Symptoms of Dependence, Multiple Substance Use, and Labor Market Outcomes

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Abstract:

The prevalence and costs of alcohol and drug disorders pose a serious social concern for policymakers. In this paper, we use data from the National Household Surveys on Drug Abuse (NHSDA) to estimate simple descriptive statistics and analysis of variance (ANOVA) models of the relationship between symptoms of dependence and labor market outcomes for alcohol, cigarettes, marijuana, and other illicit drugs. For men, we find that substance use with symptoms of dependence is associated with both lower employment rates and fewer hours of work. For women, we find that substance use with symptoms of dependence is associated with lower employment rates, but we find no consistent evidence of a relationship between symptoms of dependence and the number of hours worked. Finally, all of our point estimates are smaller in magnitude when we control for multiple substance use, suggesting that comorbidities play a critical role in the relationship between substance use and labor market outcomes. Our results suggest that policymakers and researchers should consider the full spectrum of substance use and dependence rather than focusing on the simple use of a single substance.

Keywords: Alcohol | Dependence | Drug abuse | Labor market behavior | Substance use

Article:

INTRODUCTION

According to the National Comorbidity Study [[1]], approximately 11.3% of people between the ages of 15 and 54 in the United States have past-year substance use disorders, including alcohol dependence (7.2%), alcohol abuse (2.5%), any drug dependence (2.8%), and any drug abuse (0.8%). These findings coincide with current and prior research using a variety of assessment methodologies, criteria, and community-based samples [[2]], [[3]]. While significant, these rates are much lower than the rates of "any" alcohol and drug use that are typically the focus of most epidemiological, economic, and treatment research. In fact, Grant [[4]] found that only 10% of individuals who had used drugs in the past 12 months suffered from 1-year drug dependence as defined by the DSM-IV [[5]]. These findings suggest that more direct measures of dependence and/or its related problems, rather than use per se, would help identify the highest risk employees for intervention and would better predict labor market behaviors.

The picture is further complicated by high rates of comorbidity between alcohol and other drug use disorders [[1]], [[3]], [[6]], [[7]]. In one of the first studies using the new DSM-IV criteria, Grant and Pickering [[8]] found that 23% of respondents with a lifetime alcohol use disorder also had an "other drug use" disorder, and that 69% of individuals with an "other drug use" disorder also had an alcohol use disorder. Furthermore, during the onset of dependence, one of the most common patterns—particularly among current adolescents and individuals in their 20s—is the use of alcohol followed by the use of marijuana, followed by symptoms of alcohol dependence, then symptoms of marijuana dependence [[9]], [[10]], [[11]], [[12]], [[13]]. These results indicate the importance of looking at multiple substances instead of narrowly focusing on a single substance, such as alcohol or marijuana.

In relation to labor market outcomes, past research has indicated that alcohol and drug use disorders are potentially very costly. Rice and coworkers [[14]] estimated the cost of drug and alcohol abuse to be over $44 billion in 1985, $14 billion of which was due to lost productivity. Rice [[15]] estimated the cost of alcohol abuse and alcohol dependence to be over $98 billion in 1990. Although estimates of the total social costs of alcohol and drug abuse have been criticized as potentially misleading (see Refs. [[16]], [[17]], [[18]], they do suggest that alcohol and drug abuse may have serious social consequences, especially in the labor market.

The prevalence and potential cost of alcohol and drug disorders are serious concerns for policymakers. To address these concerns better, policymakers need detailed current information on the consequences of substance use disorders. Given the recent focus on welfare-to-work programs and that many of the consequences of alcohol and drug disorders are likely to be associated with lost productivity or unemployment, policymakers need information on the relationship between substance use disorders and labor market behavior.

Despite the need for studies on the relationship between substance use disorders and labor market behavior, few such studies exist. A substantial literature has examined the effects of substance use on labor supply and wage determination (see Refs. [[19]], [[20]], [[21]], [[22]], [[23]], [[24]], [[25]], [[26]], [[27]]. However, this literature has yet to reach a definitive conclusion on the impact of substance use on labor market outcomes [[27]], [[28]]. In addition, these studies focus on substance use and do not consider substance dependence. The few studies that have examined measures of dependence have focused almost exclusively on alcoholism

[[29]], [[30]], [[31]]. Although these studies found a consistently negative impact of alcoholism on labor market outcomes, their results may be misleading because they do not fully address the potential impact of comorbidities.

