Published in final edited form as:

Drug Alcohol Depend. 2010 July 1; 110(1-2): 1–7. doi:10.1016/j.drugalcdep.2010.01.018.

Job Loss Discrimination and Former Substance Use Disorders

Marjorie L. Baldwin,

W. P. Carey School of Business, School of Health Management and Policy, Arizona State University,
Tempe, AZ 85287-4506 USA

Steven C. Marcus, and

School of Social Policy and Practice and Leonard Davis Institute of Health Economics, University
of Pennsylvania, Center for Health Equity Research & Promotion, Philadelphia Veterans' Affairs
Medical Center. Philadelphia, PA 19104-6214 USA

Jeffrey De Simone

Department of Economics, University of Texas at Arlington, Arlington, TX 76019 USA

Abstract

Persons with former alcohol or drug use disorders are protected from labor market discrimination by the Americans with Disabilities Act of 1990. They have been neglected, however, in empirical studies of labor market discrimination following implementation of the Act. We apply econometric techniques used to study other disabled groups to determine if there are significant differences in employment outcomes for persons with and without former substance use disorders and, if so, what part of these differences potentially can be attributed to employer discrimination. There are no significant differences in employment rates between persons with and without former substance use disorders, and among those who are employed no significant differences in rates of full-time employment. But persons with former substance use disorders report significantly higher rates of involuntary job loss within the previous year. Part of the differential remains unexplained after controlling for other factors that affect employment outcomes, suggesting employer discrimination may be one cause of poor job stability among this group. Certain identifiable subgroups with low levels of human capital are particularly susceptible to substance-related discrimination.

Key Phrases

Substance Use Disorders; Job Loss; Labor Market Discrimination

Corresponding Author: Marjorie L. Baldwin, Professor, W. P. Carey School of Business, School of Health Management and Policy, Arizona State University, Box 874506, Tempe, AZ 85287-4506, Phone: 480-965-7778, Fax: 480-965-6654, Marjorie.Baldwin@asu.edu.

Contributors

Authors Baldwin and Marcus designed the study and wrote the initial proposal. Author DeSimone conducted the literature review on substance abuse and stigma and wrote the summary of previous work. Author Marcus conducted the statistical analysis and Author Baldwin wrote the first draft of the article. All authors contributed to the interpretation of results and to writing and editing the final draft.

Conflict of Interest

Dr. Marcus has received grants from Ortho-McNeil Janssen and has been a consultant to Eli Lilly and Company, Bristol Myers Squibb, Astra Zeneca, and Pfizer.

Dr. Baldwin and Dr. DeSimone declare they have no conflicts of interest that could influence this research.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1. Introduction

Substance use disorders are relatively common in the U.S. Overall, there were an estimated 17.6 million persons with alcohol use disorders in the U.S. in 2001-02, (Grant et al., 2004) while drug use disorders affected approximately 4.2 million persons (Stinson et al., 2005). Much research has documented a negative correlation between employment and current illegal drug use or heavy drinking, even after holding constant many other factors that affect labor market outcomes (see e. g. Buchmueller and Zuvekas, 1998; MacDonald and Pudney, 2001; French et al., 2001; Terza, 2002; MacDonald and Shields, 2004). All such studies have assumed the poor employment outcomes are the result of diminished productivity brought about by the short- and long-term impact of substance use disorders on cognitive abilities important in the workplace.

Persons with substance use disorders are, however, subject to strong stigma which may explain, at least in part, their poor outcomes in the labor market. Studies of attitudes toward health conditions consistently rank substance use disorders among the most stigmatized conditions, comparable to HIV/AIDS, mental disorders, or being an ex-convict (see e.g. Westbrook et al., 1993 and the references therein). Persons with mental disorders experience notably poorer outcomes in the labor market than non-disabled persons (18% lower employment rate, 8% lower wage rate). Twenty percent of the employment gap, and 30 percent of the wage gap, is unexplained by functional limitations and other productivity-related variables and potentially attributed to stigma-related discrimination by employers (Baldwin and Marcus, 2007).

Unlike persons with most other serious disabilities, persons with substance use disorders may recover, creating a particularly interesting group to study because the negative productivity effects of substance use disorders typically disappear in recovery (Jordan et al., 2008). Persons with former substance use disorders may, however, still experience adverse employment outcomes because of discrimination or stigma (Luoma et al., 2007). Employers may be afraid to hire unemployed persons with former substance use disorders for fear of relapse. Employers retaining workers with former substance use disorders may treat them differently than other workers, even after recovery, if adverse on-the-job behavior was previously observed.

