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Longitudinal Changes in Drug Use Severity and Physical Health-Related Quality of Life among Untreated Stimulant Users

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Abstract

The primary objective of this study was to investigate whether drug use severity is associated with physical health-related quality of life (HRQL) over time. Data are from a longitudinal, multi-state, natural history community study of users of cocaine and/or methamphetamine who were interviewed at 6-month intervals over 2 years with a 79% follow-up participation rate. Physical HRQL was assessed with the physical component summary (PCS) of the SF-8™ Health Survey and drug, alcohol, and psychiatric severity were all assessed with the Addiction Severity Index (ASI). Random coefficient regression analyses were conducted to test for longitudinal associations between the independent variables and SF-8 PCS scores. Reductions in drug use severity over time were accompanied by only minor improvements in SF-8 PCS scores, underscoring the potential long-term harm of illicit drug use on physical health. Greater psychiatric severity was strongly associated with lower SF-8 PCS scores, suggesting that clinical attention to mental health issues could potentially lead to improvements in perceived physical health as well among stimulant users.

Keywords

health-related quality of life; methamphetamine; cocaine; rural; natural history; SF-8

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1. Introduction

While there is evidence that the use of cocaine, methamphetamine, and other illicit drugs contributes to the development of specific acute and chronic medical conditions (Bansal, Eigenbrodt, Gupta, & Mehta, 2007; Goodchild, Donaldson, & Mangini, 2007; Kaye, McKetin, Duflou, & Darke, 2007; Laposata & Mayo, 1993; Patrizi et al., 2006; Richards & Brofeldt, 2000), very little is known about the overall burden of illicit drug use on general physical health status, which is typically assessed by health-related quality of life (HRQL) instruments, such as the SF-36 (Ware, Kosinski, & Keller, 1994). Of the small number of studies that have examined perceived physical health among illicit drug users, most have administered full or abbreviated versions of the SF-36 and most of these have involved cross-sectional designs. For instance, a cross-sectional study of persons receiving residential substance abuse treatment showed that frequent use of heroin and other opiates was associated with lower SF-36 physical health scores (da Silva Lima, Fleck, Pechansky, de, & Sukop, 2005). A cross-sectional study of a community sample of crack cocaine users found that the frequency of crack cocaine use was correlated with lower scores on the SF-36 physical-role, bodily pain, and general health subscales and that self-reported addiction to crack cocaine was associated with lower scores on all of the SF-36 physical health subscales (Falck, Wang, Carlson, & Siegal, 2000). Cross-sectional analyses of baseline data collected as part of the overall study described herein showed that persons who used opioids on 20 or more days in the prior month had greater odds of poor physical health as assessed by an abbreviated version of the SF-36, the SF-8 (Falck, Wang, & Carlson, 2007).

Additional research has examined the relationship between illicit drug use and a single-item measure that asks persons to rate their overall health as excellent, very good, good, fair, or poor. This single-item measure has been firmly established as a proxy of general health (Jylha, Volpato, & Guralnik, 2006). Analyses of baseline data from the Ohio portion of the current study's overall sample indicated that approximately 41% of methamphetamine and cocaine users rated their overall health as fair or poor (Siegal, Draus, Carlson, Falck, & Wang, 2006), which far exceeds estimates of 16% for the general adult population in the U.S. (Zack, Moriarty, Stroup, Ford, & Mokdad, 2004) and 20% for methamphetamine users in substance abuse treatment (Greenwell & Brecht, 2003). Additional cross-sectional analyses of baseline data from the current study's full sample showed that mean scores for self-rated overall health did not vary according to the type or combinations of stimulants used in the past month (Garrity et al., 2007). However, persons with more days of illicit drug use and more days with drug problems in the past month exhibited worse self-rated health (Garrity et al., 2007).

A relative dearth of *longitudinal* research has investigated the relationship between illicit drug use and physical HRQL. One rare longitudinal community-based study of crack cocaine users found that the frequency of crack use was negatively associated with scores on the SF-36 physical functioning subscale, but that scores changed very little over the course of two years of follow-up (Falck, Wang, Siegal, & Carlson, 2000). In our prior longitudinal research on trajectories of cocaine and methamphetamine use, we found that many persons remit from both drugs over two years without receiving substance abuse treatment, which beckons the question of whether reductions in drug use are accompanied by improvements in physical health (Borders et al., 2008).

1.1. The Current Study

The current study advances our understanding of the longitudinal associations between drug use severity and physical HRQL by addressing three specific questions. Does average physical HRQL improve or decline over time among persons identified as illicit stimulant drug users? How is drug use severity associated with physical HRQL over time? Are demographic, social, and economic factors known to be correlates of physical health among the general population

also associated with physical HRQL among illicit drug users? These questions were investigated by conducting longitudinal analyses of data collected as part of a natural history study of not-in-treatment illicit stimulant users residing in rural areas of three states.