In this paper, we use data from the 1991, 1992, and 1993 National Household Surveys on Drug Abuse (NHSDA) to examine the labor market behavior of substance users with symptoms of dependence similar to those given in the DSM-III-R. (Although the symptoms we use are similar to those in the DSM-IV, the NHSDA questions were based on the DSM-III-R, and so we refer to them as DSM-III-R symptoms.) While the DSM-III-R is designed to allow a clinical diagnosis of dependence, the NHSDA only collects information on three of the nine symptoms that make up the DSM-III-R criteria for dependence. Thus, we do not have adequate information with which to make a diagnosis of dependence, and our results cannot be used as estimates of the prevalence of substance use disorders (see Refs. [[1]], [[2]], [[4]] and [[8]] for prevalence estimates). Despite this limitation, the NHSDA is a valuable dataset for examining the relationship between symptoms of dependence and labor market behaviors because it is representative of the noninstitutionalized U.S. household population age 12 and older. Although researchers have used the NHSDA to look at the prevalence of substance use by employed and unemployed populations (see Ref. [[32]]), to our knowledge no research has used the NHSDA to examine directly the relationship between symptoms of dependence and labor market behavior.

The purpose of our paper is twofold. First, we provide estimates of the relationship between symptoms of substance dependence and labor market behaviors for prime age workers in the United States. Second, we provide information on the impact of comorbidities on these estimates. To examine the first issue, we compare nonsubstance users to substance users with and without symptoms of dependence on several labor market indicators, such as employment status and hours of work. For men, we find that substance users with symptoms of dependence have lower employment rates and work fewer hours. For women, we find that substance use with symptoms of dependence is associated with lower employment rates, but we find no consistent evidence of a relationship between substance use with symptoms of dependence and the number of hours worked, conditional on being employed. To examine the impact of comorbidities, we use an ANOVA (analysis of variance) model to control for the use of multiple substances. For both men and women, we find that the magnitudes of all of our estimates are reduced when we control for the use of multiple substances.

DATA

We use data from the 1991, 1992, and 1993 NHSDA public use files to examine the relationship between symptoms of drug and alcohol dependence and labor market outcomes. All three NHSDA used the same data collection methodology to provide nationally representative data on the substance use of the noninstitutionalized U.S. household population age 12 and older [[33]], [[34]]. In all 3 years, the NHSDA instrument collected data on the prevalence of past-year use of cigarettes, alcohol, and illicit drugs; basic demographic and employment data; and several symptoms of dependence for each drug, including alcohol and cigarettes. Because of the sensitive nature of the survey topic, self-administered answer sheets were used for the substance use questions to increase the confidentiality and anonymity of the respondents' answers. This format was designed to minimize underreporting of substance use, which is a potential limitation

of self-reported surveys [[35]], [[36]]. In a 1990 field test of various survey instruments, Turner and coworkers [[37]] found that the self-administered format of the NHSDA decreases the underreporting of substance use compared to an interviewer-administered format.

Major changes in the 1994 NHSDA survey instrument preclude comparison with previous NHSDA [[38]], and we have excluded the 1994 NHSDA from our analysis. Similar survey changes prevent us from examining data from the NHSDA prior to 1991. Thus, we use the combined 1991, 1992, and 1993 NHSDA to provide estimates of the relationship between symptoms of dependence and labor market behavior. In all 3 years, the NHSDA used identical survey questions for the variables of interest and the same five-stage area probability sample design. Sampling weights were computed based on the probability of selection at each stage, and these weights were used in all analyses. To ensure that standard errors were calculated correctly, we used Stata statistical software, which has a set of commands designed to analyze complex survey data [[39]].

We limited our sample to individuals between the ages of 25 and 54 who were not on active military duty, not enrolled in school, not disabled, and not retired. Our intent was to restrict our analyses to those respondents at risk for labor market problems. We limited our analyses to individuals between the ages of 25 and 54 because age is one of the major covariates explaining drug use [[32]] and because age plays a major role in explaining an individual's labor force status. Individuals younger than 25 may be conducting their first major job search, and some individuals older than 54 may be preparing for early retirement. We performed our analyses separately for 25- to 34-year-olds and 35- to 54-year-olds to examine whether important age differences existed. We found no significant differences in our results between the 25- to 34-year-old sample and the 35- to 54-year-old sample. Thus, we present only the results for the combined sample of 25-to-54 year olds. A full set of results is available from the lead author on request.

