been receiving the deserved attention in our field (Gossop, Stewart, Treacy, & Marsden, 2002; Morgan, Vincente, Griffiths, & Hickman, 2008). Identifying long-term mortality indicators is an important task to help us understand and acknowledge specific contexts and risk factors that may contribute to increase death occurrence.

This is a pioneer long-term study examining mortality rate, mortality indicators, and death causes among 131 Brazilian crack/cocaine-dependent patients who sought treatment during mid 1990s in Brazil.

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## 2. Method

### 2.1. Study design and participants

This prospective cohort study was approved by The Federal São Paulo University Institutional Review Board committee. Participants were properly advised concerning study design and signed informed consent forms. The study convenience sample was composed—originally—of 131 patients who sought Taipas General Hospital's (TGH's) inpatient treatment and were consecutively admitted in the period of May 1992 through December 1994.

### 2.2. Setting

TGH is a public treatment center located at north São Paulo that receives patients from all over São Paulo City. The hospital offers a 15-day residential detoxification program where patients receive psychiatric medical care, individual and group psychotherapy, and occupational therapy. It is worthwhile to mention that TGH's detoxification program was the only substance dependence treatment program available in this area during the time the study was completed.

Patients met criteria for crack/cocaine dependence according to *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994)*. The diagnosis was established through a comprehensive clinical interview by a team of psychiatrists responsible for inpatient admissions.

### 2.3. Instruments and measures

Collateral data were collected (a) using TGH's Alcohol and Drugs Detox Unit database, (b) with the patients' families in scheduled home visits, (c) by the assessment of state prison and municipal jails' database systems, and (d) through an in-depth investigation of patients' death certificates acknowledged by The Brazilian Official Department of Mortality Records.

Interview with patients was based on the National Institute on Drug Abuse's (NIDA's) Diagnostic Source Book on Drug Abuse Research and Treatment (NIDA, 1993). Assessment included a sociodemographic questionnaire, measures of patterns of consumption, risk sexual behaviors, criminality, imprisonment, general illnesses, and death, among others.

### 2.4. Analytic methods

Statistical analyses were performed using SPSS statistical program for windows, version 13.0 (SPSS Inc., Chicago, IL). The population of São Paulo City in the year of 2000 was elected in this study as a standardized population for further statistical investigations. Annual mortality rate statistical analyses were controlled by age and gender using a direct method. Age and gender distribution and

mortality rate analysis based on the São Paulo City population were obtained with Sao Paulo State Data Analysis Department.

Excess mortality rate was estimated by the difference between observed and expected mortality rates. Ratio obtained between both mortality rates was used as a standardized mortality rate measure. Additional survival analysis considering participants' discharge was conducted using the Kaplan-Meier method. End date of the follow-up interviews was determined by the final date of interview with each subject and/or by the date acknowledged in the subjects' death certificates. In univariate analysis, stratified survival curves were compared by log-rank method considering the following variables collected during admission to inpatient treatment: sociodemographic data, years of formal education, drug use patterns, and criminal and treatment histories. Statistically significant variables ( $p < .10$ ) obtained in univariate analyses were further tested using Cox proportional hazards regression model to determine independent associations with mortality.

## 3. Results

Of the 131 patients comprising the study, 107 (81.7%) individuals or families were found and 24 (18.3%) could not be located due to residence relocation.

Table 1

Fig. 1 profile of deceased and alive patients during inpatient treatment admission

Variables	Deceased ( $n = 27$ )		Alive ( $n = 104$ )	
	$n^a$	%	$n^a$	%
Gender				
Male	26	96.3	89	86.4
Female	1	3.7	14	13.6
Age (years)				
15–19	8	29.6	30	29.2
20–24	6	22.2	41	39.8
25–29	6	22.2	14	13.6
30–34	3	11.1	9	8.7
35–39	3	11.1	5	4.8
40–42	1	3.7	4	3.8
Race				
Caucasian	19	70.4	78	76.4
Black	8	29.6	24	23.6
Marital status				
Single	18	66.7	68	66.6
Married	7	25.9	28	27.4
Divorced	2	7.4	6	6
Schooling				
Less than 8 years	15	68.2	52	68.4
8 years or more	7	31.8	24	31.6
Employment				
Yes	3	13.6	32	35.1
No	19	86.4	59	64.9

<sup>a</sup> Missing data for some variables are due to the absence of this information in the case notes.

