Austin, Wesley A.; Skinner, Sarah J.; Watson, John K.

Article

An examination of non-addictive drug (mis)use and work absenteeism

Journal of Applied Economics

Provided in Cooperation with:
University of CEMA, Buenos Aires

Suggested Citation: Austin, Wesley A.; Skinner, Sarah J.; Watson, John K. (2020) : An examination of non-addictive drug (mis)use and work absenteeism, Journal of Applied Economics, ISSN 1667-6726, Taylor & Francis, Abingdon, Vol. 23, Iss. 1, pp. 149-162, https://doi.org/10.1080/15140326.2019.1709013

Journal of Applied Economics

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/recs20

An examination of non-addictive drug (mis)use and work absenteeism

Wesley A. Austin, Sarah J. Skinner & John Keith Watson

To cite this article: Wesley A. Austin, Sarah J. Skinner & John Keith Watson (2020) An examination of non-addictive drug (mis)use and work absenteeism, Journal of Applied Economics, 23:1, 149-162, DOI: 10.1080/15140326.2019.1709013

To link to this article: https://doi.org/10.1080/15140326.2019.1709013

Published online: 02 Feb 2020.

JOURNAL OF APPLIED ECONOMICS
2020, VOL. 23, NO. 1, 149–162
https://doi.org/10.1080/15140326.2019.1709013

Routledge
Taylor & Francis Group

ARTICLE

OPEN ACCESS Check for updates

An examination of non-addictive drug (mis)use and work absenteeism

Wesley A. Austin, Sarah J. Skinner and John Keith Watson

Department of Economics and Finance, University of Louisiana at Lafayette, Lafayette, LA, USA

ABSTRACT

This article mainly examines the effect(s) of legal drug misuse on work absenteeism, which has a connecting influence to work productivity. Also, the analysis compares the effects of legal drug use (e.g., tranquilizers) on work absences to that of a commonly used, but illegal drug, marijuana. Utilizing a large dataset from the NSDUH (National Survey on Drug Use and Health), and controlling for several demographic and labor market-related variables, our results indicate that legal drug use (for nonmedical reasons) leads to an increase in work absenteeism, as does marijuana. In some instances, legal drug use has a greater effect on work absenteeism that does marijuana.

ARTICLE HISTORY
Received 20 December 2019
Accepted 20 December 2019

KEYWORDS
Drug use; absenteeism; worker productivity; marijuana use

1. Introduction

The Substance Abuse and Mental Health Services Administration estimates that about 4% of Americans over the age of 12 have abused prescription pain killers in the last 30 days. According to the Center for Disease Control poisoning is the leading cause of accidental death in the United States and 40% of those deaths are caused by misuse of prescription pain killers (opioids). The National Institute on Drug Abuse and National Institute on Health both report that prescription drug abuse affects an estimated 20% of the American population (Prescription Drug Abuse, 2011). For policymakers and society-at-large, there has been considerable concern over the various harmful effects of illicit drug use and their costs to society. One of the many potential consequences of such drug use is a reduction in labor market productivity and its associated economic benefits.

Within the past decade, there has been a significant increase in the abuse of prescription medications, most commonly in the form of pain relievers (Gu, Dillon, & Burt, 2010). Though the drugs are legal, this type of drug abuse also can impose harmful effects on the economy through a loss in productivity.

Illicit drug use may impair productivity and workplace attendance in a variety of ways. Time spent in activities where drug use occurs could substitute away from time allocated to work. Risks stemming from drug use, such as injury from accidents or fights, family

CONTACT Wesley A. Austin waustin@louisiana.edu; Wes.econ@hotmail.com Department of Economics and Finance, University of Louisiana at Lafayette, P.O. Box 44570, Lafayette, LA 70504-4570, USA

(This article is dedicated to the memory of Keith Watson (1950–2017), economist extraordinaire)

discord, and conflicts with law enforcement can also limit the capability of an individual to maintain work attendance. Many of these same problems can also arise from the improper use of legal drugs.

One important avenue through which illegal drug use and improperly used legal drugs can affect worker behavior is through absence from work. Absenteeism can have connecting effects on labor productivity, wages, etc. Labor economists have typically examined worker productivity by analyzing variables such as income and work hours, given that they are easily measured and have a salient impact on labor market fluctuations. This analysis augments the literature by investigating effects of improper use of legal drugs on work absenteeism, i.e., days missed due to "skipping" and illness or injury. Although the workplace effects of misuse of alcohol and illegal drugs have received considerable attention in the literature, the misuse of prescription drugs has not been as thoroughly studied despite potential effects on numerous labor market variables. That is the central research issue we address.