Our sample inclusion criteria yielded a total analysis sample of 14,882 men and 19,923 women (5152 men and 6972 women in 1991, 4808 men and 6428 women in 1992, and 4922 men and 6523 women in 1993). To ensure that our sample inclusion criteria did not change the ratio of men to women in our sample, we compared this ratio in our subsample to that in the overall NHSDA sample. In all 3 years, the ratio of men to women in our sample was approximately equal to the ratio in the overall NHSDA public use files.

We defined four types of substance use variables: heavy drinking, cigarette smoking, marijuana use, and other illicit drug use (i.e., cocaine, crack, hallucinogens, analgesics, sedatives, tranquilizers, stimulants, inhalants, and heroin). Heavy drinking is defined as consuming five or more drinks on five or more occasions in the past 30 days. This definition of heavy drinking is commonly used in the NHSDA main findings reports [[40]], [[41]], and we used it for consistency with those studies. We defined cigarette smoking, marijuana use, and other drug use as any past-year use.

For each type of substance, we classified a respondent as having a symptom of dependence for a substance if he/she indicated that substance in response to at least one of the following questions based on the DSM-III-R criteria for substance dependence:

1. “During the past 12 months, for which drugs have you consistently tried to cut down on your use?”

2. “During the past 12 months, for which drugs have you been unable to cut down on your use, even though you tried?”

3. “During the past 12 months, for which drugs have you needed larger amounts to get the same effects?”

4. “For which drugs have you had bad withdrawal symptoms; that is, you felt sick because you stopped or cut down on your use of them in the past 12 months?”

For each substance, we classified individuals as either nonusers, users without symptoms, or users with symptoms. If an individual indicated more than one substance in response to a question, we classified that respondent as having a symptom for each substance indicated. Heavy drinkers who indicated “alcohol” in response to one of the symptom questions were considered to be heavy drinkers with symptoms. Individuals who indicated “alcohol” in response to one of the symptom questions, but who were not heavy drinkers based on our definition were considered nonheavy drinkers for our analyses. Categories based on the number of symptoms often resulted in small sample sizes, so we used a simple 0/1 indicator for the presence of one or more symptoms.

Our labor market variables consist of the following labor market performance variables: indicator variables for currently employed, currently unemployed, or currently working full time; and weeks worked in the past year and hours worked at all jobs in the past 30 days. Following Bureau of Labor Statistics (BLS) definitions, respondents were considered “currently employed” if they were working at a legitimate job either full or part time or if they had a job but were not working because of an extended illness, maternity leave, furlough, or strike. Individuals were “unemployed” if they were not working, but were actively searching for work. Following BLS definitions, our unemployment variable is defined only for labor force participants; individuals who were not working and not looking for work were not considered part of the labor force and were therefore not classified as being unemployed. Thus, the percentage of our sample that is employed and the percentage that is unemployed do not sum to one. The indicator for currently working full time is based on a respondent's reporting working full time (i.e., 35 hours a week or more) and is not derived from our variable for the number of hours worked at all jobs in the past 30 days. We defined our indicator of full-time status to be conditional on being employed. The question pertaining to the hours worked at all jobs in the past 30 days was only asked of those who were currently working, so the variable for the hours worked is strictly positive. The question pertaining to weeks worked in the last year was asked of all respondents, so that variable includes zeros. Table 1 presents the sample size, mean, and standard deviation of all analysis variables.

