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Estimating absenteeism related to non-alcohol substance use in a US national cohort of full-time employees

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Abstract

Objective: We aimed to estimate absenteeism due to substance use disorder among full-time employees.

Methods: We used the 2018 National Survey on Drug Use and Health to identify a sample of individuals employed full-time. We used a survey-weighted multivariable negative binomial model to evaluate the association between absenteeism and type of substance use disorder controlling for available demographic information.

Results: In the adjusted model, we estimated opioid use without a disorder had the highest absenteeism for use, and polysubstance use disorder had the highest absenteeism among use disorders. In a hypothetical firm of 10,000 employees, we estimate \$232,000 of lost wage value annually.

Conclusions: Substance use is associated with absenteeism and presents a compelling argument for employers to promote programs that support treatment for employees and reduce downstream costs associated with absenteeism and turnover.

Keywords

opioid use disorder; substance use disorder; treatment; absenteeism; employer cost

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Ethical considerations: Boston University IRB ruled this study not human subjects research (retrospective analysis of anonymous publicly available data)

Introduction

The toll of substance use disorders (SUD) in the United States is staggering. Opioid use alone is the leading cause of unintentional death for Americans¹ and extracts annual societal costs of approximately \$787 billion related to health care, premature mortality, criminal activity, and productivity loss.² Concurrently, emerging evidence indicates an increasing burden of stimulant use disorder,³ injection behaviors,⁴ and polysubstance use.⁴⁻⁶ Despite the prevalence of SUD, evidence-based treatment is underutilized, even among those with employer-sponsored commercial health insurance.^{7,8} For some SUD, such as opioid use disorder, treatment has been shown to be beneficial by reducing cravings, increasing abstinence, and reducing mortality; thereby, making it a key component to addressing the economic and public health consequences of these disorders.^{9,10}

Employers have a potential role to play in the U.S. substance use epidemic, because they provide health insurance for over half (55%) of Americans.¹¹ The number of persons who receive care for SUD could potentially increase greatly if employers were to insist that the health insurance products provided to employees cover evidence-based treatments for SUD. Employers could also implement initiatives to encourage employees to take advantage of the services provided, the number of persons who receive such care could greatly increase. Such expansion of benefits would come at a cost, and in a market-driven private sector, it is not realistic to expect employers to embrace that cost out of altruism alone. However, with additional data on the costs incurred by their businesses as a result of untreated or undertreated SUD, employers could make more informed decisions on how best to address this issue; given the costs associated with turnover, the best decision would likely be mutually beneficial to employers and current employees with an SUD.

The burden of SUD nationally is well documented, but the effect of SUD on employers specifically is not well understood. Previous work has largely focused on opioid use disorder alone,^{12,13} which substantially underestimates the extent of substance use employers face in the workplace. The multi-substance work that exists¹⁴ does not differentiate between the effect of casual or infrequent substance use, and the presence of a disorder, a necessary distinction for informing the most efficient use of employer resources to mitigate the aforementioned costs. Unstable employment and absenteeism are frequently cited concerns of untreated substance use,¹⁵ but the effects of substance use are most often studied in terms of overdose and increased healthcare utilization.^{7,13,16}

Employers, in addition to their employees with SUD, stand to benefit from SUD treatments that can reduce downstream healthcare costs (which contribute to the insurance premiums paid by employers and employees) and the costs associated with absenteeism and turnover. This mutual interest in the health of employees has driven the advent of employer assistance or wellness programs, which promise to support the health of employees while benefiting the employer's bottom-line. These programs can be helpful in encouraging health behaviors and educating or linking employees to care that their insurance covers, but that they are not utilizing, possibly because they are unaware. For example, medications for opioid use disorder are widely covered by commercial insurance, but are underutilized.⁸ However, while 4 out of 5 large US employers offer an employer wellness program,¹⁷ a minority