Overall, the primary motivation of this article is to further examine the critical issue of drug use on labor market productivity. This has implications not only for individual citizens and workers, but for society at-large via the effects on wage growth, human capital accumulation and even effects on real GDP. In general terms, this article augments the literature by incorporating the effects drug misuse might have on work absenteeism.

The article is organized as follows: the next section describes the literature, the subsequent sections, respectively, discuss the methodology, the main results, robustness and instrumental variables, and the final section discusses conclusions that may be drawn.

1.1. Literature overview

Instead of following the previous research, which focuses on economic factors such as labor market participation, job performance and wages to determine the economic effects of drug abuse, this study uses work absenteeism as an economic measure of lost productivity.

In earlier articles, Allen (1983) reports that the average employee in the United States has an absence rate of 3.5% and the annual costs of absenteeism are an estimated $26.4 billion. Allen (1981) also reports that the age of employees significantly affects absenteeism, as younger workers are more likely to be absent.

The previous research investigating absenteeism illustrates that several factors play an important role in the decision to be absent. (Ault, Ekelund, Jackson, Saba, & Saurman, 1991) reports that smoking per se does not materially increase absenteeism; rather, it is increased by other factors such as age, alcohol consumption, occupational level, gender, physical limitations, etc., that may be spuriously correlated with smoking. (Vistnes, 1997) performs an extensive study involving drug use and absenteeism and finds that gender and health status play the most significant roles on absenteeism. Vistnes argues that health factors play the largest role in absenteeism because workers self-reporting to be in poor or fair health have a higher tendency to take days off from work. Along with personal characteristics, De Boer, Bakker, Syroit, & Schaufeli (2002) report that management policies and intrinsic factors, such as perceived unfairness from management, play a significant role in predicting absenteeism.

Several studies support the theory that drug use and abuse yields harmful effects on the economy via the labor market. (Kaestner, 1994) reports that illicit drug users will be less likely to be active participants in the labor market. French, Zarkin, Hartwell, and Bray (1995) find in his study of drug use at five worksites, 18% of alcohol users and 12% of illicit drug users report lower levels of performance at work due to the effects of drug use. French, Roebuck, & Alexandre (2001) also note a distinctive difference between the effects of casual drug use and chronic drug abuse on employment and labor force participation.

Contrary to the intuitive notion of drug use causing negative effects on labor market outcomes, some studies actually report positive effects of drug usage on wages. If wages are an accurate reflection of productivity, then a situation in which drug users earn higher wages displays a positive relationship between drug use and productivity. (Gill & Michaels, 1992) find a positive relationship between drug use and wages when accounting for self-selection bias (i.e., variables simultaneously affecting earnings and drug use). (Kaestner, 1991) also finds a positive relationship between drug use and wages, after correcting for potential simultaneity. His findings report similar effects of drug use across gender and between current versus lifetime drug use.

Spencer and Steers (1980) analyze "skipping" work and find *job challenge* to be the only significant variable of the five work experience variables tested (age, tenure in the organization, tenure in the position, gender, education). However, absences due to illness have proven to be more complex than an employee calling-in to work simply because he or she is sick. Studies reveal that absenteeism is affected by the availability of compensation payments when work is missed. Employees eligible for compensation payments are more likely to be absent than those without compensation plans. Barmby, Ercolani, & Treble (2002) show that higher compensation plans also increase the number of absences and the length of the absences. Thus, the decision to call in to work due to illness may be affected by more than just the illness itself.

This research will extend the literature by investigating the effects of misuse of legal drugs on work productivity (measured by absenteeism). The data contain variables on "nonmedical" use (described below) of these drugs – this could also be characterized as "recreational" drug use. The results will also be compared to those of illegal drug use (specifically, marijuana and alcohol). Thus far, the economics literature has not widely addressed this topic. Moreover, this analysis employs a very large dataset that allows for the control of important personal and labor market characteristics.

2. Materials and methods

The National Survey on Drug Use and Health (NSDUH), sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA), is annually administered to approximately 55,000 civilian, non-institutionalized individuals age 12 and over, chosen so that the application of sample weights produces a nationally representative sample. The survey is completely anonymous. There are no experiments on human or animal subjects. The data have extensive information on many facets of both legal and illegal drug use and has a section devoted to workplace variables.