The extent of negative attitudes toward persons with substance use disorders is evidenced by the controversies surrounding coverage of substance use disorders in the Americans with Disabilities Act of 1990 (ADA). When the ADA was debated, coverage of mental illness in general was a contentious issue (Campbell and Kaufmann, 1997). In the final compromise, persons with substance use disorders are protected, but the law limits their protection in important ways. Current drug users are not protected, for example, and current alcohol users are not protected if drinking affects their work. Missing from the ADA debates were objective empirical data on the labor market experiences of persons with substance use disorders, and the extent to which employer discrimination affects outcomes. Fifteen years after implementation of the ADA (1992-1994), objective information on how persons with different types of substance use disorders fare in the labor market, and the relative importance of discrimination in determining outcomes, is still lacking.

Economists have developed methods for estimating the potential impact of discrimination in the labor market, and applied the methods to study employment outcomes of various minority groups (see e.g. Oaxaca, 1973; Reimers, 1983; Cotton, 1988). A series of studies has applied the methods to study discrimination against persons with disabilities, in general, and persons with mental disorders, in particular (Baldwin and Johnson, 1994; 1995; 1996; 2000; Baldwin and Marcus, 2007). Substance use disorders are known to elicit strong stigma so a logical next step is to focus a discrimination study on persons with substance use disorders.

The purpose of this research is to use a large nationally representative survey of alcohol and drug use, abuse, and dependence (National Epidemiologic Survey on Alcohol and Related Conditions, or NESARC), in conjunction with econometric techniques used to study discrimination, to address two questions: Are there significant differences in employment outcomes for persons with and without substance use disorders? If so, what part of these differences potentially can be attributed to discrimination?

2. Methods

2.1 Data

The 2001-02 NESARC is the first wave of a national longitudinal survey of substance use and related disorders conducted and sponsored by the National Institute on Alcohol Abuse and Alcoholism. The weighted sample represents the non-institutionalized population of the U.S. age 18 and older. Data are collected in personal interviews conducted in respondents' homes. The final sample includes 43,093 interviews, with an overall response rate of 81%.

The NESARC provides a set of DSM-IV diagnostic variables that includes measures of current (within the past year) and lifetime substance use disorders. We restrict our study samples to persons with *former* substance use disorders, defined as persons who meet DSM-IV criteria for lifetime alcohol (drug) abuse or dependence and have not consumed alcohol (or used drugs) within the past 12 months. The restriction ensures our study group is covered by the anti-discrimination provisions of the ADA.

Discrimination against persons with substance use disorders can be expressed in decisions related to hiring, termination, job placement, promotion, and/or wages. The labor market outcomes analyzed here are: employment status (employed/not employed in the last 12 months); employment intensity (employed full-time/part-time); and loss of employment (fired or laid-off within the last year).

We exclude persons who are unavailable for full-time competitive employment in the study period (i.e. full-time students, members of the armed forces, and unpaid workers). After exclusions there are 25,349 persons in the data; 2,554 meet criteria for former drug abuse/dependence, 5,718 meet criteria for former alcohol abuse/dependence.

All analyses are conducted using SUDAAN to take account of the complex stratification and sample weighting adjustments used to make the NESARC sample representative of the U.S. population.

2.2 Analysis

We estimate the probability of each employment outcome (working, working full-time, job loss) using Zou's (2004) modified Poisson regression model for binary outcomes. The following discussion develops the model for the case of job loss, but the translation to other outcomes is straightforward.

Let y_i be a binary variable that equals one if individual i has lost his/her job in the last 12 months, zero otherwise. Assume the underlying probability of job loss is $f(x_i)$ where $x_i=1$ if the individual has a former substance use disorder and $x_i=0$ if not. To ensure $f(x_i)$ is positive, define

$$\log f(x_i) = \alpha + \beta x_i + \gamma z_i, \quad (1)$$

where z_i is a vector of variables representing individual, family, and productivity-related characteristics that also influence the probability of job loss. Table 1 provides definitions of the dependent (employment outcomes) and independent (functional limitations, demographic and human capital characteristics) variables in the model.

Assuming y_i follows a Poisson distribution, the log-likelihood function for the model is

$$\ell(\alpha + \beta x_i + \gamma z_i) = c \sum_{i=1}^n [y_i(\alpha + \beta x_i + \gamma z_i) - \exp(\alpha + \beta x_i + \gamma z_i)], \quad (2)$$

where c is a constant term. Then the relative risk of persons with a former substance use disorder having lost a job, compared to those with no former disorder, is

$$\widehat{RR} = \exp(\widehat{\beta}). \quad (3)$$

Zou (2004) notes the error term in the above model is mis-specified when the underlying data are binomially distributed, and derives a sandwich estimator to calculate a robust error variance.