of individuals reporting substance use describe working for an employer with a wellness program featuring substance use components.^{18,19} Furthermore, while some employers have sought out information on substance use generally through drug testing, for example, the largest benefits of wellness programs could come from the facilitation of treatment for those with a use disorder rather than testing for casual use. To better evaluate the potential benefits to employers of treating substance use disorders over testing for casual use, more evidence is needed to understand the absenteeism costs of substance use and use disorder. There is limited research in this area, with the most recent absenteeism estimates based on 2014 data¹⁴ – which precedes important changes in substance use epidemics, including fentanyl proliferation in opioids²⁰⁻²² and stimulants,²³ the increase of polysubstance use,²⁴ as well as the increasing availability of marijuana for recreational use and corresponding changes in social norms around use.^{25,26} Furthermore, there has been no comparison of absenteeism costs associated with substance use versus use disorder. This is critical, as the return on investment (ROI) of resources committed to policies focused on the detection of substance use generally, is likely to differ from the ROI of resources used to encourage diagnosis of SUD and access to treatment. This study quantifies the potential benefit to US employers of addressing active substance use and use disorder in the workplace, by estimating and comparing the costs associated with absenteeism among persons who report working full time and using substances (with and without an indicated use disorder), to those who report no substance use.

Materials and Methods

Population and cohort design

We created our analytic cohort from the publicly available 2018 release of the National Survey on Drug Use and Health (NSDUH). NSDUH estimates the prevalence of non-alcohol substance use in the United States civilian, noninstitutionalized population aged 12 and older; we narrowed our scope to focus on individuals who are currently working full-time. The 2018 NSDUH is the 38th iteration of this survey and included a total sample of 67,791 interviews conducted in 2018. To estimate the effect of substance use on absenteeism, we examined six different substance categories: 1) opioid misuse (including heroin or other opioids not used as prescribed by a doctor); 2) marijuana use; 3) prescription stimulant misuse (not used as directed by a provider); 4) cocaine use; 5) methamphetamine use; and 6) two or more substances. To distinguish between substance use and use disorder, we created three cohorts based on self-reported substance use questionnaires asking about use over the previous 12 months: 1) individuals reporting any use of one of the substances; 2) those who met the Diagnostic and Statistical Manual of Mental Illness, Fifth Edition (DSM-V) criteria for an SUD based on their responses to survey questions; and 3) a control group with no reported substance use or use disorder. These categories are non-overlapping; i.e., we are comparing: 1) those who report substance use, but do not meet the criteria for a use disorder; 2) those who do meet the criteria for a use disorder, and; 3) a control cohort with no reported substance use in the prior 12 months.

Outcome Measures

The primary outcome was absenteeism. We defined this based on the higher of two answers to: “During the past 30 days [...], how many whole days of work did you miss because you were sick or injured?” and “During the past 30 days, [...] how many whole days of work did you miss because you just didn't want to be there?” We used the higher of these two values, instead of summing them, due to some individuals reporting values with a sum of more than 30 missed days.

Analysis

First, we characterized each cohort based on demographic characteristics including age, gender, marital status, education, race, ethnicity, and population density of the county of residence. Next, we developed a multivariable statistical model of absenteeism, consisting of the control cohort (i.e., persons with no reported substance use in the prior 12 months); persons who report substance use, but do not meet the criteria for a use disorder, and; persons with an SUD. We weighted the regression to represent the national census-based population and to incorporate the complex survey design of NSDUH. We tested for overdispersion to help determine whether a Poisson or negative binomial distribution would provide the best model fit for the observed absenteeism data, controlling for the aforementioned characteristics. Finally, we calculated the cost associated with absenteeism among those substance use and SUD categories significantly associated with absenteeism in the statistical model. For each category we multiplied the predicted mean annual missed days by median annual wage. NSDUH does not provide individual-level wage or salary information; thus, we utilized nationally-representative, age, sex, and education stratified wages from the Bureau of Labor Statistics (BLS)²⁷ to calculate a weighted wage that reflected the age-sex distribution of our study sample.

Sensitivity analyses

We conducted several sensitivity analyses to test the robustness of our results. First, we considered an alternative measure of missed work days by summing the two measures (“During the past 30 days [...], how many whole days of work did you miss because you were sick or injured?” and “During the past 30 days, [...] how many whole days of work did you miss because you just didn't want to be there?”) and capping the result of the summation at 30 days. Second, in recognition that marijuana can be prescribed for medical use in states with medical legalization, we evaluated stratifying our marijuana use measure by those who attested that their marijuana use was “recommended by a doctor or other health care professional” versus those who did not attest to this. Thirdly, we sought to assess whether missed work days associated with marijuana use differed in states with or without legalization for medical use. To that end we stratified marijuana use by whether a participant lived in a state where a “law or initiative allowing the use of marijuana for medical reasons had been passed” (there was no question specific to legalization for recreational purposes).