### 3.1. Main outcomes and sample profile

Among the subjects found, 43 (32.8%) subjects reported to be abstinent in the past 12 months, 22 (16.8%) subjects were actively using crack in the past 12 months, and 13 (10%) subjects were incarcerated. Families of 2 (1.5%) subjects reported that individuals were missing, and they were still waiting for information regarding their fates. Twenty-seven deaths (20.6%) were confirmed by official records (insert Table 1).

Chi-square analyses of data collected during TGH's inpatient admission treatment revealed no significant differences in sociodemographic, legal problems, previous history of drug treatment, and drug consumption measures between found and missing patients at the 12-year follow-up.

Most patients sought treatment after 1.5 years of crack use. Sample profile at admission was as follows: male (88.5%), single (67%), Caucasian (74.6%), young adult (mean age = 23.6 years,  $SD = 6.7$ ), unemployed (67%), and lacking basic education (56%). Crack onset use was around patients' early 20s (22 years,  $SD = 6.9$ ).

### 3.2. Mortality rate

Observed mortality rate calculated by the direct standardization method and adjusted for gender and age was 22.85

deaths per 1,000/residents. The expected all-cause mortality rate in São Paulo, adjusted for gender and age, was 1.83 deaths per 1,000/residents (at the year of 2000), giving an excess mortality rate of 21.02 deaths per 1,000 individuals and a mortality ratio of 12.4. Individuals included in this study were 12 times more likely to die when compared with the general population.

### 3.3. Survival analysis

Of 27 deaths, 25 occurred during the first 4 years of study, contributing to the decline of patients' survival chances. Survival curve reached stability during Year 5. Moreover, at Year 8, survival curve displayed a subtle decline. Nonetheless, stability was rapidly restored and maintained until the conclusion of the study (Fig. 1). According to the survival analysis, the probability of being alive after 12 years posttreatment was 0.77 (95% confidence interval [CI] = 0.74–0.81), and mortality chances were observed in 23% of the sample.

Comparison analysis including stratified curves showed that patients with 4 or more years of education had increased survival chances compared with those patients with less than 4 years of education (0.80 vs. 0.47, respectively,  $p = .044$ ). Patients without previous history of IV cocaine use demonstrated higher chances of survival compared with