The estimated coefficient, $\widehat{\beta}$, of the variable identifying persons with former substance use disorders measures the impact of former disorders on current employment outcomes, apart from the effect of human capital (education, work experience), functional limitations, and other control variables in the model. The coefficient has been widely interpreted as a measure of the potential impact of discrimination against a disadvantaged group (Hallock et al., 1998; Baldwin and Marcus, 2006). We extend this approach to measure the abuse attributable fraction (AAF), an estimate of the difference in outcomes between two groups that might be attributed to a particular causal factor (Rothman and Greenland, 1998).

Given estimates of relative risk as shown above, the abuse attributable fraction, the proportionate change in expectation of an employment outcome potentially associated with employer discrimination, is

$$AAF(employed) = \frac{\widehat{RR} - 1}{\widehat{RR}}. \quad (4)$$

We estimate modified Poisson models (equation 2) for three employment outcomes (employed, employed full-time, lost job), correcting the estimated variance with Zou's (2004) sandwich estimator. Binary variables in each model identify persons with former alcohol disorders and persons with former drug disorders. The only significant effects of former substance use disorders on employment outcomes are for job loss, so we focus our analyses of relative risk and abuse attributable fractions on that outcome.

We compute summary AAFs comparing persons with former alcohol disorders vs. persons with no current or former alcohol disorder, and persons with former drug disorders vs. persons with no current or former drug disorder. Then we re-estimate the job loss model for subgroups defined by human capital and demographic characteristics (age, education, gender, race, income). By comparing abuse attributable fractions within strata we can identify subgroups of workers (e.g. less educated workers, older workers) who may be subject to greater discrimination related to former substance use disorders.

3. Results

Table 2 reports observed rates for the key employment outcomes: currently working; working full-time (conditional on working); and job loss (conditional on having worked in the past 12 months), for persons with and without former alcohol/drug disorders. The results show: (1) No significant differences in employment rates between persons with and without former substance use disorders. (2) A significant difference in rates of full-time employment between persons with and without former alcohol use disorders, with the ‘disadvantaged’ group having a higher probability of working full-time. (3) Significant differences in job loss rates such that persons with former substance use disorders are significantly more likely to report job loss within the preceding 12 months. The unadjusted risk ratio for job loss is 1.3 (9% vs. 7%) for former alcohol disorders and 1.9 (13% vs. 7%) for former drug disorders. Given these results (confirmed by modified Poisson regression models for all three employment outcomes) the remainder of the article focuses on rates of job loss, the area where persons with former substance use disorders appear to be significantly disadvantaged.

Table 3 provides more detailed comparisons of job loss rates within strata defined by demographic and human capital characteristics. Overall, persons with former substance use disorders who are young (age 18-29), non-White, have low income, or less than high school education, are particularly at risk for recent job loss relative to their counterparts with no substance use disorder. Co-morbid mental disorders have a large positive effect on the probability of recent job loss, for both persons with and without former substance use disorders.

The observed differences in job loss rates within and across strata may be related to employer discrimination against persons with former substance use disorders, or to differences in other characteristics correlated with poor employment outcomes. To examine what these characteristics might be Table 4 compares means of demographic and human capital characteristics for persons with and without former substance use disorders. We see that, relative to persons with no history of substance abuse/dependence, persons with former substance use disorders are more likely to report a co-morbid medical or mental disorder. Health disorders are independently associated with poor employment outcomes and may, in part, explain the difference in job loss rates. On the other hand, persons with former substance use disorders are more likely to be male, white, and middle-aged, characteristics typically associated with better outcomes in the labor market. Persons with former substance use disorders are more likely to have graduated from high school, but less likely to have graduated from college than persons without a history of substance disorders. Higher education is correlated with better employment outcomes, so the overall effect of education on the differential rates of job termination is ambiguous.

To isolate the effect of former substance use disorders on job loss rates we estimate Poisson models (equation 2) of the probability of recent job loss, controlling for the demographic, functional limitations, and human capital characteristics defined above. Table 5 reports risk ratios and abuse attributable fractions from the job loss models estimated for the full sample and for subgroups defined by demographic and human capital strata.

Overall, former substance use disorders, either drug or alcohol related, are associated with a significant increase in risk of job loss, even after controlling for other factors that affect employment outcomes. Among persons with former drug use disorders the job loss rate is 23 percent higher than would be predicted in the absence of a history of drug abuse/dependence (Table 5, row 1). Certain subgroups are particularly susceptible to elevated risk of job loss associated with former drug abuse/dependence, namely: persons with co-morbid medical disorders (AAF=32%); persons with only a high school education (26%); persons in the youngest (35%) or oldest (38%) age strata; and persons in the lowest income stratum (27%).