Results

In the nationally weighted sample of 114,054,678 individuals employed full time: 20,853,616 (18%) reported illicit substance use without a disorder (including marijuana,

but not alcohol or tobacco); 2,943,571(3%) met the DSM-V criteria for an SUD based on their survey responses, and; 90,257,491 (79%) reported no substance use in the past 12 months. Overall, SUD was less common than any substance use, and the proportion of those with SUD versus those reporting any substance use differed by substance (Table 1). There were notable demographic differences among the three cohorts as well. In general, we found that those with no reported substance use (the control group) were older, and more likely to be married, and a college graduate, compared to those who used any substances (chi-square p -value<0.05).

We fit a regression model to predict the annual days missed for those in each substance use and SUD category, as well as those who reported no substance use or SUD. Our survey-weighted multivariable negative binomial model found that marijuana, opioid, and polysubstance use without a disorder were significantly associated with higher absenteeism compared to no substance use, with incident rate ratios (IRRs) ranging from 1.38 (marijuana use, 95% confidence interval (CI) 1.23-1.55) to 1.82 (opioid use, 95% CI 1.18-2.79) (Table 2). Every type of SUD was associated with more annual missed work days than the control group ranging from 1.79 times as many missed work days for marijuana use disorder (95% CI 1.39-2.30) to 3.44 for polysubstance use disorder (95% CI 2.82-4.47).

We next used our fitted model to predict the days of missed work for each substance use and disorder category found to be significantly associated with absenteeism in the negative binomial model and for the control group (Table 3). The control condition, no substance use, predicted the lowest number of average annual missed workdays (9). Excess missed days relative to no use ranged from a low of 3 excess days (marijuana use) to 7 excess days (opioid use) for substance use without a disorder and a low of 7 days (marijuana use disorder) to 23 excess missed days (polysubstance use disorder) for SUD (Table 3). We used age, sex, and education stratified wage data from the BLS to calculate a per-employee absenteeism cost of \$1,800 in the control, no substance use group. The stratified wage estimates for substance use without a disorder imply an excess average lost value per worker per year ranging from \$600 to \$1,200. For SUD, average yearly lost value ranged between \$1,200 and \$3,700 per worker relative to those with no use or disorder (Table 3).

Results of sensitivity analyses

All three sensitivity analyses demonstrated robustness in our results. First, summing the missed work measures instead of taking the higher of the two yielded a 0.2 additional missed days per month on average, and all of our regression estimates had overlapping confidence intervals with the baseline results (Supplemental Table 1). Second, we did not find a significance difference between those who attested their marijuana use was recommended by a provider versus not in terms of missed days: the IRR for marijuana use recommended by a provider was 1.35 versus 1.45 when not recommended, but the confidence intervals overlapped (95% CI 1.21-1.49 and 1.14-1.87, respectively) (Supplemental Table 2). Third, we did not find a significance difference when stratifying the effect of marijuana use on missed work days based on legalization in the state, with the confidence intervals for the estimates overlapping in this case as well (Supplemental Table 3). Because we did not

observe a statistically significant difference in the estimates for the sensitivity analyses, we did not re-calculate the cost of absenteeism for these scenarios.