We use 2006 and 2007 NSDUH data. These 2 years are merged data that have been "pooled" together. Although more recent years are available, they are not utilized to avoid

any effects from the Great Recession of 2008 which are still present in recent years, especially, some would argue, in the labor market. Our sample from this rather large data set consists of observations with age *categories* ranging from 18 years old to those 65 and over. Substance use is examined over three time categories: ever used, number of days in the last month, number of days in the last week. For "ever used" there are 48,926 observations; for "number of days in the last month" there are 44,173 observations. The reason for the reduction is that respondents' may choose how to report frequency of use as follows: days per week, days per month, or days per year. For example, a respondent who used drugs *last week* may choose to actually report it as use in the *days per month* category. In any event, there are still a very large number of observations in each category. Our sample is also restricted to those employed.

Consider the following equation, in which work absenteeism (A) is a function of legal drug (mis)use (D_1), marijuana/alcohol use (D_2) as well as other explanatory determinants (X),

$$\left(A = \beta_0 + D_1\beta_1 + D_2\beta_2 + X\beta_3 + \varepsilon\right)$$

In the above equation, which applies to individual NSDUH respondents (with the corresponding observation-level subscript suppressed), vector (X) represents sets of explanatory variables that affect absenteeism (A), but of prime importance is the effects of legal drug misuse, and marijuana use, (D_1 and D_2), could have on absenteeism. The β's are parameters to be estimated and ε is error term that encompasses all factors influencing the corresponding dependent variable that is not explicitly controlled for on the right hand side of the equation. Since data on absenteeism are left censored (at zero), skewed to the right, and leptokurtic (Hammer & Landau, 1981) suggest using tobit analysis to eliminate many of the statistical difficulties these properties cause; our subsequent statistical analysis follows that recommendation. Also, as a "robustness" check of sorts, an instrumental variables regression is employed. The instruments and methodology are explained below.

2.1. Absenteeism

The analysis is conducted utilizing a sample of currently working individuals (ages 18–65+ years old). All respondents are asked to report the number of workdays (ranging from 0 to 30) over the past 30 days that were missed because of illness or injury (i.e., they missed work by calling-in and reporting the illness to the employer), as well as days missed due to "skipping" in which the respondent did not report to work that day/night. The former merits attention in that the harmful, lingering effects from drug use may be the reason for reporting illness or injury, not any illness itself. In other words, people *may* report illness, not because of a legitimate illness, but instead to cope with the effects of said drug use.

2.2. Legal drug use (misuse)

Four separate categories of legal drug are utilized: Painkillers, Tranquilizers, Stimulants, and Sedatives. For each drug category, *amount of drug use* is measured as follows: 1) if the

respondent has *ever* used the drug for nonmedical reasons; 2) how many days in the past 30 days has the drug been used for nonmedical reasons.

For a respondent, nonmedical use is defined as taking the drug when not prescribed for you, or only because of "the feeling or experience they caused." While it is entirely possible that these drugs were obtained as remnants of a legitimate prescription for the individual or family member, it is also possible they were obtained by stealing, forging a prescription, or on the black market – which blurs the distinction between drugs obtained illegally and illegal drugs. We do not use data on an individual drug. The NSDUH administrators will code, for example, a specific painkilling drug a respondent is taking (nonmedically) into the overall "painkiller" drug category.

2.3. Marijuana use

As with the four legal drug categories outlined above, marijuana use is also examined. The amount of use is measured as follows: 1) if the respondent has *ever* used the marijuana; 2) how many days per month in the past year has marijuana been used.

2.4. Alcohol use

Along with legal drug use and marijuana use, alcohol consumption is also incorporated into the analysis along the same lines. The amount of alcohol use is measured as follows: 1) if the respondent has *ever* used alcohol; 2) how many days per month in the past year has alcohol been consumed.

2.5. Other explanatory variables

Several variables from the NSDUH data provide individual and occupational information on the respondent: an age category is included as a binary measure of gender and a binary variable indicating if the respondent graduated from any college. Racial categories include Caucasian, African American, Asian, non-white Hispanic, with multiracial as the base.

An indicator for *risk* of bodily harm associated with smoking cigarettes is included (and could be considered a proxy for overall risk aversion). This risk variable is measured on a strict binary scale with '0′ indicating no or slight risk and '1′ indicating moderate or great risk. Those with higher levels of risk aversion with respect to smoking may invest more in human capital and therefore have lower rates of absenteeism. In addition, a dummy is included for whether marijuana is legal ('1′) or not ('0′) in the respondent's state of residence. "Married with kids" is also a binary variable equal to '1′ if the individual is married with children and equal to '0′ otherwise. The size of the firm which employs the worker is measured by number of employees at the workers' location. It is possible that the firm could have more employees at another branch office, plant, etc. The size of the firm is denoted by the following dummy variables: '0′ = less than 100 people work for your employer out of this office, store, etc.; '1′ = 100 people or more work out of this office, store, etc. The main justification for inclusion of this variable is that larger firms are more apt to offer compensation for time off (i.e., paid sick leave) versus smaller employers.