Among persons with former alcohol use disorders the job loss rate is 15 percent higher than would be predicted based on their characteristics (Table 5, row 1). Subgroups particularly susceptible to excess risk of job loss associated with former alcohol abuse/dependence include: women (AAF=31%); persons with only a high school education (21%); persons age 30-49 (24%); and Hispanics (35%). Persons in the lowest income stratum also have higher rates of job loss associated with former substance use disorders (AAF=19%), however there is a risk of endogeneity between current income and job termination in the previous year. The endogeneity does not affect the substantive results reported here, but the reader is cautioned against drawing conclusions about the effect of income on job loss.

4. Discussion

The study has three primary findings: 1) there is no significant difference in employment rates between persons with and without former substance use disorders. 2) Persons with former substance use disorders report significantly higher rates of job loss within the previous year than do persons with no history of substance use disorder. 3) Certain identifiable subgroups are particularly susceptible to job loss related to former substance use disorders. All three findings have important implications for labor market policies and practice in the U.S.

The federal government has been actively engaged in setting guidelines governing employment of persons with disabilities at least since the 1990's. Specifically, the Americans with Disabilities Act of 1990 (ADA) includes persons with former substance use disorders as a protected group, prohibiting discrimination against such persons in the workplace. The law does not prohibit productivity-related employment and wage differentials. It does prohibit differences in outcomes associated with negative attitudes, or stigma, toward a group that is noticeably different from the 'norm'. Differences associated with race, ethnicity, gender, and disability status are common precursors to stigma, a term originating from the Greek word for the tattoo, or mark, identifying slaves or criminals. Our results indicate the ADA may have been effective in achieving its anti-discrimination goals regarding employment of persons with former substance use disorders. Once employed, however, the ADA may not protect persons with former substance use disorders from discriminatory job termination.

An extensive literature has examined the impact of current substance use disorders (which are not covered by the ADA) on labor market outcomes but there is a paucity of research examining the impact of former substance use disorders. Previous research has found negative correlations between concurrent substance use and employment. MacDonald and Shields (2004), for example, show that being a problem drinker reduces the probability of working by 7-31 percent, a large impact considering the lower bound estimate is similar in magnitude to the positive effect of having a college degree. As examples of studies focusing on illegal drug use, Kaestner (1994a; 1994b) reports both marijuana and cocaine negatively affect wage rates and labor supply; Register and Williams (1992) report that male employment falls as the frequency of past month marijuana use rises.

Our results, however, suggest persons with *former* substance use disorders are able to obtain employment upon recovery. The results imply that improvements in employment prospects are important outcomes of successful drug and alcohol treatment programs, so the decision to cover former substance use disorders under the ADA appears to be reasonable.

Although having a former substance use disorder appears not to impact hiring decisions, it has a significant effect on job tenure. The effect of former substance use disorders on recent job loss has not been studied in prior research. In fact, it is difficult to explain why a history of substance use disorder, among persons who are not currently using, should affect job tenure independent of human capital and demographic characteristics. One explanation may be that

a former substance use disorder is only revealed after one is on the job. Employers and co-workers may then become sensitive about the probability of relapse and its potential effect on job performance. Another possible explanation is that persons with former substance use disorders have emotional or cognitive deficits that reduce productivity and affect interactions with co-workers but are not captured by the functional limitations variables in our models. Assuming these workers can perform the essential functions of the job, with or without accommodation, they are still protected from discrimination under the ADA. In fact, the ADA requires employers to make reasonable accommodations for workers with disabilities provided the accommodations do not impose 'undue hardship' on the firm. It is unknown whether the employers of workers in our sample attempted such accommodations.

It remains unclear whether our results on job loss indicate discriminatory behavior on the part of employers. For example, assume a worker is performing her job as well or better than others, but one day confides to a co-worker she has a history of substance use disorder. The information reaches a manager, who terminates her employment because the manager believes there is a high statistical probability of relapse. In this case the action is consistent with 'statistical' discrimination, defined as making judgments about an individual based on the perceived characteristics of a group (as opposed to discrimination based on prejudice or stigma). On the other hand, assume a worker with former substance use disorder has cognitive deficits, unobserved during the job interview, that negatively affect his job performance. In this case the decision to terminate the employee would not be considered discrimination (although the ADA requires the poor performance relate to an essential function of the job, and is unable to be remediated with reasonable accommodation).