2. Method

2.1. Overview of Study Design

A community-based, longitudinal, natural history study was conducted among 706 rural stimulant users. Participant eligibility criteria included being 18 years of age or older, using crack or powder form cocaine and/or methamphetamine by any route of administration in the past 30 days, and receiving no formal drug abuse treatment within the past 30 days. Interviews were collected every 6 months over a 24-month period. For the analyses presented here, we excluded 132 participants who received formal substance abuse services over the follow-up period because prior research has indicated substantial differences between persons receiving and not receiving treatment (Fortney, Booth, Zhang, Humphrey, & Wiseman, 1998). This strategy allowed us to gauge the effects of drug use on perceived physical health in the absence of treatment.

2.2. Study Setting

Recent stimulant users were recruited in three rural counties in each of three states: Arkansas, Kentucky, and Ohio. Counties were classified as rural according to the U.S. Office of Management and Budget definition of a non-metropolitan county, or a county with a population of 50,000 or fewer persons. In addition to being rural, the counties were selected according to manageable driving distance from the researchers' universities, location contiguous to or near other recruiting counties, and signs of local cocaine and/or methamphetamine use. According to information from the 2000 U.S. Census, the Arkansas counties have much higher percentages of African Americans (49%-57%) compared to the Ohio (1%-8%) and Kentucky (0%-2%) counties. The Arkansas and Kentucky counties have higher proportions of the population with annual household incomes below $10,000 (22%-24% in Arkansas and 14%-18% in Kentucky) relative to Ohio (6%-8%).

2.3. Participant Recruitment

Participants were recruited using Respondent-Driven Sampling (RDS), a variant of snowball sampling (Heckathorn, 2002; Wang, Falck, Li, Rahman, & Carlson, 2007). This type of non-probabilistic sampling is critical for recruiting community "hidden populations" such as illegal drug users. Project staff recruited "seeds" by visiting places known to be frequented by drug users such as bars, tattoo parlors, and county fairs. The seeds, in turn, referred other participants to the study. Theoretically, RDS can generate a sample that is much more representative of the hidden population under study than can snowball or targeted sampling (Heckathorn, Semaan, Broadhead, & Hughes, 2002) although the theoretical basis is relatively untested. However, in papers studying RDS properties in recruiting samples of drug users for the Ohio sample for the current report Wang and colleagues (Wang et al., 2005; Wang et al., 2007) have shown (a) that the final composition of the sample appears independent of seed characteristics; (b) that samples "converge" within five waves on gender, race, age, and cocaine abuse/dependence diagnosis even though actual recruitment happens more slowly than predicted by Heckathorn (Heckathorn, 1997; Heckathorn, 2002); and (c) that the Ohio sample penetrated deeply into some social networks, as evidenced by the "productivity" of several seeds (this penetration was also observed in the Arkansas and Kentucky samples in unpublished data) (Wang et al., 2007). Overall, we conclude that RDS is an extremely useful and cost-effective method to identify hidden populations and that it has certain very advantageous properties, but that it cannot produce population-based prevalence estimates such as those generated by the National Survey on Drug Use and Health (Booth, Leukefeld, Falck, Wang, & Carlson, 2006).

All participants completed an informed consent process prior to the baseline interview. The study was approved by the institutional review boards of the investigators' universities and also operated under a Certificate of Confidentiality from the National Institute on Drug Abuse (NIDA).

2.4. Data Collection Procedures

Trained research assistants conducted office-based, face-to-face, structured interviews using computer-assisted personal interview (CAPI) technology. The interviews consisted of author-generated items coupled with standardized instruments, including the SF-8. Baseline interviews were conducted at field site offices as were most follow-up interviews, although by necessity some of the latter were conducted in other places, such as jails. Urinalysis was conducted to help assure the veracity of self-reported drug use. Extensive tracking information was obtained at the baseline interview so that participants could be located for follow-up interviews, culminating in a 79% follow-up participation rate at the 24-month interview. Additional analyses of attrition showed that males and whites were slightly less likely to complete the follow-up interviews.