Family size is measured by the following: number in the family from one to six or more members. This variable in particular may indicate a high opportunity cost of working (as family size increases), which, in turn, can affect work absences. Alternatively, if only one family member is working, family size may denote attachment to the labor force as the working family member has "breadwinner" status; such status could imply less absenteeism. Categorical variables are also included to denote those that live in a large MSA (over 1 million) and those in smaller MSA's (under 1 million); the base category is "not in MSA". Those in larger MSAs may enjoy greater job/career opportunities. Furthermore, the number of times someone moved in the last year is incorporated as this could proxy for "job hopping" which may increase absenteeism.

Many employers have policies forbidding their workers to consume drugs (legal drug use is generally permitted provided the employee can provide a prescription). Some employers test for alcohol/drugs in employees' bloodstream as part of the hiring process and some follow up with subsequent random alcohol/drug tests. These policies may impact employees' drinking and drug use habits. In the NSDUH data, random alcohol/drug testing is equal to '1′ if the worker is subject to random alcohol/drug testing after being hired, and '0′ if not.

3. Results

Table 1 presents select descriptive statistics. Absenteeism in the sample is dispersed as follows: 0.75 days of work per month are missed due to illness and 0.262 days of work per month are missed due to "skipping work". The most commonly abused prescription medication reported by the respondent is pain relievers – nearly 20% of respondents report misusing pain relievers at least once in their lifetime.

Pain relievers are reported to be misused on average 0.12 days per month. In the days per week timeframe, pain relievers are reported to be misused 0.04 days per week. These values are difficult to interpret because the value is likely brought down by the high number of respondents that do not use pain relievers at all (either medically or non-medically), but those that do abuse pain relievers tend to misuse frequently. About half of respondents have used marijuana at least once; about 60% have used alcohol at least once.

3.1. A note on non-drug explanatory variables

Several non-drug variables in the model have significant effects on both absenteeism measures. Those that are college graduates, and those married with kids, miss fewer days due to "skipping" and illness compared to individuals not in those categories.

Generally, females, vis-à-vis males, miss fewer days from "skipping" work but miss more days due to illness. As family size increases, ceteris paribus, there is an increase in both days missed due to "skipping" and days missed from illness. This is also true for those that have moved more within the past year. This potentially confirms that those that have large families and/or move often simply have a higher opportunity cost of work attendance.

For workers subject to workplace drug testing, fewer days are missed due to "skipping" but more days are missed due to illness compared to workers not subject to drug testing. Also, very young workers (21 and under) have higher incidences of absenteeism than

Table 1. Descriptive statistics.

Variable	Mean	Standard deviation
# of days missed due to skipping (past 30 days)	0.262	1.202
# of days missed due to reported illness (past 30 days)	0.750	2.715
Ever used pain relievers (nonmedically)	0.196	0.397
Ever used tranquilizers (nonmedically)	0.103	0.304
Ever used sedatives (nonmedically)	0.098	0.297
Ever used stimulants (nonmedically)	0.027	0.162
Number of days in past month-used pain relievers (nonmedically)	0.115	1.115
Number of days in past month-used tranquilizers (nonmedically)	0.038	0.577
Number of days in past month-used sedatives (nonmedically)	0.030	0.627
Number of days in past month-used stimulants (nonmedically)	0.006	0.262
Ever used marijuana	0.504	0.500
Number of days in past month-used marijuana	1.465	5.610
Ever drank alcohol	0.605	0.817
Number of days in past month-drank alcohol	1.559	3.804
Risk of bodily harm from smoking	0.942	0.232
Respondent subject to workplace drug testing	0.416	0.493
marijuana legal in your state	0.113	0.345
Respondent is female	0.499	0.500
Respondent is a college graduate	0.223	0.416
Race (Caucasion)	0.668	0.471
Race (African American)	0.108	0.310
Race (Asian)	0.032	0.176
Race (non-white Hispanic)	0.150	0.357
Age 21 or younger	0.268	0.443
Respondent is married with children	0.239	0.426
Number of workers at the firm	2.558	1.325
Family Income (below $20,000)	0.170	0.442
Family Income ($20,000 – $49,999)	0.349	0.477
Family Income ($50,000 – $74,999)	0.194	0.396
Family Income ($75,000 and over)	0.287	0.452
Number of times moved (past year)	0.516	0.841
MSA segment with 1+ million persons	0.418	0.493
MSA segment of less than 1 million	0.496	0.500
Number in family	2.971	1.325

workers over 21. Also, noteworthy is that individuals in the highest income range ($75,000+) miss less work, again possibly reflecting a greater opportunity cost of work absenteeism. Workers at larger firms (100+ employees) incur more absenteeism due to illness – possibly due to more liberal paid "sick leave" policies. For the most part, MSA size is not significant.