Our results show that certain subgroups are more susceptible to job loss related to former substance use disorders than others, namely persons with lower levels of education or income, and persons with an additional stigmatizing characteristic (e.g. race, gender, or health condition). Consistent with the findings of discrimination studies for many other disadvantaged groups, investments in human capital appear to 'protect' workers, to some degree, from substance-related discrimination. Among workers with a college education, for example, there are no significant differences in termination rates between persons with and without former substance use disorders. Research also consistently finds positive interaction effects of discrimination when a person has more than one stigmatizing characteristic. Here we see the effect among persons with former *drug* use disorders and co-morbid medical disorders, and among persons with former *alcohol* use disorders who are Hispanic or female.

There is no significant marginal effect of former substance use disorders among persons with co-morbid mental disorders, yet mental disorders are among the most stigmatized of health conditions. It may be that the effect of mental disorders on termination rates is so large it simply swamps the effect of a former substance use disorder. A similar argument could explain why there is no significant marginal effect of former substance use disorders among persons having less than a high school education.

Interestingly, the effects of age are precisely opposite for persons with former alcohol vs. former drug use disorders. Persons in the youngest or oldest age groups with former *drug* use disorders have significantly higher rates of job terminations, whereas middle-age workers with former *alcohol* use disorders have significantly higher rates. If prior drug use is more stigmatizing or otherwise damaging to productivity than prior alcohol use, the age pattern may relate to more marginal attachment to the labor force among both younger and older workers. Younger workers have the highest unemployment rates, while older workers are near retirement age and may have trouble finding a job match if they previously lost a job they held for an extended tenure. For prior alcohol use, (Mullahy and Sindelar, 1993) find a similar age pattern and hypothesize it arises because alcohol problems cause younger adults to enter the

labor force rather than continue schooling, and older adults to continue working (possibly in lower-quality jobs than otherwise) rather than retire.

Two results we have not explored fully in this article are: (1) Persons with former alcohol use disorders who are working have a significantly *higher* rate of full-time employment than their counterparts without a history of substance abuse/dependence (Table 2). (2) There is no significant effect of former alcohol abuse/dependence on rates of job terminations for men, but a highly significant effect for women (Table 3). One possible explanation is that heavy alcohol use is more socially acceptable among men than among women, so women with a history of alcohol use disorders are more subject to job termination motivated by prejudice. Gender differences may also help explain the counterintuitive result for full-time employment, because men are more likely than women to have a history of alcohol abuse/dependence and to work full-time. These results provide preliminary evidence that issues of substance use disorders should be included in studies of labor market discrimination against women, as well as gender issues being a more central focus of studies of labor market outcomes for persons with substance use disorders.

4.1 Limitations

The results of the study need to be interpreted in light of the following limitations. First, the dependent variables measuring work outcomes (employment status, employment intensity, job loss) are not as comprehensive or detailed as one would like. The measures may not reflect the realities of today's economy where many people work multiple jobs, have contingent employment, or are underemployed. Moreover, information on wages is missing from the survey data, so we are unable to estimate discrimination expressed as unexplained wage differentials. Still, employment status and intensity are standard measures of employment outcomes used in studies of labor market discrimination.

Second, if important determinants of employment outcomes are omitted from the set of independent variables in the models, and if the omitted variables are correlated with former substance use disorders, then the estimates of discrimination may be biased. For example, if workers with a former substance use disorder have cognitive limitations that affect worker productivity and these limitations are not included in the models, employment differences that result from differences in cognitive skills would be part of the effect captured by the binary controls for former substance use disorders, leading to an over-estimate of the discrimination effect. In reality we cannot be certain if we are under- or over-estimating the effects of discrimination, because the direction of the bias depends on whether the omitted variable increases or decreases the likelihood of positive employment outcomes for the disadvantaged group. It is impossible to avoid the omitted variables problem without perfect controls for all factors that affect an employment decision. The NESARC includes a rich set of variables describing the functions most likely to be affected by substance use disorders, but our results should still be interpreted cautiously as the *potential* impact of employer discrimination.

Finally, our study rigorously compares two diagnostically accurate groups (persons with and without former substance use disorders) at one point in time. Readers are cautioned against generalizing the results across time.

5. Conclusions

Econometric studies of labor market discrimination have neglected persons with substance use disorders. Most discrimination studies treat persons with disabilities as one homogeneous group or combine persons with substance use disorders and persons with mental disorders into the same group. Our results, however, suggest the labor market experiences of persons with disabilities vary widely by disability type. In particular, labor market discrimination against

persons with former substance use disorders appears to be manifested in job loss rates after hiring, rather than as differentials in employment status or intensity. Future discrimination research should also focus on smaller subgroups of the disabled population.