2.5. Measures

2.5.1. Physical-Health Related Quality of Life—The physical component summary (PCS) score of the SF-8, an abbreviated version of the commonly used SF-36 and SF-12 instruments, was used to assess physical health-related quality of life (Ware, Loskinski, Dewey, & Gandek, 2001). Like the SF-36 and SF-12, the SF-8 produces a physical component summary (PCS) score, mental component summary (MCS) scores, and more specific subscale scores covering eight domains of health-related quality of life (physical functioning, role limitations due to physical health problems, bodily pain, energy/fatigue, general self-rated health, social functioning, role limitations due to emotional problems, and psychological distress and well-being). A major advantage of the SF-8 is that it requires only 1 to 2 minutes to complete without sacrificing validity and reliability. Several studies have demonstrated that the SF-8 PCS has strong content and construct validity properties (Lefante, Jr., Harmon, Ashby, Barnard, & Webber, 2005; Turner-Bowker, Bayliss, Ware, Jr., & Kosinski, 2003; Ware et al., 2001) and is able to detect changes in health status over a 6-month period (Lefante, Jr. et al., 2005). The SF-8 PCS has been estimated to have alternative forms reliability of 0.88 and two week test-retest reliability of 0.73 (Ware et al., 2001). In this study, a standard 4-week recall period was used and scores were calculated using the SF Health Outcomes™ Scoring Software to produce U.S. population norm-based scores (Ware et al., 2001).

2.5.2. Drug Use Severity—Although a criterion for study eligibility was recent use of methamphetamine and/or cocaine, most of the participants used multiple illicit drugs. Unfortunately, there is no standard approach for measuring the frequency and severity of polydrug use. Some researchers have defined polydrug use as using 2 or more drugs over a specific time period, such as a few hours, week, month, or year (Schensul, Convey, & Burkholder, 2005). Other researchers have used latent class analysis to develop polydrug use classifications, but their classifications schemas are not easily transferable to other studies (Falck, Siegal, Wang, Carlson, & Draus, 2005; Monga et al., 2007). To capture the severity of polydrug use, we adopted the drug use composite score from the Addiction Severity Index (ASI). Since its development over 25 years ago, the ASI has become the standard instrument for measuring addiction in both research and clinical treatment settings (McLellan, Alterman, Cacciola, Metzger, & O'Brien, 1992; McLellan et al., 1992). The drug use composite score is based on a series of questions about the number of days using various illicit drugs, being troubled or bothered by drug use, and perceived need for treatment for drug problems in the past 30 days.

2.5.3. Alcohol Use and Psychiatric Severity—Because alcohol use and psychiatric problems are common among illicit drug users and could affect physical health, we also included as independent variables the ASI-alcohol use and psychiatric status composite scores. Like the drug use composite, the alcohol use composite is a function of a series of questions about reported alcohol use frequency and associated problems in the past 30 days. The psychiatric status composite is based on the frequency of psychiatric problems, being troubled by psychological or emotional problems, and perceived need for treatment. Each of these composite scores has been demonstrated to have strong concurrent, predictive, and discriminant validity and reliability in a variety of settings and populations (McLellan, Alterman, Rikoon, & Carise, 2006; McLellan et al., 2006). The scores range between 0 and 1, with 0 indicating the "best" and 1 indicating the "worst" possible severity.

2.5.4. Covariates—We created separate indicator variables representing the baseline, 6, 12, 18, and 24-month interviews to test for non-linear differences over time. We adjusted for age of first substance use, demographics, social and economic factors, medical care access indicators, and physical health problems in our multivariable models. Demographics included age in years, gender, and race/ethnicity. Social and economic factors were marital status, having any children, educational attainment, being currently employed or working for wages, and past year personal income. Medical care access indicators were whether the participant had a usual physician to visit for medical problems and any health insurance coverage (because a low proportion of participants had any insurance, more specific insurance categories were not created). We also adjusted for a count of the participant's self-reported history of 28 physical medical conditions, including conditions with strong associations with substance use, which could affect perceived health status. With the exception of race/ethnicity, gender, age of onset of first substance use, having children, having a usual doctor, and having health insurance coverage, all of the covariates were treated as time variant independent variables.

2.6. Statistical Analysis

We used random coefficient regression analysis to account for the correlation of observations taken longitudinally using the REPEATED option within the MIXED procedure in SAS® and an unstructured (general) covariance structure. The regression coefficients from this mixed model reflect both the "between-subjects" and the "within-subjects" differences. We tested for interactions between each time point and ASI-drug, alcohol, and psychiatric scores. Only significant interaction terms were considered for inclusion in the final models.

3. Results

3.1. Sample Characteristics

As shown in Table 1, the mean age was 33.4 years (SD=10.50) and the mean age of onset of first alcohol or drug use was 12.3 (SD=3.71). On average, the sample can be characterized as mostly male, white, low income, not married or living with a partner, having a child, and having no college education. Approximately 50% reported having a usual doctor to visit for medical illnesses and only 28% reported having health insurance coverage. Participants had a mean of 3.2 (SD=3.05) self-reported physical medical conditions or illnesses.