3.2. Effects on absenteeism-ever used legal drugs for nonmedical reasons; marijuana; alcohol

Table 2 shows the effect on absenteeism for those that have ever misused, even once, pain relievers, tranquilizers, stimulants and sedatives. It also shows the effect on absenteeism of ever consuming alcohol and marijuana and other factors not directly related to drug use.

Pain relievers have the most salient effects. For those that have ever misused these drugs, absenteeism due to "skipping" in the past 30 days is almost 1 day greater (0.83 days) than those that either did not use pain relievers at all or, if they did, did not misuse the drugs. Those that have misused pain relievers also have increased rates of absenteeism due to illness (0.74 days) versus those that did not use/misuse. Again, it is assumed that

Table 2. Tobit regressions of ever used drugs & other variables on days missed (skipping/illness).

	Days missed due to skipping		Days missed due to illness	
Explanatory variables	Coefficient	Standard error	Coefficient	Standard error
Ever used pain relievers	0.830*	0.108	0.737*	0.127
Ever used tranquilizers	0.287**	0.138	0.505*	0.164
Ever used sedatives	−0.278	0.234	−0.254	0.279
Ever used stimulants	0.203	0.135	0.094	0.162
Ever consumed alcohol	0.320*	0.018	0.158*	0.117
Ever used marijuana	0.870*	0.088	0.761*	0.101
Risk of bodily harm from smoking	−0.187	0.161	−0.088	0.189
Respondent subject to workplace drug testing	−0.251*	0.086	0.547*	0.098
Respondent is female	−0.294*	0.080	1.113*	0.092
Marijuana legal in your state	0.018	0.318	0.266	0.036
Respondent is a college graduate	−0.491*	0.110	−1.258*	0.126
Race (Caucasain)	−0.789*	0.187	−1.003*	0.215
Race (African American)	1.067*	0.211	0.304	0.247
Race (Asian)	−0.029	0.284	−0.775*	0.333
Race (non-white Hispanic)	−0.156	0.207	−0.551**	0.241
Age 21 or younger	0.934*	0.096	0.293*	0.114
Respondent is married with children	−0.496*	0.108	−0.478**	0.122
Firm size (# of employees)	0.016	0.318	0.245*	0.036
Family Income ($20,000 – $49,999)	0.011	0.111	0.083*	0.129
Family Income ($50,000 – $74,999)	−0.173	0.132	−0.364**	0.152
Family Income ($75,000 and over)	−0.256**	0.128	−0.720*	0.149
Number of times moved (past year)	0.265*	0.046	0.530*	0.053
MSA segment with 1+ million persons	0.515*	0.157	−0.239	0.174
MSA segment of less than 1 million	0.105	0.153	−0.045	0.167
Number in family	0.093*	0.033	0.137*	0.038

*Statistically significant at 1%.
**Statistically significant at 5%.

the reason for absence due to illness may be due to coping with the effects of misusing the drug.

Misuse of tranquilizers increases absence due to "skipping" by 0.29 days (almost one third of a day) compared to those that did not use tranquilizers. Missing due to illness is also elevated by 0.50 days (one half of a day). Misuse of stimulants does not significantly affect absenteeism, nor does misuse of sedatives.

Also, Table 2 presents the effects on absenteeism for those that have ever used, even once, marijuana. Absenteeism in the past 30 days due to "skipping" is almost 1 day greater (0.87) for those that ever used marijuana compared to those that have never used. Absenteeism in the past 30 days due to illness is 0.76 days greater. For alcohol use: absenteeism in the past 30 days due to "skipping" is 0.32 days greater for those that ever used alcohol compared to those that have never used. Absenteeism in the past 30 days due to illness is about one sixth of a day greater (0.16).

3.3. Effects on absenteeism-number of days (in past 30 days) used legal drugs for nonmedical reasons; marijuana; alcohol

Table 3 also shows that misusing legal drugs more frequently (i.e., monthly) leads to increased absenteeism. For those that have misused pain relievers in the past 30 days, absenteeism due to "skipping" is elevated by 0.08 days for each day the misuse occurred, again compared to those that either did not use pain relievers at all or, if they did, did not

Table 3. Tobit regressions of # of days used drugs in past 30 days & other variables on days missed (skipping/illness).