Discussion

In this study of workplace absenteeism, we found that, on average, individuals who reported any illicit substance use in the past 12 months, had more missed days of work than those who had not, and this effect was largest in those with an SUD. In the case of marijuana, having a use disorder versus any use was only associated with 4 additional days of missed work, but in the case of polysubstance, having more than one use disorder was associated with 18 more days (over three work weeks) of missed work than polysubstance use without a disorder. Based on our weighted population estimates of substance use (20,078,377 individuals with substance use significantly associated with excess missed days), SUD (2,943,571 individuals), non-using individuals (90,257,491), and our weighted wage estimate, this implies a national cost to employers of 10.9 and 5.5 billion dollars per year in lost wages attributable to substance use without a disorder and SUD, respectively. In a hypothetical firm with 10,000 employees, these numbers correspond to 1,760 employees using one of the substances (without a disorder) associated with excess missed days, and 258 with an SUD, contributing a total of 6,528 and 3,148 hours of excess missed work, respectively, compared to employees not using substances. The combined wage value of time lost for this hypothetical firm would be \$232,000 per year. Previous studies have shown that treatment for SUD can reduce both active substance use and absenteeism^{9,15}; thus, reducing barriers to SUD treatment may be an efficient (and hence profit-maximizing) way for employers to address the excess absenteeism associated with SUD.

One possible, but mistaken, interpretation of these data is that firms should identify substance use and substance use disorder and not hire those people, and even replace those who have already been hired. First, were firms to replace all people who use substances or have a substance use disorder, they would be excluding or replacing 21% of the current workforce according to our weighted estimate. Clearly, by excluding 21% of the current workforce, employers would be routinely overlooking highly skilled and talented labor, which would likely limit long-term productivity and success, similar to systematic discrimination in all hiring practices.^{14,28-30} Further, a large cost that we are unable to capture in this analysis is the cost of employee turnover. Prior studies indicate that this cost is substantial and consists not only of advertising dollars, but also lost productivity (and potentially quality) resulting from the time spent by: a) others in searching for and training a replacement, conducting exit interviews, etc.; b) the departing employee in preparing to leave; c) the new employee in getting comfortable with required tasks in a new setting; and d) miscellaneous costs, including severance pay, certifications, uniforms, etc. One study reviewed 30 case studies of the economic costs of employee turnover, and found a range of costs equal to 5.8% to 213% of an employee's annual salary, with a median value of ~21%.³¹ Our estimated hourly wage of \$20.31 translates to an annual salary of \$42,245, indicating a typical turnover cost of \$8,871; thus, for the typical employee using substances, the cost of turnover outweighs the cost of absenteeism by \$7,671. By ensuring treatment for substance use disorder is readily available for employees, employers are likely to benefit

from both increased productivity among employees who obtain treatment, and reduced downstream healthcare costs/insurance premiums.

Given the continuing epidemic of opioid overdose³² and the burden of polysubstance use disorders, it is more important than ever to characterize the effects of untreated SUD and explore the potential benefits of increasing access to treatment or harm reduction measures such as naloxone distribution³³ in contexts infrequently discussed, such as places of employment. A strength of the current study is a novel employer-based cost perspective that can offer important insights for real-world policy making. Because employer-based health insurance is the dominant form in the United States, it is critical that employers have a thorough understanding of the costs associated with failing to address SUDs among their workforce.

Our study has several limitations. Due to the nature of the survey, we were not able to capture actual wages or even industry information that could have improved the accuracy of our absenteeism cost. This may affect our calculations if individuals who use substances or have an SUD work in systematically lower or higher paid positions than the control group; however, given that 70% of the pre-weighted sample either uses substances periodically or has an SUD due to the targeting of NSDUH, this is unlikely. Even if those who use substances or have an SUD are paid more or less on average, our estimates are conservative in that: 1) we capture only the wages associated with absenteeism, not turnover costs that may result from persistent absenteeism or the cost of additional hiring need to cover for employment inefficiencies, and; 2) we defined days absent based on the higher (as opposed to the sum) of two answers to questions asking about days missed due to illness or injury, versus days missed due to not wanting to be there, although a sensitivity analysis revealed this did not significantly change results. Additionally, because we defined SUD based on self-report from NSDUH, we may be underestimating the number of individuals who use substances or have an SUD due to social desirability-bias and the stigma associated with substance use. Next, we were unable to fully capture the nuance of changing marijuana legalization status. While we included a sensitivity analysis of whether or not marijuana was legal for medical use in a participant's state, there was no question specific to legalization for recreational use, and no other geographic identifier of where the participant resided. We encourage further research to evaluate how legalization status, specifically medical vs. recreational, affects absenteeism outcomes. Finally, we calculate annual estimates based on survey responses from the previous 30 days, which assumes that NSDUH captures a representative month.