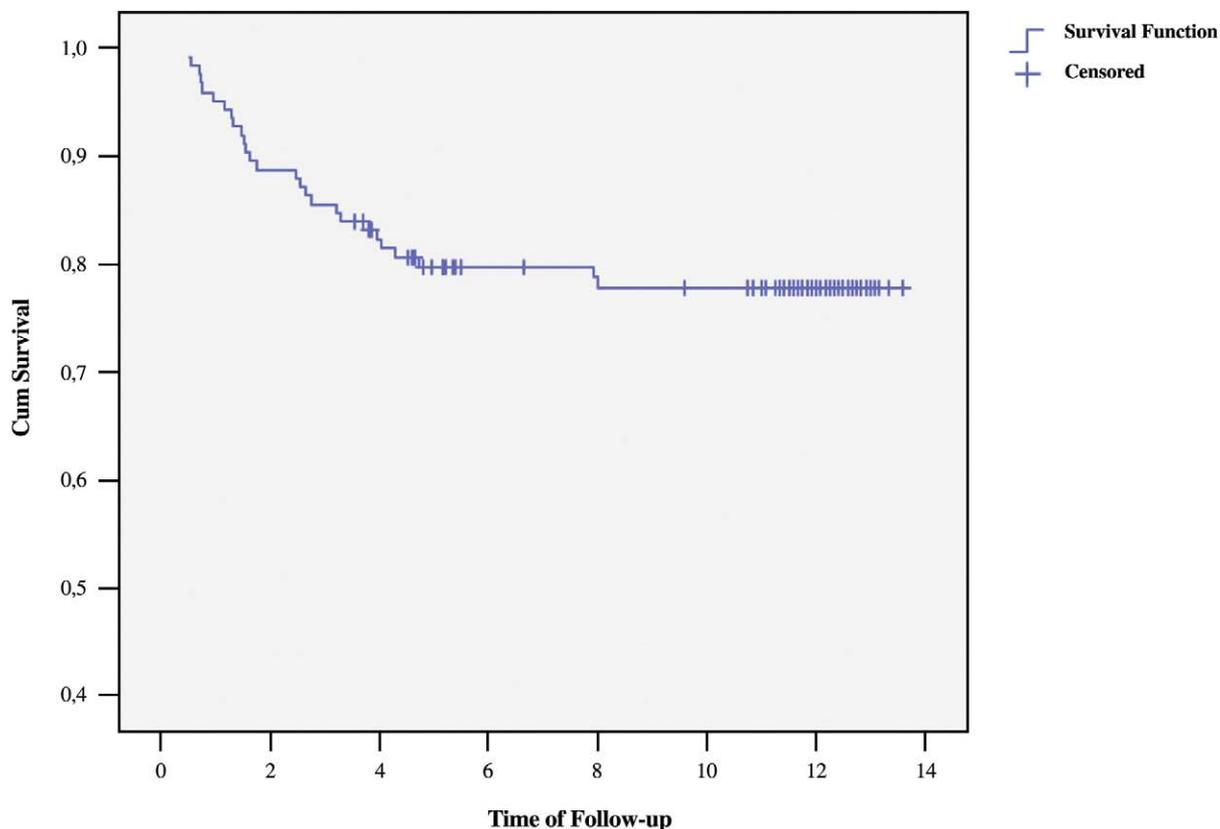


Fig. 1. This analysis included information on 125 (95.4%) patients: 107 located at the 12-year follow-up, and 18 located at the 2- and 5-year follow-up. On average, time of follow-up after discharge from inpatient treatment was 10.6 years.

those patients who had previous history of IV cocaine use (0.84 vs. 0.58, respectively,  $p = .002$ ). Identified HIV-positive patients during TGH's inpatient treatment admission showed lower survival chances than those who were HIV-negative (0.25 vs. 0.82, respectively,  $p = .000$ ). The variables described above entered Cox proportional hazards analysis, and the significant remaining variable in the model was previous history of IV cocaine (95% CI = 1.08–5.79,  $p = .031$ ). Risk of mortality among subjects with previous history of IV cocaine use was 2.5 times higher than those without previous history of IV cocaine use.

### 3.4. Death causes

The most significant death cause was homicide ( $n = 16$ ) followed by HIV/AIDS ( $n = 6$ ), overdose ( $n = 3$ ), drowning ( $n = 1$ ), and hepatitis B infection ( $n = 1$ ). It is worthwhile to mention that two of three subjects who died from overdose and six of six individuals who died from HIV/AIDS had previous history of IV cocaine use.

## 4. Discussion

This 12-year follow-up study introduces to the international literature an original investigation among Brazilian crack/cocaine-dependent patients contributing for the examination of mortality as an important long-term outcome in a longitudinal perspective within the field of crack/cocaine abuse.

The mortality rate observed in this study (20.6%) can be considered extremely high, especially if we compare it with mortality rates found in previous studies contemplating the very same substance. Siegal et al. (2002) reported a 2.3% rate in a 3-year follow-up research including 430 crack users. Moreover, an 8-year follow-up study composed of 401 subjects and a 12-year follow-up study with 321 male veterans confirmed a 7% and 8.7% mortality rates, respectively (Falck et al., 2007; Hser et al., 2006). Differences in results might somewhat be related to socio-demographic sample variations.