Our study is a good first step in estimating the potential effects of discrimination on employment outcomes of persons with former substance use disorders but no existing national survey has all the data required to analyze the topic in depth. With the addition of only a few questions (e. g. wage rates, work experience, occupation) the NESARC could be used to study a broad array of policy-relevant questions on the effects of substance use disorders on employment. Given the importance of employment as a source of financial stability and self-esteem, one hopes the NIAAA would consider broadening the scope of the survey in this direction.

Acknowledgments

Role of Funding Source

This research was supported by grant # R03 DA019860-01 from the National Institute of Drug and Alcohol Abuse (NIDA). NIDA had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

References

- Baldwin ML, Marcus SC. Perceived and Measured Stigma Among Workers with Serious Mental Disorders. *Psychiatric Services* 2006;57:388–392. [PubMed: 16524998]
- Baldwin ML, Marcus SC. Labor Market Outcomes of Persons with Mental Disorders. *Industrial Relations* 2007;46:481–510.
- Buchmueller TC, Zuvekas SH. Drug use, drug abuse, and labour market outcomes. *Health Economics* 1998;7(3):229–245. [PubMed: 9639336]
- Campbell, J.; Kaufmann, C. *Mental Disorder, Work Disability, and The Law*. University of Chicago Press; Chicago: 1997. Equality and Difference in the ADA: Unintended Consequences for Employment of People with Mental Health Disabilities; p. 221-239.
- Cotton J. On the Decomposition of Wage Differentials. *Review of Economics and Statistics* 1988;70:236–243.
- French, MT.; Holtmann, AG.; McGeary, KA.; Zarkin, GA. *The Experience of Developed Countries and Lessons for Developing Countries*. Edward Elgar Publishing Limited; United Kingdom: 2001. Substance Use and Workplace Attendance, in *Economic Analysis of Substance Use and Abuse*; p. 239-253.
- Grant BF, Dawson DA, Stinson FS, Chou SP, Dufour MC, Pickering RP. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991-1992 and 2001-2002. *Drug Alcohol Depend* 2004;74(3):223–34. [PubMed: 15194200]
- Hallock KF, Hendricks W, Broadbent E. Discrimination by Gender and Disability Status: Do Worker Perceptions Match Statistical Measures? *Southern Economic Journal* 1998;65(2):245–263.
- Kaestner R. New estimates of the effect of marijuana and cocaine use on wages. *Industrial and Labor Relations Review* 1994a;47(3):454–70.
- Kaestner R. The effect of illicit drug-use on the labor supply of young adults. *Journal of Human Resources* 1994b;29(1):126–155.
- Jordan N, Grissom G, Alonzo G, Dietzen L, Sangsland S. Economic benefit of chemical dependency treatment to employers. *Journal of Substance Abuse Treatment* 2008;34(3):311–9. [PubMed: 17614238]
- Luoma JB, Twohig MP, Waltz T, Hayes SC, Roget N, Padilla M, Fisher G. An investigation of stigma in individuals receiving treatment for substance abuse. *Addictive Behaviors* 2007;32(7):1331–46. [PubMed: 17092656]
- MacDonald Z, Pudney SE. Illicit drug use and labour market achievement: evidence from the UK. *Applied Economics* 2001;33:1655–1668.

- MacDonald Z, Shields MA. Does problem drinking affect employment? Evidence from England. *Health Economics* 2004;13(2):139–55. [PubMed: 14737752]
- Mullahy J, Sindelar JL. Alcoholism, Work, and Income. *Journal of Labor Economics* 1993;11(3):494–520.
- Oaxaca RL. Male-Female Wage Differentials in Urban Labor Markets. *International Economic Review* 1973;14:693–709.
- Register CA, Williams DR. Labor market effects of marijuana and cocaine use among young men. *Industrial and Labor Relations Review* 1992;45(3):435–48.
- Reimers C. Labor Market Discrimination Against Hispanic and Black Men. *Review of Economics and Statistics* 1983;65:570–579.
- Rothman, KJ.; Greenland, S. *Modern Epidemiology*. 2nd. Philadelphia: Lippincott Williams and Wilkins; 1998.
- Stinson FS, Grant BF, Dawson DA, Ruan WJ, Huang B, Saha T. Comorbidity between DSM-IV alcohol and specific drug use disorders in the United States: Results from the national epidemiologic survey on alcohol and related conditions. *Drug and Alcohol Dependence* 2005;80(1):105–16. [PubMed: 16157233]
- Terza J. Alcohol Abuse and Employment A Second Look. *Journal of Applied Econometrics* 2002;17:393–404.
- Westbrook MT, Legge V, Pennay Mark. Attitudes towards disabilities in a multicultural society. *Social Science and Medicine* 1993;36:615–624. [PubMed: 8456331]
- Zou G. A modified Poisson regression approach to prospective studies with binary data. *American Journal of Epidemiology* 2004;159(7):702–706. [PubMed: 15033648]