Table 1. Descriptive Statistics of Analysis Variables

Variable	Men		Women	
	N	Mean	*N*	Mean
Employed	14,882	0.932	19,923	0.719
		(0.252)		(0.449)
Unemployed	14,592	0.052	14,741	0.054
		(0.223)		(0.226)
Working full time	13,388	0.954	13,439	0.788
		(0.209)		(0.409)
Weeks worked in past year	14,626	47.844	19,589	36.487
		(11.166)		(21.492)
Hours worked in past month	13,138	175.245	13,242	142.984
		(56.153)		(55.626)
Heavy alcohol use				
Nonheavy drinkers	14,882	0.898	19,923	0.980
		(0.303)		(0.140)
Heavy drinkers without symptoms	14,882	0.045	19,923	0.010
		(0.208)		(0.099)
Heavy drinkers with symptoms	14,882	0.057	19,923	0.010
		(0.231)		(0.101)
Cigarettes				
Nonsmokers	14,882	0.613	19,923	0.678
		(0.487)		(0.467)
Smokers without symptoms	14,882	0.128	19,923	0.093
		(0.334)		(0.291)
Smokers with symptoms	14,882	0.258	19,923	0.229
		(0.438)		(0.420)
Marijuana				
Nonusers	14,882	0.878	19,923	0.935
		(0.327)		(0.246)
Users without symptoms	14,882	0.087	19,923	0.050
		(0.282)		(0.217)
Users with symptoms	14,882	0.035	19,923	0.015
		(0.183)		(0.123)
Other illicit drugs				
Nonusers	14,882	0.920	19,923	0.948
		(0.271)		(0.222)
Users without symptoms	14,882	0.059	19,923	0.038
		(0.236)		(0.192)
Users with symptoms	14,882	0.021	19,923	0.014
		(0.142)		(0.115)

Note: Standard deviations in parentheses. Means and standard deviations are weighted to reflect population estimates.

METHODS

We conducted all analyses separately for men and women. Past research has shown that men and women differ substantially in both their labor market and their substance use behaviors [[29]], [[42]], [[43]], [[44]], [[45]]. Because of these behavioral differences, we decided that separate analyses would provide the best estimates of the relationship between symptoms of dependence and labor market outcomes.

We used a two-step approach to examine the relationship between symptoms of dependence and labor market behavior. First, we used simple means to describe the relationship between symptoms of dependence and labor market outcomes. We calculated the mean of each labor market variable for nonusers and the differential from that mean for users with symptoms and users without symptoms. We tested for the significance of these differentials using t tests. Because the simple mean differentials consider each substance in isolation, they do not control for multiple substance use. Thus, the simple mean differentials describe the relationship between symptoms of dependence and labor market outcomes while ignoring the effects of comorbidities.

Second, we estimated the following ANOVA model for each labor market outcome to examine the impact of comorbidities on the simple mean differentials we found above:

$$\begin{aligned} LM = {} & \alpha + \delta_{1992}\text{NHSDA92} + \delta_{1993}\text{NHSDA93} + \beta_1\text{HVYDRKN} \\ & + \beta_2\text{HVYDRKS} + \beta_3\text{CIGN} + \beta_4\text{CIGS} + \beta_5\ \text{MRJN} \\ & + \beta_5\text{MRJS} + \beta_7\text{OTHN} + \beta_8\text{OTHS} + \varepsilon \end{aligned}$$

where *LM* is one of our labor market outcome variables (i.e., employment status, unemployment status, full-time status, weeks worked, or hours worked); HVYDRKN is an indicator variable for heavy drinkers without symptoms; HVYDRKS is an indicator variable for heavy drinkers with symptoms; CIGN is an indicator variable for cigarette smokers without symptoms; CIGS is an indicator variables for cigarette smokers with symptoms; MRJN is an indicator variable for marijuana users without symptoms; MRJS is an indicator variable for marijuana users with symptoms; OTHN is an indicator variable for other drug users without symptoms; OTHS is an indicator variable for other drug users with symptoms; and ϵ is an error term. The α is the mean of the labor market outcome for individuals who used none of the substances in 1991, and the δ_i are year-specific shifts in that mean.

The β_i can be interpreted as the differential in the mean of the outcome variable for users of a given substance from the mean for individuals who used none of the substances. Because we include all of the substance use/symptom categories in our ANOVA model, the model controls for the comorbidities that our simple means analyses ignored. Thus, β_1 reflects the differential in the mean level of the outcome relative to nonusers for individuals who were heavy drinkers without symptoms of dependence per se. Similarly, β_2 is the differential for individuals who were heavy drinkers with symptoms of dependence.

RESULTS

Table 2 shows the mean of our labor market outcomes for nonusing men and the differential from that mean for substance-using men with and without symptoms by substance. For all labor market outcomes, we find a negative and significant relationship between labor market outcomes and substance use with symptoms of dependence for men. For example, 94% of men who do not use other illicit drugs are employed, but only 72% of men who use other illicit drugs with symptoms are employed, a statistically significant 22 percentage point ($p <$. 01) differential. Also, men who use other illicit drugs and have symptoms of dependence worked an average of 9.5 ($p <$. 01) fewer weeks in the past year and, conditional on being employed, almost 20 ($p <$. 01) fewer hours in the past month than nonusing men did. Although other illicit drug use with

symptoms has the largest differentials, we see a negative relationship between use with symptoms of dependence and labor market outcomes for all of the substances and all of the outcomes in Table 2.