Conclusion

This paper demonstrates to employers the real, and substantial, cost of unaddressed SUD in their workforce. Moreover, attempting to avoid those costs would not be an optimal strategy, given the even larger costs of attempting to exclude this population from their workforce and applicant pool, such as with pre-employment drug tests. Assuming the characteristics of the labor pool reflect those of the labor force, employers should consider the fact that screening and removing candidates who use substances would reduce the number of applicants by ~20%, which would severely limit the number of talented candidates, resulting in further

downstream costs in the way of reduced productivity and quality. These same firms would eventually find themselves competing in a greatly limited labor pool, driving up wages for potentially lower quality employees.

The magnitude of the absenteeism cost is higher among those meeting criteria for substance use disorder than for those only reporting use, suggesting that interventions aimed at preventing SUDs, and mitigating the negative effects of SUDs by lowering barriers to, and incentivizing use of, evidence-based treatments, have the potential to produce the largest returns on investment for employers. Employers negotiating for more comprehensive insurance products or investing in wellness programs with specific support for those with substance use disorder stand a better chance of recouping the wage-value lost due to absenteeism, than those without such provisions. Were employers to place their substantial economic power behind the drive to increase coverage for and access to substance use treatment, they could become a major force for change and a powerful ally in the fight against the SUD epidemic in America.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1:

Weighted demographic characteristics of full -time employees with and without reported substance use in the National Survey of Drug Use and Health in 2018

	Substance use or misuse without disorder		Substance use disorder		No reported substance use or disorder (control)		Chi-square p-value
	n	%	n	%	n	%	
Total	20,853,616	100%	2,943,571	100%	90,257,491	100%	
Substance*							
Marijuana	14,660,617	70%	1,487,890	51%	N/A	N/A	
Cocaine	213,564	1%	254,585	9%	N/A	N/A	
Opioid	1,691,503	8%	498,865	17%	N/A	N/A	
Prescription stimulant	477,297	2%	189,100	6%	N/A	N/A	
Methamphetamine	84,379	0%	235,898	8%	N/A	N/A	
>1 substance	3,726,257	18%	277,232	9%	N/A	N/A	
Sex							
Male	12,366,183	59%	2,068,909	70%	50,622,266	56%	<0.01
Female	8,487,433	41%	874,662	30%	39,635,225	44%	
Age							
12-17	82,929	0%	35,091	1%	371,887	0%	<0.01
18-25	4,260,634	20%	919,735	31%	7,859,281	9%	
26-34	6,350,133	30%	978,585	33%	16,675,248	18%	
35-49	6,039,952	29%	672,752	23%	31,820,077	35%	
>=50	4,119,967	20%	337,409	11%	33,530,998	37%	
>=50	4,119,967	20%	337,409	11%	33,530,998	37%	
Marital Status							
Married	7,535,402	36%	662,053	22%	54,544,230	60%	<0.01
Widowed	244,797	1%	72,238	2%	1,592,062	2%	
Divorced or Separated	2,927,342	14%	368,662	13%	12,329,991	14%	
Never Married	10,146,074	49%	1,840,618	63%	21,791,208	24%	
Education							
Under 18 years old	82,929	0%	35,091	1%	371,887	0%	<0.01
Less than high school	1,258,828	6%	289,542	10%	6,770,588	8%	
High school graduate	4,234,377	20%	717,404	24%	18,625,604	21%	
Some college/Associates	7,264,986	35%	1,019,385	35%	27,593,650	31%	
College graduate	8,012,497	38%	882,150	30%	36,895,761	41%	
Race							
White non-Hispanic	14,410,744	69%	1,932,781	66%	57,348,401	64%	<0.01
Black non-Hispanic	2,260,912	11%	344,655	12%	9,716,709	11%	
Native American/Alaska native	106,638	1%	9,570	0%	430,847	0%	
Native Hawaiian/Pacific Islander	62,740	0%	27,596	1%	263,654	0%	
Asian non-Hispanic	63,860	0%	82,268	3%	6,032,389	7%	
More than one race non-Hispanic	458,649	2%	82,778	3%	1,356,916	2%	
Hispanic	2,915,333	14%	463,923	16%	15,108,576	17%	
County population density							

	Substance use or misuse without disorder		Substance use disorder		No reported substance use or disorder (control)		Chi-square p-value
	n	%	n	%	n	%	
Large metropolitan	12,909,378	62%	1,645,292	56%	50,546,417	56%	<0.01
Small metropolitan	5,750,921	28%	976,171	33%	26,600,670	29%	
Non-metropolitan	2,193,317	11%	322,108	11%	13,110,405	15%	

Occasionally category totals will not add to overall total due to rounding as these are weighted estimates rather than observed counts.