Table 1

Variable Definitions for Models of Employment Outcomes

Category	Variable name	Variable definition
Employment outcomes	Employed	Worked for pay within last year
	Full-time	Work for pay 35 or more hours/week
	Job loss	Fired or laid off from paid job within last year
Demographic characteristics	Male	Gender=male
	Female	Gender=female
	Married	Marital status= married or living with someone as if
	Single	Marital status=divorced, widowed, separated, never married
	White	Race/ethnicity=non-Hispanic Caucasian
	Hispanic	Race/ethnicity=Hispanic or Latino
	Black	Race/ethnicity=Black or African-American
	Other	Race/ethnicity=Asian, American Indian, Native Alaskan, Native Pacific Islander
	Income	Last year total household income
	Northeast	Census region=northeast
	Midwest	Census region=midwest
	South	Census region=south
	West	Census region=west
Human capital characteristics	Age	Age in years at date of interview
	Less than high school	Education= not a high school graduate
	High school	Education=high school graduate, with or without some college
	College	Education=college degree (BS/BA), with or without post-graduate degree
	Medical	Diagnosed with medical disorder
	Mental	Diagnosed with psychotic disorder and/or meets DSM IV criteria for major depression
Functional limitations	Social limitations	Health interferes with social activities most or all the time
	Emotional limitations	Emotional problems affect work most or all the time
	Physical limitations	Physical health affects work most or all the time

Source: NIAAA 2001 - 2002 NESARC

Table 2
Rates for Employment Outcomes: Persons with Former Drug or Alcohol Disorders vs. No-Disorder Comparison Groups

Outcome measure	Drug abuse/dependence ^a		Alcohol abuse/dependence ^b	
	Former (N= 2,554)	None (N=22,247)	Former (N=5,718)	None (N=17,140)
Currently employed	N=2,308 91% [89.3, 92.2]	N=20,354 92% [91.7, 92.8]	N=5,305 93% [92.3, 93.9]	N=15,571 92% [90.9, 92.3]
Working full-time	88% [85.7, 89.3]	87% [86.1, 87.3]	89% [87.9, 90.1]	86% [84.8, 86.3]
Employed within last 12 months	N=2,489	N=21,468	N=5,601	N=16,453
Job loss within last 12 months	13% [10.9, 14.3]	7% [6.8, 7.8]	9% [8.2, 10.2]	7% [6.3, 7.4]
				0.00

Notes: 'Former' indicates prior to past year. 95% confidence intervals in brackets. P-value for χ^2 test of significance differences with one degree of freedom.

^aExcludes 548 persons with current drug use disorders.

^bExcludes 2,491 persons with current alcohol use disorders.

Source: NIAAA 2001 - 2002 NESARC.

Table 3
Bivariate Rates of Job Loss, for Samples Stratified by Demographic Characteristics: Persons with Former Drug or Alcohol Disorders vs. Comparison Group

Variable	Rate of job loss					
	Drug abuse/dependence			Alcohol abuse/dependence		
	Former	None	Significance	Former	None	Significance
Male	12%	8%	**	9%	8%	
Female	12%	6%	**	9%	6%	**
Medical disorder	12%	7%	*	8%	7%	
No medical disorder	12%	7%	**	9%	7%	**
Mental disorder	16%	13%		14%	14%	
No mental disorder	11%	6%	**	9%	6%	**
Less than high school	21%	12%	*	15%	12%	
High school graduate	13%	7%	**	10%	7%	**
College degree	6%	5%		5%	4%	
Age 18-29	21%	10%	**	12%	11%	
30-49	10%	6%	**	9%	6%	**
50-64	11%	5%	*	8%	5%	**
White	11%	7%	**	9%	6%	**
Black	14%	9%		11%	9%	
Hispanic	11%	9%		12%	8%	*
Other	21%	8%	*	13%	8%	
Income < 50,000	17%	9%	**	13%	9%	**
50,000 to <100,000	8%	5%	*	6%	5%	*
> 100,000	4%	4%		4%	4%	

Note: 'Former' indicates prior to past year.

** indicates difference between former substance abuse and comparison group is significant at the .01 level or better;

* indicates difference is significant at the .05 level or better.