Table 2. Labor Market Behavior of Nonusers, Users Without Symptoms of Dependence, and Users with Symptoms of Dependence: Men

	Employed	Unemployed	Working full time	Weeks worked in past year	Hours worked in past month
Heavy alcohol use					
Nonheavy drinkers (mean)	0.937	0.047	0.957	48.132	175.567
	(0.004)	(0.003)	(0.003)	(0.200)	(1.062)
Heavy drinkers without symptoms (differential from no use)	−0.014	0.015	−0.027	−0.997	−1.725
	(0.013)	(0.012)	(0.018)	(0.727)	(3.573)
Heavy drinkers with symptoms (differential from no use)	−0.087[a]	0.076[a]	−0.018	−4.305[a]	−4.740
	(0.023)	(0.022)	(0.014)	(0.877)	(3.332)
Cigarettes					
Nonsmokers (mean)	0.951	0.037	0.959	48.733	176.655
	(0.004)	(0.003)	(0.004)	(0.224)	(1.033)
Smokers without symptoms (differential from no use)	−0.038[a]	0.033[a]	−0.001	−1.804[a]	−6.537[b]
	(0.010)	(0.009)	(0.008)	(0.500)	(2.555)
Smokers with symptoms (differential from no use)	−0.056	0.043[a]	−0.020[a]	−2.551[a]	−2.364
	(0.009)	(0.007)	(0.007)	(0.421)	(2.398)
Marijuana					
Nonusers (mean)	0.941	0.044	0.958	48.185	176.484
	(0.004)	(0.003)	(0.003)	(0.213)	(1.122)
Users without symptoms (differential from no use)	−0.055[a]	0.055[a]	−0.026[b]	2.371[a]	−10.883[a]
	(0.016)	(0.015)	(0.011)	(0.602)	(2.465)
Users with symptoms (differential from no use)	−0.133[a]	0.102[a]	−0.043	−3.852[a]	−10.898[b]
	(0.022)	(0.022)	(0.023)	(0.714)	(4.604)
Other illicit drugs					
Nonusers (mean)	0.940	0.046	0.958	48.185	175.862
	(0.004)	(0.003)	(0.003)	(0.204)	(1.062)
Users without symptoms (differential from no use)	−0.066[a]	0.056[a]	−0.032[b]	−2.397[b]	−5.449
	(0.017)	(0.015)	(0.014)	(0.644)	(3.458)
Users with symptoms (differential from no use)	−0.216[a]	0.166[a]	−0.105[a]	−9.524[a]	−19.535[a]
	(0.044)	(0.044)	(0.035)	(1.805)	(6.426)

Standard errors in parentheses.
[a] Significantly different from zero at the .01 level.
[b] Significantly different from zero at the .05 level.

Table 3. Labor Market Behavior of Nonusers, Users Without Symptoms of Dependence, and Users with Symptoms of Dependence: Women

	Employed	Unemployed	Working full time	Weeks worked in past year	Hours worked in past month
Heavy alcohol use					
Nonheavy drinkers (mean)	0.721	0.052	0.786	36.530	143.022
	(0.008)	(0.004)	(0.009)	(0.356)	(1.178)
Heavy drinkers without symptoms (differential from no use)	−0.054	0.071	0.129[a]	−0.215	9.635[b]
	(0.060)	(0.040)	(0.028)	(2.158)	(4.168)
Heavy drinkers with symptoms (differential from no use)	−0.151[a]	0.106[a]	0.067	−4.003	−14.003
	(0.055)	(0.036)	(0.039)	(2.494)	(9.850)
Cigarettes					
Nonsmokers (mean)	0.729	0.037	0.775	36.737	140.960
	(0.009)	(0.005)	(0.011)	(0.417)	(1.477)
Smokers without symptoms (differential from no use)	−0.049[b]	0.048[a]	0.068[a]	−1.413	8.167[b]
	(0.021)	(0.015)	(0.019)	(0.926)	(3.296)
Smokers with symptoms (differential from no use)	−0.024	0.051[a]	0.031	−0.513	5.760[b]
	(0.015)	(0.010)	(0.018)	(0.731)	(2.473)
Marijuana					
Nonusers (mean)	0.720	0.049	0.787	36.507	142.952
	(0.008)	(0.004)	(0.010)	(0.370)	(1.215)
Users without symptoms (differential from no use)	−0.022	0.707[a]	0.010	−0.340	2.910
	(0.025)	(0.019)	(0.025)	(1.171)	(3.111)
User with symptoms (differential from no use)	0.009	0.059[b]	0.035	−0.172	−6.766
	(0.040)	(0.026)	(0.042)	(2.172)	(5.473)
Other illicit drugs					
Nonusers (mean)	0.719	0.052	0.787	36.536	142.825
	(0.008)	(0.004)	(0.010)	(0.361)	(1.172)
Users without symptoms (differential from no use)	0.030	0.022	0.018	0.106	3.908
	(0.024)	(0.015)	(0.029)	(1.092)	(3.584)
Users with symptoms (differential from no use)	−0.106[b]	0.079[a]	0.015	−4.031	0.519
	(0.048)	(0.029)	(0.058)	(2.356)	(8.396)