Although past 30 day methamphetamine and/or cocaine use were criteria for participation in the study, the use of other substances was common, which we briefly summarize here. Approximately 59%, 48%, and 43% reported using crack cocaine, powder cocaine, and/or methamphetamine, respectively, in the past 30 days. Marijuana was commonly used by 81% of participants in the past month. Approximately 42% and 25% of respondents reported the illicit use of prescription painkillers and tranquilizers. Several other drugs, including ecstasy

(MDMA), heroin, LSD, PCP, and inhalants were used more rarely by between 0.52% and 12% of the sample.

We compared the mean SF-8 PCS scores for our sample to U.S. population norms for adults, which are provided in the SF-8 scoring manual (Ware et al., 2001). As shown in Table 2, for two of the younger age categories (ages 18–24 and ages 30–34), the means for our sample were very similar to those for the U.S. However, for age groups 25–29, 35–39, 40–44, 45–49, and 50–54, the sample had substantially lower mean SF-8 PCS scores. Moreover, the magnitude of the disparity between the sample and the U.S. norms widened with increasing age.

3.2. Unadjusted SF-8 PCS and ASI-Drug, Alcohol and Psychiatric Scores Over Time

Table 3 shows unadjusted mean SF-8 PCS and ASI-drug, alcohol, and psychiatric scores at each interview date. Unadjusted SF-8 PCS scores did not change over the 24-month follow-up period, as indicated by the results from repeated measures analyses in which time was the only independent variable. However, ASI-drug, alcohol, and psychiatric scores declined (improved) significantly over time.

3.3. Random Coefficient Regression Analysis of SF-8 PCS

Results from the multivariate longitudinal analyses of SF-8 PCS scores are shown in Table 4, with significant findings bolded. Adjusted for other variables in the model, the dummy variables contrasting the 24-month interview and baseline indicate that SF-8 PCS scores improved significantly. However, the magnitude of this contrast is small: the coefficient of 1.3 indicates that compared to baseline, the SF-8 PCS score is, on average, 1.3 points higher. No other contrast regarding interview time was significant.

The negative coefficient for the ASI-drug severity score in the model indicates that higher (worse) drug severity is associated with lower (worse) SF-8 PCS scores. However, the size of the coefficient (-4.6) should be interpreted in light of the ASI scaling (0–1). Theoretically, this coefficient would suggest that a one unit increase in ASI drug severity would be associated with a 4.6 decrease in the SF-8 PCS score. When we consider the data in Table 3, a more realistic decrease in drug severity of, for example, 0.09 (the difference in mean drug severity scores between baseline and 24 months), would be associated with a relatively small and probably not clinically significant increase in PCS scores. Higher (worse) ASI-alcohol scores were associated with higher (better) SF-8 PCS scores (coefficient of 3.1). Finally, greater psychiatric severity was negatively associated with physical health (coefficient of −3.5), indicating that worse mental health was associated with worse physical health. We also tested for interactions between the ASI-drug, ASI-alcohol, and ASI-psychiatric scores and time, but because none of those interactions was significant, they were not included in our final models.

The age of first onset of substance use was not associated with SF-8 PCS scores. Of the demographic characteristics included as covariates, increasing age was negatively associated with SF-8 PCS scores, which is not surprisingly given the age-related PCS data in Table 2. Being African American, as compared to white, was associated with better SF-8 PCS scores. Married/living with a partner was not significant, but persons with children had better PCS scores compared to persons with no children. Having a high school degree and having college/technical training as compared to less than a high school degree were associated with better SF-8 PCS scores. Past year income, having a usual doctor, and having health care insurance were not significant. Finally, a greater number of physical health conditions was negatively associated with SF-8 PCS.

4. Discussion

Illicit drug use is generally thought to have a negative effect on physical health status, but very few studies have examined the longitudinal relationship between drug use and perceived physical health. Using data from a natural history study of not-in-treatment illicit drug users, this study investigated the degree to which drug use severity is associated with physical HRQL and whether physical HRQL improves over time. On average, physical HRQL changed very little over two years. Results from our longitudinal analyses indicate that drug use severity has an adverse relationship with physical health status, even though the strength of this relationship is small in the absence of large improvements or declines in drug use severity. These findings are similar to those from a prior longitudinal study of SF-36 scores among crack-cocaine users, although the latter study included individuals who may have attended treatment during the course of follow-up (Falck et al., 2000). We suggest that even though decreases in drug use may reduce the risk of particular negative physical health events (e.g., abstinence from cocaine has been shown to lower the risk of a heart attack) (Hollander et al., 1995), this overall risk reduction may not immediately be associated with *substantial* improvements in perceived physical well-being. Rather, it may be that substantial improvements in physical health status may not begin to manifest for several years following major reductions or cessation of drug use.