Present sample profile is in accordance with general Brazilian crack/cocaine profile pointed in previous studies. Most of the subjects were young adult males, lacking basic education, unemployed, and with high rates of legal problems (Carvalho & Seibel, 2009; Duailibi, Ribeiro, & Laranjeira, 2008; Zeni & Araujo, 2009). National and international studies agree that crack/cocaine users' marginalized, segregated, and deprived living conditions, which may be related to maintenance of drug use patterns, should be considered an alarming public health concern (Fischer et al., 2006; Vogenthaler et al., 2010, in press).

Survival chances declined especially during the first 4 years of assessment. It is worthwhile to mention that the period described above co-occurs with the time frame when crack was introduced in Brazil (beginning of the 90s). During this time, Brazil witnessed frequent violent drug

dealers' disputes to control crack trafficking along with intense police repression as a response to conflicts. Access to crack involved greater exposure to violence, generally resulting in fights with police and other crack/cocaine users; as well as drug dealers' retaliation due to drug debts. This scenario helped to increase the number of homicide incidents (Cordeiro & Donalisio, 2001; Ribeiro, Dunn, Sesso, Dias, & Laranjeira, 2006). Individuals assessed in the 12-year follow-up study appear to be the same individuals affected by crack violent debut in Brazil.

Another important phenomenon observed during crack introduction in Brazil was the exchange of IV cocaine use to smoked cocaine. According to individuals who migrated from IV cocaine to crack, crack was considered to be a more powerful and reliable substance decreasing risks of HIV/AIDS contamination (Dunn & Laranjeira, 1999; Dunn & Ferri, 1998). Increased risk of mortality was associated with previous history of IV cocaine, and the latter was present in the majority of subjects' deaths by overdose and HIV/AIDS. Crack consumption combined with IV cocaine use appeared to intensify drug dependence, increasing the odds of HIV/AIDS and overdose deaths (Baum et al., 2009; Cardoso et al., 2006).

The survival curve achieved steadiness after the fourth year of follow-up study. Explanation for this result remains unclear and should be further investigate in future studies. Nonetheless, some observed events occurred in Brazil at the end of the 90s, which could have contributed to increase stability. At the end of 1990, commerce of crack appeared to be already established, decreasing the number of violent conflicts between drug dealers who were in the beginning battling for crack trafficking control. During this period, Brazil also witnessed a significant financial development, reaching the status of eighth largest economy in the world promoting a better socioeconomic living condition for its population. Furthermore, it was observed that there was a decrease in general homicide rates among young male adults (Gois, 2007; Brazilian Institute of Geography and Statistics, 2006).

It is worthwhile to mention that after 12 years of treatment discharge, 32.8% of the subjects were not using crack. It is possible that the interruption of drug use protected individuals from the destructive impact of crack and supported them to build healthier lifestyles away from violence and hence decreasing mortality risks.

Nonetheless, this study has some limitations that should be addressed. Individuals included in this study were part of a convenience clinical sample assessed in a single substance dependence treatment program available in the north Sao Paulo area during the time study was conducted. Because of study distinctiveness, data should be carefully analyzed and not generalized to other crack-dependent populations and other substance treatment contexts. It is important to mention that investigators conducted a comprehensive research to ensure that the few participants missing in this study were not included in the mortality record list provided by The Brazilian Official Mortality Department.

This study made a national and international significant contribution to the field of chemical dependence since it launched a long-term follow-up investigation stressing mortality factors among Brazilian crack-dependent patients. High mortality rate along with exposure to violence, illustrated by several cases of homicide; the migration phenomenon of IV cocaine use to smoked cocaine (considered as an important mortality predictor); and deaths caused by HIV/AIDS and overdose were critical outcomes discussed in this study. Study results highlight the need to develop ongoing treatment programs devoted to identify patients and/or group of individuals presenting greater risk of mortality and increased general health problems related to crack/cocaine use and to motivate patients to commit to healthier lifestyles.

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