Standard errors in parentheses.
[a] Significantly different from zero at the .01 level.
[b] Significantly different from zero at the .05 level.

Table 2 shows a similar pattern for substance use without symptoms of dependence, although the differentials are generally smaller in magnitude than those associated with use with symptoms of dependence. We see that cigarette use without symptoms of dependence, marijuana use without

symptoms of dependence, and other illicit drug use without symptoms of dependence are significantly and negatively related to labor market outcomes.

Table 3 shows the results of our means analyses for women. Our results suggest that substance-using women who have symptoms of dependence are less likely to be employed than their nonusing counterparts are, but the relationship with the amount worked (i.e., full-time status, weeks worked in the past year, and hours worked in the past month) is mixed. For example, women who are heavy drinkers with symptoms of dependence had an employment rate that was almost 15 percentage points ($p <. 01$) lower than that of women who are not heavy drinkers, and they had an unemployment rate that was almost 11 percentage points ($p <. 01$) higher. However, women who are heavy drinkers with symptoms of dependence had insignificant differentials from their nonheavy drinking counterparts for the percentage working full time, the number of weeks worked in the past year, and the number of hours worked in the past month. Furthermore, the differential for working full time was positive, while the differential for the number of hours worked in the past month was negative. This suggests that substance use with symptoms of dependence is associated with both a higher probability of currently working full time and a lower number of hours worked in the past month and indicates a mixed relationship. We find similar results for substance use with symptoms of dependence for cigarettes, marijuana, and other illicit drugs.

The differentials associated with use without symptoms of dependence reported in Table 3 also suggest a mixed relationship with labor market outcomes for women. Both heavy drinking without symptoms of dependence and cigarette smoking without symptoms of dependence are associated with an increase in the likelihood of working full time and an increase in the number of hours worked. However, cigarette smoking without symptoms of dependence is associated with a lower probability of being employed and a higher probability of being unemployed for women, and marijuana use without symptoms of dependence is associated a higher probability of unemployment.

Table 4 reports our ANOVA results for men. The coefficient estimates represent the differential in the mean of the outcome variable for users of a given substance from the mean for individuals who used no substances at all. Because we include all of the substance use/symptom categories in our ANOVA model, the model controls for the comorbidities that our means analyses ignored. In general, we still see a negative relationship between labor market outcomes and substance use with symptoms of dependence for men. However, the magnitude of this relationship is smaller once we control for comorbidities. For example, “other drug”–using men who have symptoms of dependence have an employment rate that is 16 percentage points lower than the employment rate of men who used no substances. Although this differential still represents a substantial decline in employment rates, it is considerably smaller than the 22 percentage point differential we saw in Table 2. Looking across all labor market outcomes and all substances, we see that the differentials associated with substance use with symptoms of dependence for any particular substance are overstated when we failed to account for the other substances used by individuals.