The association between mental and physical health is well-documented and further supported by our finding of a strong relationship between ASI-psychiatric severity and SF-8 PCS scores. Prior research has shown that persons with mental illness frequently have higher rates of physical disease than persons without mental illness (Jones et al., 2004; Vreeland, 2007). Similarly, a cross-sectional study conducted among veterans receiving substance abuse treatment demonstrated that ASI-psychiatric status composite scores were correlated with SF-36 PCS scores (Calsyn et al., 2004). From a treatment perspective, our findings underscore that attention to mental health issues could potentially lead to improvements in physical health among illicit drug users. Thus, the impact of treatment on HRQL might be indirect through improevements in mental health functioning.

We were surprised to find that higher ASI-alcohol use scores were concurrently associated with better SF-8 PCS scores because a number of population-based studies have shown that heavy alcohol consumption is associated with poorer physical HRQL (Okoro et al., 2004; Okosun, Seale, Daniel, & Eriksen, 2005; Stranges et al., 2006). On the other hand, moderate alcohol consumption has been shown to be associated with better SF-36 PCS scores (Stranges et al., 2006). One explanation for the discrepancy in findings from the aforementioned studies and those presented here is that the ASI-alcohol composite does not distinguish “good” and “bad” drinking levels. We conducted further analyses in which we substituted the ASI-alcohol score in the simultaneous model with the number of drinks usually consumed when drinking. Compared to abstainers, those who usually drank 5 or more drinks had higher SF-8 scores, whereas those who usually drank 1 to 4 drinks did not differ from abstainers. These findings further suggest that the relationship between alcohol use and perceived physical health differs among illicit drug users and the general population.

The current study also helps to confirm that many demographic, social, and economic characteristics known to be correlates of physical health among the general population of adults are also correlates among illicit drug users (Evans & Stoddart, 1990; Low, Low, Baumler, & Huynh, 2005). Even in our sample of economically disadvantaged drug users, greater educational attainment was associated with better health. Those who are better educated may be more knowledgeable about how to lessen the impact of risky health behaviors than less educated users. In addition, we found that having children and working were associated with better physical health. Having children might be a proxy for stronger social networks, but we

question whether this is case because many of the participants in this study did not reside with their children. Working could also be a proxy for stronger social networks and social support, which promote better physical health (Berkman & Glass, 2000). Alternatively, the positive association between working and physical HRQL may be attributable to a healthy worker effect in which persons who are healthier self select into the workforce (Li & Sung, 1999).

African American race exhibited a positive prospective relationship with SF-8 PCS scores, which contradicts prevailing evidence regarding health disparities. The underlying reason for this difference in perceived health is unclear, but we postulate that it is partially attributable to racial differences in attitudes and beliefs about drug use. If whites perceive that illicit drug use is much more harmful than do African Americans, we would expect that the white drug users would form more negative perceptions of their health. Racial differences in drug choice could also explain these health differences. Prior research on our sample has shown that African Americans largely refrain from methamphetamine, whereas whites use both cocaine and methamphetamine (Booth et al., 2006; Borders et al., 2008). However, we conducted additional analyses which indicated that racial differences in SF-8 PCS scores persisted after adjusting for the use of cocaine only, methamphetamine only, or combinations of both stimulants.

A major strength of the current study is that it illustrates the natural history of drug use and perceived physical health among individuals who did not receive substance abuse treatment during the two year observation period. Nevertheless, the sample does have some potential limitations which should be recognized when interpreting and generalizing the study findings. Non-probabilistic sampling methods, such as respondent-driven sampling, are essential for identifying and recruiting “hidden” populations, such as illicit drug users, within a community. Although respondent-driven sampling does not yield population-level estimates of substance use or physical health, such as those produced by national epidemiology studies, it generates a more representative sample of hidden populations than snowball or targeted sampling (Heckathorn, 1997; Heckathorn, 2002; Wang et al., 2007).

4.1. Conclusion

Our results again confirm the health compromising effects illicit drug use places on individuals’ physical HRQL. Of particular concern is that, in general, declines in drug use were associated with only minor improvements in perceived physical health status over the two year time frame of the study. This research also provides evidence of a strong relationship between mental and physical health, suggesting that improved access to mental health treatment among illicit drug users could yield additional physical health benefits. We recommend that future research follow person over even longer periods of time to further elucidate the longitudinal relationships between substance use and physical health.

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Reference List

Bansal D, Eigenbrodt M, Gupta E, Mehta JL. Traditional risk factors and acute myocardial infarction in patients hospitalized with cocaine-associated chest pain. Clinical Cardiology 2007;30:290–294. [PubMed: 17551964]

Berkman, LF.; Glass, T. Social integration, social networks, social support, and health. In: Berkman, LF.; Kawachi, I., editors. Social Epidemiology. New York, NY: Oxford University Press; 2000. p. 137-173.