	Days missed due to skipping		Days missed due to illness	
Explanatory variables	Coefficient	Standard error	Coefficient	Standard error
Number of days in past month-used pain relievers	0.077***	0.039	0.114**	0.049
Number of days in past month-used tranquilizers	0.246*	0.078	0.171***	0.106
Number of days in past month-used sedatives	0.031	0.228	−0.072	0.298
Number of days in past month-used stimulants	0.132**	0.070	−0.047	0.100
Number of days in past month-drank alcohol	0.012	0.010	−0.002	0.012
Number of days in past month-used marijuana	0.071*	0.007	0.057*	0.009
Risk of bodily harm from smoking	−0.211	0.174	0.087*	0.206
Respondent subject to workplace drug testing	−0.228*	0.091	0.573*	0.103
Respondent is female	−0.376*	0.084	1.19*	0.096
Marijuana legal in your state	0.029	0.334	0.299	0.038
Respondent is a college graduate	−0.492*	0.116	−1.125*	0.131
Race (Caucasain)	−0.836*	0.200	−1.132*	0.229
Race (African American)	0.751*	0.222	0.002	0.261
Race (Asian)	−0.480***	0.298	−1.198*	0.348
Race (non-white Hispanic)	−0.538**	0.220	−0.869*	0.253
Age 21 or younger	0.762*	0.104	0.238**	0.121
Respondent is married with children	−0.531*	0.114	−0.445*	0.127
Firm size (# of employees)	0.021	0.334	0.255*	0.038
Family Income ($20,000 – $49,999)	−0.019	0.120	0.146	0.139
Family Income ($50,000 – $74,999)	−0.166	0.142	−0.305***	0.163
Family Income ($75,000 and over)	−0.228***	0.138	−0.704*	0.159
Number of times moved (past year)	0.337*	0.049	0.581*	0.057
MSA segment with 1+ million persons	0.629*	0.166	−0.219	0.183
MSA segment of less than 1 million	0.155	0.162	−0.026	0.176
Number in family	0.103*	0.035	0.128*	0.040

*Statistically significant at 1%.
**Statistically significant at 5%.
***Statistically significant at 10%.

misuse. Those that have misused pain relievers also have increased rates of absenteeism due to illness per episode of misuse (0.12 days) compared to those that did not use at all or misuse the drugs.

For those that have misused tranquilizers in the past 30 days, absenteeism due to "skipping" is elevated by 0.25 days (a quarter of a day) for each day the misuse occurred, again compared to those that either did not use tranquilizers at all or, if they did, did not misuse. Those that have misused tranquilizers also have increased rates (per episode of misuse) of absence due to illness (0.17 days) compared to those that did not use at all or misuse.

Stimulant misuse also has significant effects. Absenteeism due to "skipping" is elevated by 0.13 days for each day the misuse occurred, compared to those that either did not use stimulants at all or, if they did, did not misuse. Misuse of sedatives does not significantly affect absenteeism.

The effects on absenteeism for those that have used alcohol and marijuana in the past 30 days are also shown in Table 3. Absenteeism in the past 30 days due to "skipping" is 0.07 days greater for each day the use of marijuana occurred, compared to those that did not use at all. Those that have used marijuana in the past 30 days also have increased rates of absence due to illness per episode of use (0.06 days) compared to those that did not use at all. Alcohol use is not a significant variable for this time category of substance use.

3.4. Comparisons

Interestingly, *ever used* has the largest effect on both absenteeism variables. This holds for all substances in the study. For those that have ever used marijuana, 0.87 more days of work due to "skipping" are missed compared to those that did not use. For absences due to illness, marijuana "ever users" missed 0.76 days more than nonusers. However, "ever" misuse of pain relievers has similar effects. For those that have ever misused pain killers, 0.83 more days of work due to "skipping" are missed compared to those that did not use or misuse. For absences due to illness, pain killer "ever misusers" are absent 0.73 days more than those that never used pain killers or have used them as prescribed. "Ever" use of alcohol also increases absenteeism but the effect is not as great as that of marijuana/pain reliever "ever" use. A potential partial explanation for the difference between "ever users" and nonusers lies in the possibility the "ever users" have a more lackadaisical attitude toward work or (more speculatively) life in general.

When substance use is measured by the *number of days of past month* each episode of legal drug misuse (pain relievers, tranquilizers) results in a greater incidence of work absenteeism than marijuana use. Alcohol consumption did not statistically affect absenteeism.