Table 4. ANOVA Results for Men

	Employed	Unemployed	Working full time	Weeks worked in past year	Hours worked in past month
Heavy drinking without symptoms	−1.97E-04	0.001	−0.023	−0.377	1.223
	(0.013)	(0.012)	(0.019)	(0.705)	(3.651)
Heavy drinking with symptoms	−0.048[a]	0.046[a]	−0.003	−2.846[b]	−1.871
	(0.021)	(0.020)	(0.013)	(0.801)	(3.444)
Cigarette use without symptoms	−0.032[b]	0.028[b]	0.003	−1.512[b]	−6.000[a]
	(0.010)	(0.009)	(0.009)	(0.482)	(2.592)
Cigarette use with symptoms	−0.037[b]	0.027[b]	−0.014	−1.844[b]	−0.754
	(0.008)	(0.006)	(0.008)	(0.410)	(2.488)
Marijuana use without symptoms	−0.022	0.028[a]	−0.010	−0.716	−9.589[b]
	(0.016)	(0.014)	(0.011)	(0.537)	(2.768)
Marijuana use with symptoms	−0.065[b]	0.050[a]	−0.014	−0.572	−7.870
	(0.023)	(0.022)	(0.024)	(0.868)	(5.117)
Other drug use without symptoms	−0.034	0.027	−0.023	−1.309	−0.523
	(0.018)	(0.016)	(0.015)	(0.697)	(3.740)
Other drug use with symptoms	−0.164[b]	0.123[b]	−0.092[b]	−8.049[b]	−13.767[a]
	(0.044)	(0.043)	(0.035)	(1.845)	(6.731)
Intercept	0.954[b]	0.033[b]	0.962[b]	49.481[b]	178.148[b]
	(0.007)	(0.006)	(0.006)	(0.280)	(1.770)
1992 intercept shift	0.000	−0.001	0.005	−0.824[a]	−2.356
	(0.009)	(0.008)	(0.008)	(0.415)	(2.381)
1993 intercept shift	0.010	−0.006	−0.002	−0.542	0.492
	(0.009)	(0.008)	(0.008)	(0.420)	(2.519)
Model F	8.710	6.380	2.430	9.730	4.050
p	0.000	0.000	0.008	0.000	0.000

Standard errors in parentheses.
[a] Significantly different from zero at the .05 level.
[b] Significantly different from zero at the .01 level.

The differentials associated with use without symptoms in Table 4 are also smaller than their Table 2 counterparts. We see significant differentials associated with cigarette use without symptoms and with marijuana use without symptoms. However, none of the differentials associated with other illicit drug use without symptoms of dependence are significant after controlling for multiple substance use.

Table 5 presents our ANOVA results for women. Comparing the differentials in Table 5 to those in Table 3, we see that controlling for comorbidities has the same effect on the estimated differentials for women as it does for men—it decreases the magnitude of the differential. Furthermore, this decrease in magnitude makes many of the differentials insignificant. For example, the differential associated with heavy drinking with symptoms of dependence falls from a significant 11 percentage points in Table 3 to an insignificant 7 percentage points in Table 5. Thus, our failure to control for comorbidities in Table 3 affected not only the magnitude of our estimate, but also the results of our hypothesis tests. Controlling for comorbidities did not, however, affect the sign of the differentials in most cases. Thus, the results in Table 5 still suggest that substance-using women who have symptoms of dependence are less likely to be employed than their nonusing counterparts are, but the relationship with the amount worked is still mixed. Controlling for comorbidities also reduced the magnitude of the differentials associated with use without symptoms for women but had little impact on significance levels.

Table 5. ANOVA Results for Womn

	Employed	Unemployed	Working full time	Weeks worked in past year	Hours worked in past month
Heavy drinking without symptoms	−0.041	0.042	0.113[a]	0.166	6.847
	(0.062)	(0.042)	(0.029)	(2.129)	(4.323)
Heavy drinking with symptoms	−0.136[b]	0.068	0.054	−3.358	−16.920[b]
	(0.053)	(0.035)	(0.041)	(2.464)	(9.924)
Cigarette use without symptoms	−0.044[b]	0.040[a]	0.064[a]	−1.231	8.085[b]
	(0.021)	(0.014)	(0.019)	(0.933)	(3.301)
Cigarette use with symptoms	−0.020	0.044	0.028	−0.394	6.211[b]
	(0.015)	(0.010)	(0.018)	(0.750)	(2.550)
Marijuana use without symptoms	−0.006	0.050[b]	−0.013[a]	0.263	0.259
	(0.028)	(0.020)	(0.027)	(1.295)	(3.417)
Marijuana use with symptoms	0.040	0.031	0.019	0.949	−9.397
	(0.040)	(0.024)	(0.043)	(2.110)	(5.947)
Other drug use without symptoms	0.044	−0.008	0.003	0.384	3.387
	(0.025)	(0.014)	(0.032)	(1.110)	(3.828)
Other drug use with symptoms	−0.087	0.039	−0.002	−3.827	2.897
	(0.049)	(0.027)	(0.059)	(2.386)	(7.797)
Intercept	0.725[a]	0.033[a]	0.773[a]	36.889[a]	139.260[a]
	(0.012)	(0.006)	(0.014)	(0.602)	(1.898)
1992 intercept shift	−0.009	0.006	0.010	−1.317	2.274
	(0.016)	(0.009)	(0.017)	(0.845)	(2.272)
1993 intercept shift	0.021	0.000	−0.005	0.862	2.721
	(0.017)	(0.010)	(0.019)	(0.769)	(2.457)
Model *F*	2.250	6.270	3.110	1.520	2.000
p	0.015	0.000	0.001	0.129	0.032