Booth BM, Leukefeld C, Falck RS, Wang J, Carlson R. Correlates of rural methamphetamine and cocaine users: Results from a multistate community study. Journal of Studies on Alcohol 2006;67:493–501. [PubMed: 16736068]

Borders TF, Booth BM, Han X, Wright P, Leukefeld C, Falck RS, et al. Longitudinal changes in methamphetamine and cocaine use in untreated rural stimulant users: racial differences and the impact of methamphetamine legislation. Addiction 2008;103:800–808. [PubMed: 18412758]

Calsyn DA, Saxon AJ, Bush KR, Howell DN, Baer JS, Sloan KL, et al. The Addiction Severity Index medical and psychiatric composite scores measure similar domains as the SF-36 in substance-dependent veterans: concurrent and discriminant validity. Drug & Alcohol Dependence 2004;76:165–171. [PubMed: 15488340]

da Silva Lima AF, Fleck M, Pechansky F, de BR, Sukop P. Psychometric properties of the World Health Organization quality of life instrument (WHOQoL-BREF) in alcoholic males: a pilot study. Quality of Life Research 2005;14:473–478. [PubMed: 15892436]

Evans RG, Stoddart GL. Producing health, consuming health care. Social Science & Medicine 1990;31:1347–1363. [PubMed: 2126895]

Falck RS, Siegal HA, Wang J, Carlson RG, Draus PJ. Nonmedical drug use among stimulant-using adults in small towns in rural Ohio. Journal of Substance Abuse Treatment 2005;28:341–349. [PubMed: 15925268]

Falck RS, Wang J, Carlson RG. Health status of illicit stimulant drug users in rural Ohio. Journal of Psychoactive Drugs, Suppl 2007:4–5.

Falck RS, Wang J, Carlson RG, Siegal HA. Crack-cocaine use and health status as defined by the SF-36. Addictive Behaviors 2000;25:579–584. [PubMed: 10972449]

Falck RS, Wang J, Siegal HA, Carlson RG. Longitudinal application of the medical outcomes study 36-item short-form health survey with not-in-treatment crack-cocaine users. Medical Care 2000;38:902–910. [PubMed: 10982112]

Fortney J, Booth B, Zhang M, Humphrey J, Wiseman E. Controlling for selection bias in the evaluation of Alcoholics Anonymous as aftercare treatment. Journal of Studies on Alcohol 1998;59:690–697. [PubMed: 9811090]

Garrity TF, Leukefeld CG, Carlson RG, Falck RS, Wang J, Booth BM. Physical health, illicit drug use, and demographic characteristics in rural stimulant users. Journal of Rural Health 2007;23:99–107. [PubMed: 17397365]

Goodchild JH, Donaldson M, Mangini DJ. Methamphetamine abuse and the impact on dental health. Dentistry Today 2007;26:124–131. [PubMed: 17555197]

Greenwell L, Brecht ML. Self-reported health status among treated methamphetamine users. American Journal of Drug & Alcohol Abuse 2003;29:75–104. [PubMed: 12731682]

Heckathorn DD. Respondent-driven sampling: A new approach to the study of hidden populations. Social Problems 1997;44(2):174–199.

Heckathorn DD. Respondent-driven sampling II: Deriving valid population estimates from chain-referral samples of hidden populations. Social Problems 2002;49(1):11–34.

Heckathorn DD, Semaan S, Broadhead RS, Hughes JJ. Extension of respondent-driven sampling: A new approach to the study of injection drug users aged 18–25. AIDS and Behavior 2002;6(1):55–67.

Hollander JE, Hoffman RS, Gennis P, Fairweather P, Feldman JA, Fish SS, et al. Cocaine-associated chest pain: one-year follow-up. Academic Emergency Medicine 1995;2:179–184. [PubMed: 7497030]

Jones DR, Macias C, Barreira PJ, Fisher WH, Hargreaves WA, Harding CM. Prevalence, severity, and co-occurrence of chronic physical health problems of persons with serious mental illness. Psychiatric Services 2004;55:1250–1257. [PubMed: 15534013]

Jylha M, Volpato S, Guralnik JM. Self-rated health showed a graded association with frequently used biomarkers in a large population sample. Journal of Clinical Epidemiology 2006;59:465–471. [PubMed: 16632134]

Kaye S, McKetin R, Duflou J, Darke S. Methamphetamine and cardiovascular pathology: a review of the evidence. Addiction 2007;102:1204–1211. [PubMed: 17565561]