3.5. Robustness and instrumental variables

To better establish "robustness" and account for unobserved endogeneity, an instrumental variables (IV) regression is employed. Unobserved endogeneity could emanate from unobservable factors that may influence both drug misuse and work absenteeism. Several NSDUH variables conceivably influence legal drug use without having direct effects on work absenteeism and are thus candidates to serve as instrumental variables. The specific variables utilized are perceived risk of bodily harm from marijuana use; marijuana availability and thoughts of suicide.

To use IV, there must be at least one, preferably two or more, variables (i.e., instruments or IVs) that affect legal drug (mis)use but have no direct impact on work absenteeism. Two important conditions that the instrument vector must satisfy in order for IV to produce consistent estimates of the causal drug (mis)use effect β_1: First, the instruments must be highly correlated with legal drug (mis)use but not correlated with the work absenteeism outcome through any other means besides drug (mis)use. If the correlation between the instruments and legal drug misuse is not statistically significant the estimate for β_1 above is indeterminate. The strength of this correlation is judged from the first-stage regression F-statistic for the joint significance of α_1.

Second, if a direct correlation between the instruments and work absenteeism exists outside of the route from the instruments to drug (mis)use to work absenteeism, then consequently the estimate for β_1 above is no longer a consistent estimate of the causal effect of drug (mis)use on absenteeism. The reason multiple instruments are preferred is that this overidentifies the work absenteeism equation, which allows for specification tests to determine the empirical validity of excluding the instrument set in that equation. Typically, the estimator is generated by a two-stage least squares (2SLS) procedure.

One other methodological point warrants attention. Although IV estimates are consistent if the instrument strength and exogeneity conditions outlined above are satisfied,

they are inefficient relative to OLS and similar estimators if it turns out that legal drug (mis)use is truly exogenous with respect to work absenteeism, in which case an OLS estimator can be interpreted as yielding causal effects. Thus, it is desirable to econometrically test the null hypothesis that legal drug (mis)use is exogenous in the work absenteeism equation. This is done using a Hausman (1978) test, which proffers that, if legal drug (mis)use and the error term are uncorrelated, IV and OLS estimates should differ only by sampling error. If the null hypothesis of exogeneity is rejected, OLS estimates are inconsistent and hence conclusions should be based on IV estimates; failure to reject the null means that OLS or similar estimates are preferable because of their smaller standard errors.

3.6. Instrumental variables

(1) *Risk associated with marijuana use*: a binary measure indicates if the respondent feels there is great/moderate risk or slight/no risk of harm, physically or otherwise, from consuming marijuana once/twice a week. While risk aversion could arguably be linked to work productivity outcomes in that more risk-averse individuals are more likely to accumulate human capital and work harder as possible "insurance" against having a low standard of living, in this instance the domain of risk involves bodily harm from consuming an illegal substance. Therefore, it is assumed to have no direct connection to work absenteeism. Some evidence shows that risk associated with one variable is different from risk associated with another – risk aversion is not evenly spread among all aspects of human decisions (Heath & Tversky, 1991). Therefore, the risk associated with substance use is different from, and possibly not correlated with, the risk associated with failure to obtain human capital, but would be correlated to legal drug use in that those who associate greater risk with marijuana use are also less likely to misuse another substance: legal drugs. Nonetheless, potential endogeneity does exist.

(2) *Availability of marijuana*: this is measured on a scale of '0′ (virtually impossible to access) to '5′ (very easy to access). Potential endogeneity emanates from marijuana availability possibly serving to proxy for "quality" of the employee which could, therefore, bias the work absenteeism outcome.

(3) *Thoughts of suicide*: a binary measure indicates if the respondent thinks about suicide when personal problems are at their worst. Thoughts of suicide may certainly be tied to (mis)use of legal drugs. There is also potential endogeneity regarding thoughts of suicide in that they may proxy mental health issues, and therefore could lead to increased work absenteeism.

3.7. Results & comparisons

The hypothesis of exogeneity of legal drug (mis)use is supported by the IV regression results. For brevity, only results from the "ever used" legal drug misuse/use category is reported. Results for legal drug (mis)use in the "days in past month" category were similar and are available upon request. Results from first-stage regressions of the drinking measures on the instrumental variables are shown in Tables 4 and 5. Easy access to marijuana and thoughts of suicide has positive effects on legal drug use, while perceived

Table 4. First-stage regression estimates for work absenteeism – skipping.