Standard errors in parentheses.
[a] Significantly different from zero at the .01 level.
[b] significantly different from zero at the .05 level.

DISCUSSION

Both our simple means analyses and our ANOVA analyses provide interesting insights into the relationship between substance use with symptoms of dependence and labor market behaviors for men and women. For both men and women, our results indicate that substance use with symptoms of dependence is associated with lower employment and higher unemployment. For men, substance use with symptoms of dependence is also associated with a lower likelihood of full-time employment, fewer weeks worked in the past year, and fewer hours worked in the past month. For women, however, we find a mixed relationship between substance use with symptoms of dependence and the amount worked (i.e., full-time status, weeks worked in the past year, and hours worked in the past month). For both men and women, we overestimated the magnitude of these relationships when we failed to control for multiple substance use. The reduction in magnitude that resulted from controlling for comorbidities was substantial, and the conclusions of our hypothesis tests were altered for women.

Although we purposefully kept our analyses simple to focus on symptoms of dependence and comorbidities, by doing so our analyses have two important limitations. First, both our univariate and our ANOVA analyses were purely descriptive and therefore cannot be used to infer

causality. Thus, we cannot state that substance use with symptoms of dependence causes unemployment, but instead that it is associated with higher unemployment rates.

Second, we omitted covariates that may be correlated with substance use or symptoms of dependence, such as income or marital status, from our ANOVA models. Omitting these variables from our ANOVA models ensures that any differences between the results from our means analyses and those from our ANOVA models are due solely to controlling for comorbidities. Had we included other covariates in our ANOVA model, we would have been unable to distinguish the effect of controlling for comorbidities from the effects of controlling for the other covariates. On the other hand, because we did not control for other covariates, we cannot rule out the possibility that our results are biased estimates of the relationship between substance use with symptoms of dependence and labor market outcomes.

To assess the sensitivity of our results to the inclusion of these covariates, we estimated ANOVA models that included variables measuring race, education, marital status, and age. For men, we found that our differentials were slightly smaller in magnitude than those reported in Table 4, which reduced significance levels only slightly. For women, we found that some differentials were reduced in magnitude, while others were increased. The effect on significance levels was that one differential, cigarette use without symptoms, became insignificant, while two differentials, heavy drinking with symptoms of dependence and marijuana use with symptoms of dependence, became significant.

Despite the simplicity of our analyses, our results have important implications for research and policy. Past research on the impact of substance use per se on labor market outcomes has failed to find a consistent relationship [[19]], [[20]], [[21]], [[22]], [[23]], [[24]], [[25]], [[26]], [[27]], [[28]]. Our research suggests that more reliable results may be found by examining substance use with symptoms of dependence instead of use per se. Beyond the health economics literature, our results have implications for researchers attempting to understand the etiology of workplace problems. Recent research indicates that the impact of alcohol use on workplace problems such as on-the-job drunkenness or absenteeism may be mediated by dependence, that is, the correlation between use and problems goes to zero when dependence is controlled for [[46]], [[47]], [[48]], [[49]]. Our results augment this literature by suggesting that the mediating effects of dependence may extend beyond on-the-job behaviors to a wider range of labor market outcomes.

Finally, our results highlight the fact that few illicit drug users consume a single substance, and multiple substance use often interacts in complex ways. Both researchers and policymakers need to be aware of the importance of comorbidities in the relationship between symptoms of dependence and labor market outcomes. Although it is tempting to decompose a substance abuse problem into an alcohol problem or a marijuana problem, our results indicate that we may do better to examine the full spectrum of substance use when conducting research or formulating policy.

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