Table 4

Sample Means: Persons with Former Drug or Alcohol Disorders vs. Comparison Groups

Variable	Drug abuse/dependence		Alcohol abuse/dependence	
	Former	None	Former	None
Male	0.67 [.640, .694]	0.51 [.498, .517]	0.67 [.658, .691]	0.46 [.454, .476]
Age 18-29	0.17 [.149, .193]	0.20 [.191, .207]	0.14 [.125, .149]	0.22 [.211, .228]
Age 30-49	0.67 [.639, .691]	0.54 [.534, .551]	0.62 [.601, .631]	0.53 [.522, .540]
Age 50-64	0.16 [.146, .184]	0.26 [.250, .266]	0.25 [.235, .261]	0.25 [.242, .258]
High school graduate	0.65 [.623, .680]	0.58 [.561, .594]	0.59 [.568, .610]	0.58 [.565, .600]
College degree	0.24 [.212, .264]	0.30 [.285, .315]	0.32 [.296, .340]	0.28 [.270, .300]
Black	0.09 [.071, .102]	0.13 [.111, .144]	0.07 [.058, .078]	0.14 [.126, .164]
Hispanic	0.07 [.052, .090]	0.14 [.112, .172]	0.07 [.059, .093]	0.16 [.125, .191]
Other	0.06 [.046, .077]	0.08 [.070, .100]	0.05 [.043, .062]	0.09 [.078, .111]
Midwest	0.23 [.177, .295]	0.23 [.164, .304]	0.27 [.211, .338]	0.21 [.148, .291]
South	0.31 [.250, .374]	0.35 [.284, .424]	0.31 [.254, .371]	0.36 [.289, .438]
West	0.28 [.210, .358]	0.22 [.152, .305]	0.23 [.175, .305]	0.22 [.150, .314]
Married	0.67 [.644, .690]	0.67 [.658, .682]	0.70 [.688, .716]	0.66 [.645, .671]
Single	0.33 [.310, .356]	0.33 [.318, .342]	0.30 [.284, .312]	0.34 [.329, .356]
Income < 50,000	0.52 [.489, .545]	0.51 [.492, .526]	0.45 [.432, .476]	0.53 [.513, .547]
Income 50,000 to <100,000	0.34 [.311, .367]	0.34 [.333, .354]	0.37 [.359, .389]	0.33 [.319, .343]
Medical disorder	0.27 [.247, .297]	0.23 [.219, .243]	0.27 [.259, .289]	0.22 [.208, .232]
Mental disorder	0.13 [.116, .156]	0.06 [.058, .067]	0.09 [.085, .104]	0.06 [.055, .065]
Social limitations	0.06 [.043, .071]	0.03 [.029, .035]	0.04 [.033, .045]	0.03 [.029, .036]
Emotional limitations	0.05 [.038, .060]	0.04 [.037, .044]	0.04 [.034, .047]	0.04 [.038, .045]
Work limitations	0.08 [.070, .099]	0.06 [.057, .066]	0.07 [.064, .080]	0.06 [.056, .065]

Notes: 'Former' indicates prior to past year. 95% confidence intervals in brackets.

Source: NIAAA 2001 - 2002 NESARC.

Table 5

Risk Ratios and Abuse Attributable Fractions Calculated from Modified Poisson Models of Job Loss

Model	Former drug abuse/dependence		Former alcohol abuse/dependence	
	Relative risk	Abuse attributable fraction	Relative risk	Abuse attributable fraction
Overall	1.30**	23.08%	1.18*	15.25%
Male	1.34*	25.37%	1.04	3.85%
Female	1.23*	18.70%	1.45**	31.03%
Medical disorder	1.46*	31.51%	0.90	-11.11%
Mental disorder	1.02	1.96%	0.92	-8.70%
Less than high school	1.37	27.01%	1.01	0.99%
High school graduate	1.36*	26.47%	1.26*	20.63%
College degree	1.05	4.76%	1.10	9.09%
Age 18-29	1.53*	34.64%	0.91	-9.89%
30-49	1.14	12.28%	1.32**	24.24%
50-64	1.60*	37.50%	1.25	20.00%
White	1.25*	20.00%	1.17	14.52%
Black	1.37	27.01%	1.07	6.54%
Hispanic	1.04	3.85%	1.53*	34.64%
Other	1.69	40.83%	1.16	13.79%
Income < 50,000	1.37*	27.01%	1.23*	18.70%
50,000 to <100,000	1.13	11.50%	1.26	20.63%
> 100,000	0.91	-9.89%	0.79	-26.58%

Note: 'Former' indicates prior to past year.

** indicates difference between former substance abuse and comparison group is significant at the .01 level or better;

* indicates difference is significant at the .05 level or better.

Source: NIAAA 2001 - 2002 NESARC.