Laposata EA, Mayo GL. A review of pulmonary pathology and mechanisms associated with inhalation of freebase cocaine ("crack"). American Journal of Forensic Medicine & Pathology 1993;14:1–9. [PubMed: 8493959]

Lefante JJ Jr, Harmon GN, Ashby KM, Barnard D, Webber LS. Use of the SF-8 to assess health-related quality of life for a chronically ill, low-income population participating in the Central Louisiana Medication Access Program (CMAP). Quality of Life Research 2005;14:665–673. [PubMed: 16022060]

Li CY, Sung FC. A review of the healthy worker effect in occupational epidemiology. Occupational Medicine 1999;49:225–229. [PubMed: 10474913]

Low MD, Low BJ, Baumler ER, Huynh PT. Can education policy be health policy? Implications of research on the social determinants of health. Journal of Health Politics, Policy & Law 2005;30:1131–1162.

McLellan AT, Alterman AI, Cacciola J, Metzger D, O'Brien CP. A new measure of substance abuse treatment: Initial studies of the treatment services review. Journal of Nervous and Mental Disease 1992;180(2):101–110. [PubMed: 1737971]

McLellan AT, Alterman AI, Rikoon SH, Carise D. The Addiction Severity Index at 25: origins, contributions and transitions. American Journal on Addictions 2006;15:113–124. [PubMed: 16595348]

McLellan AT, Kushner H, Metzger D, Peters R, Smith I, Grissom G, et al. The Fifth Edition of the Addiction Severity Index. Journal of Substance Abuse Treatment 1992;9(3):199–213. [PubMed: 1334156]

Monga N, Rehm J, Fischer B, Brissette S, Bruneau J, El-Guebaly N, et al. Using latent class analysis (LCA) to analyze patterns of drug use in a population of illegal opioid users. Drug & Alcohol Dependence 2007;88:1–8. [PubMed: 17049753]

Okoro CA, Brewer RD, Naimi TS, Moriarty DG, Giles WH, Mokdad AH. Binge drinking and health-related quality of life: do popular perceptions match reality? American Journal of Preventive Medicine 2004;26:230–233. [PubMed: 15026103]

Okosun IS, Seale JP, Daniel JB, Eriksen MP. Poor health is associated with episodic heavy alcohol use: evidence from a National Survey. Public Health 2005;119:509–517. [PubMed: 15826892]

Patrizi R, Pasceri V, Sciahbasi A, Summaria F, Rosano GM, Lioy E. Evidence of cocaine-related coronary atherosclerosis in young patients with myocardial infarction. Journal of the American College of Cardiology 2006;47:2120–2122. [PubMed: 16697335]

Richards JR, Brofeldt BT. Patterns of tooth wear associated with methamphetamine use. Journal of Periodontology 2000;71:1371–1374. [PubMed: 10972655]

Schensul JJ, Convey M, Burkholder G. Challenges in measuring concurrency, agency and intentionality in polydrug research. Addictive Behaviors 2005;30:571–574. [PubMed: 15718073]

Siegal HA, Draus PJ, Carlson RG, Falck RS, Wang J. Perspectives on health among adult users of illicit stimulant drugs in rural Ohio. Journal of Rural Health 2006;22:169–173. [PubMed: 16606430]

Stranges S, Notaro J, Freudenheim JL, Calogero RM, Muti P, Farinaro E, et al. Alcohol drinking pattern and subjective health in a population-based study. Addiction 2006;101:1265–1276. [PubMed: 16911725]

Turner-Bowker DM, Bayliss MS, Ware JE Jr, Kosinski M. Usefulness of the SF-8 Health Survey for comparing the impact of migraine and other conditions. Quality of Life Research 2003;12:1003–1012. [PubMed: 14651418]

Vreeland B. Bridging the gap between mental and physical health: a multidisciplinary approach. Journal of Clinical Psychiatry 2007;68

Wang J, Carlson RG, Falck RS, Siegal HA, Rahman A, Li L. Respondent-driven sampling to recruit MDMA users: A methodological assessment. Drug and Alcohol Dependence 2005;78(2):147–157. [PubMed: 15845318]

Wang J, Falck RS, Li L, Rahman A, Carlson RG. Respondent-driven sampling in the recruitment of illicit stimulant drug users in a rural setting: findings and technical issues. Addictive Behaviors 2007;32:924–937. [PubMed: 16901654]

Ware, JE.; Kosinski, M.; Keller, SD. SF-36 Physical and Mental Component Summary Measures: A User's Manual. Boston, MA: New England Medical Center; 1994.