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Table 2:

Adjusted negative binomial regression model predicting the effect on substance use or substance use disorder on missed work days.

	Incident rate ratio (95% confidence interval)
Substance use and SUD	
No substance use/SUD	Reference
Marijuana use without SUD *	1.38 (1.23-1.55)
Cocaine use without SUD	1.03 (0.52-2.04)
Opioid use without SUD *	1.82 (1.18-2.79)
Prescription stimulants not used as directed without SUD	1.65 (0.60-4.49)
Methamphetamine use without SUD	0.62 (0.14-2.78)
>1 substance use without SUD *	1.51 (1.27-1.79)
Marijuana use disorder *	1.79 (1.39-2.30)
Cocaine use disorder *	2.48 (1.69-3.64)
Opioid use disorder *	2.91 (1.85-4.57)
Prescription stimulants use disorder *	3.24 (2.04-5.15)
Methamphetamine use disorder *	2.63 (1.43-4.84)
>1 SUD *	3.55 (2.82-4.47)
Sex	
Male	Reference
Female *	1.17 (1.04-1.31)
Age years	
17-25 *	1.15 (1.00-1.33)
26-34	Reference
35-49 *	0.83 (0.73-0.95)
50 or Older *	0.70 (0.62-0.81)
Marriage status	
Married	Reference
Widow	0.95 (0.63-1.42)
Divorced or Separated *	1.19 (1.01-1.40)
Never Married	1.07 (0.96-1.19)
Education	
Under 18 *	1.33 (1.07-1.65)
Less high school	1.06 (0.91-1.24)
High school grad	1.08 (0.95-1.22)
Some college	Reference
College graduate	1.15 (0.83-1.59)
Race/ethnicity	
White non-Hispanic	Reference

	Incident rate ratio (95% confidence interval)
Black non-Hispanic*	1.31 (1.13-1.51)
Native American/Alaska native	1.45 (0.95-2.20)
Native Hawaiian/Pacific Islander	1.34 (0.90-2.01)
Asian non-Hispanic	1.08 (0.83-1.39)
More than one race non-Hispanic	0.85 (0.65-1.10)
Hispanic	0.96 (0.82-1.13)
County population density	
Large metropolitan	Reference
Small metropolitan	1.06 (0.93-1.21)
Non-metropolitan	1.06 (0.92-1.22)

SUD=Substance use disorder

* Statistically significant at $p < 0.05$

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Table 3:

Predicted absenteeism corresponding lost wage value with and without substance use and substance use disorder

	Any substance use			Substance use disorder		
	Average annual missed days per worker	95% CI	Average wage value lost per worker per year*	Average annual missed days per worker	95% CI	Average wage value lost per worker per year*
No substance use (control)	9	(9 - 9)	\$1,800	9	(9 - 9)	\$1,800
Marijuana	12	(11 -14)	\$2,200	16	(12 - 20)	\$2,800
Cocaine		<i>NA</i>		22	(14 - 31)	\$3,800
Opioid	16	(9 - 23)	\$3,000	26	(15 - 38)	\$4,500
Stimulant		<i>NA</i>		29	(16 - 43)	\$5,000
Methamphetamine		<i>NA</i>		24	(9 - 38)	\$4,200
>1 substance	14	(11 - 16)	\$2,600	32	(25 - 39)	\$5,500

NA = Not applicable. These categories were not associated with excess absenteeism in the adjusted model, so do not contribute to excess cost related to absenteeism.

* In 2019 dollars, based on full-time employee working an 8-hour day with a median hourly wage weighted by age, sex, and education from the Bureau of Labor Statistics. Rounded to the nearest \$100.