Ware, JE.; Loskinski, M.; Dewey, JE.; Gandek, B. How to score and interpret single-item health status measures: A manual for users of the SF-8™ Health Survey. Lincoln, RI: Quality Metric Incorporated;

Zack MM, Moriarty DG, Stroup DF, Ford ES, Mokdad AH. Worsening trends in adult health-related quality of life and self-rated health-United States, 1993–-2001. Public Health Reports 2004;119:493–505. [PubMed: 15313113]

TABLE 1

Sample Characteristics at Baseline (n=574)

Variable	
Age of first substance use, mean (SD)	12.28 (3.71)
Demographics	
Age, mean (SD)	33.43 (10.50)
Gender, %	
Male	60.45
Female	39.55
Race/ethnicity, %	
White	65.85
African American	31.53
Other	2.62
Social and Economic Factors	
Married/live with other, %	
Yes	15.51
No	84.49
Have children, %	
Yes	66.20
No	33.80
Educational status, %	
< High sch./equiv.	41.46
High sch. deg./equiv.	42.16
College/tech. training	16.38
Currently working, %	
Yes	33.28
No	66.72
Past year income, %	
< $5,000	55.42
$5,000–9,999	16.61
$10,000–15,999	14.86
≥$16,000	13.11
Medical Care Access Factors	
Have usual doctor, %	
Yes	50.17
No	49.83
Health care insurance, %	
Yes	27.53
No	72.47
No. of physical diseases, mean (SD)	3.20 (3.05)

TABLE 2

Comparison of SF-8 PCS for the Sample and U.S. Population

Age	Sample Mean (SD)	U.S. Mean (SD)	*p*-value*
18–24	51.67	52.06	0.530
	(6.74)	(7.04)	
25–29	49.42	51.42	0.032
	(10.46)	(7.86)	
30–34	50.38	50.37	0.992
	(9.58)	(8.23)	
35–39	47.58	50.27	0.021
	(11.72)	(8.53)	
40–44	45.61	49.66	<0.0001
	(11.04)	(8.95)	
45–49	42.20	48.46	<0.0001
	(10.47)	(9.32)	
50–54	41.99	47.45	0.0088
	(10.25)	(9.96)	

* *p*-value is for unpaired two sample t-test.

TABLE 3

Mean (SD) SF-8 PCS and ASI-Drug, Alcohol, and Psychiatric Scores over Time

Variable	Baseline n=574	6 months n=477	12 months n=461	18 months n=455	24 months n=440	*p*-value*
SF-8 PCS	48.10	48.30	48.38	48.02	48.55	0.839
	(10.33)	(10.30)	(10.26)	(10.69)	(10.28)	
ASI-Drug	0.20	0.14	0.12	0.12	0.11	<0.0001
	(0.14)	(0.12)	(0.11)	(0.11)	(0.11)	
ASI-Alcohol	0.17	0.14	0.14	0.12	0.12	<0.0001
	(0.18)	(0.17)	(0.15)	(0.14)	(0.15)	
ASI-Psychiatric	0.19	0.18	0.17	0.14	0.13	<0.0001
	(0.22)	(0.23)	(0.21)	(0.20)	(0.20)	

**p*-value is for Type 3 fixed effect of time, which represents the overall effect of time.

TABLE 4

Random Coefficient Regression Analysis of SF-8 PCS

Variable	Est. Par.	*p*-value
Intercept	59.791	
Interview (Time)		
Baseline	Reference	
6-month	0.622	0.163
12-month	0.777	0.100
18-month	0.499	0.290
24-month	**1.323**	0.015
ASI-Scores		
ASI-Drug	**−4.586**	0.014
ASI-Alcohol	**3.134**	0.022
ASI-Psychiatric	**−3.494**	0.001
Age of first substance use, years	0.019	0.762
Demographics		
Age, years	**−0.310**	<.0001
Gender		
Male	−0.866	0.147
Female	Reference	
Race/ethnicity		
African American	**1.551**	0.029
Other	0.709	0.668
White	Reference	
Social and Economic Factors		
Married/ live with other		
Yes	−0.048	0.928
No	Reference	
Have children		
Yes	**1.884**	0.003
No	Reference	
Educational status		
< High sch./equiv.	Reference	
High sch. deg./equiv.	**1.487**	0.012
College/tech. training	**2.981**	0.001
Currently working		
Yes	0.593	0.162
No	Reference	
Past year income		
<$5,000	Reference	
$5,000–9,9999	−0.385	0.446
$10,000–15,999	0.068	0.908
$>$16,000	0.259	0.680
Medical Care Access Factors		

Variable	Est. Par.	*p*-value
Have usual doctor		
Yes	−0.818	0.158
No	Reference	
Have health care insurance		
Yes	−0.659	0.094
No	Reference	
No. of physical diseases	**−1.021**	<0.0001

Note: Significant findings are bolded. The model also controlled for state of residence.