Exogeneous variables	Ever used pain Killers nonmedically	Ever used tranquilizers Nonmedically	Ever used stimulants Nonmedically	Ever used sedatives Nonmedically
Risk of bodily harm from mj use	−0.177	−0.135	−0.113	−0.035
	(0.000)	(0.000)	(0.000)	(0.000)
Availability of marijuana	0.0388	0.024	0.019	0.058
	(0.000)	(0.000)	(0.000)	(0.000)
Thoughts of suicide	0.033	.0003	0.030	0.022
	(0.000)	(0.133)	(0.016)	(0.023)
F stat/chi2-coefficient of joint significance	116.32	85.74	70.29	24.80
P-value of significance level	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table 5. First stage regression estimates for work absenteeism – illness.

Exogeneous variables	Ever used pain Nonmedically	Ever used tranquilizers Nonmedically	Ever used stimulants Nonmedically	Ever used sedatives Nonmedically
Risk of bodily harm from mj use	−0.178	−0.136	−0.113	−0.035
	(0.000)	(0.000)	(0.000)	(0.000)
Availability of marijuana	0.0338	0.025	0.020	0.010
	(0.000)	(0.000)	(0.000)	(0.000)
Thoughts of suicide	0.005	.0002	0.040	0.027
	(0.208)	(0.136)	(0.015)	(0.029)
F stat/chi2-coefficient of joint significance	116.13	85.64	70.33	25.65
P-value of significance level	(0.0000)	(0.0000)	(0.0000)	(0.0000)

risk has negative effects. The F statistics and χ^2 coefficients and associated p-values give strong evidence of joint instrument significance with respect to all the drug (mis)use measures.

In Table 6, the overidentification tests have associated p-values that offer strong evidence in support of the assumption of instrument exogeneity at the 10% level, so validation of the IV's augments the hypothesis that legal drug (mis)use effects on work

Table 6. IV estimates of ever misused legal drugs on workdays missed (skipping/illness).

Drug variables	IV (days missed-skipped)	IV (days missed-illness)
Ever used pain killers nonmedically	0.360*	0.651*
Marginal Effect Standard Error	(0.0730)	(0.2400)
P-value of overidentification test	0.862	0.363
Hausman statistic	1.391	1.641
Ever used tranquilizers nonmedically	0.492*	0.922*
Marginal Effect Standard Error	(0.1010)	(0.3300)
P-value of overidentification test	0.692	0.460
Hausman statistic	3.700	1.497
Ever used stimulants nonmedically	0.596*	1.128**
Marginal Effect Standard Error	(0.1230)	(0.4000)
P-value of overidentification test	0.700	0.510
Hausman statistic	2.384	1.991
Ever used sedatives nonmedically	1.908*	3.621*
Marginal Effect Standard Error	(0.4210)	(1.3100)
P-value of overidentification test	0.565	0.496
Hausman statistic	1.504	1.567

*Statistically significant at 1%.
**Statistically significant at 5%.

absenteeism are causal and drug (mis)use is properly identified as exogenous in the work absenteeism equation. The Hausman coefficients are never significant, and therefore signify that there are no statistically significant differences between the OLS and IV parameter estimates for all the legal drug (mis)use measures – indicating that drug (mis) use and the error term in work absenteeism equation are indeed not correlated. Therefore, OLS estimates may be interpreted as showing causal effects. By extension, Tobit estimates can also show causal effects and as noted above, Tobit regressions would be preferable to OLS due to the nature of the data.

4. Discussion

This paper contributes to the literature by examining the effects of legal (and illegal drug) use on work productivity, as measured by work absenteeism. The previous literature has established a negative link between illegal drug use and labor market outcomes such as wages and employment. However, the research has largely not addressed misuse of *legal drugs* such as painkillers. In addition, absenteeism as a labor market outcome has not been investigated as widely as wages and employment rates.

This study finds evidence that legal drug misuse increases the incidence of work absenteeism, measured by both "skipping" and missing work due to illness or injury. Absenteeism due to misuse of legal drugs is also compared to potential absenteeism due to marijuana use. Overall, both increase both measures of absenteeism. Yet legal drug misuse, in most instances, has a similar or greater impact on absenteeism than does marijuana use. Alcohol consumption has a negative impact on work attendance in some instances but the effects are not as pronounced. While our dataset is large and contains many well-defined variables that can be utilized to gauge how drug use affects work productivity, future research may incorporate other macroeconomic covariates that are not present in the data.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Dr. Wesley A. Austin is an Associate Professor of Economics at the University of Louisiana at Lafayette. His primary research interests encompass health and labor economics.

Dr. Sarah J. Skinner is an Associate Professor of Economics at the University of Louisiana at Lafayette. Her primary research interests encompass econometrics and the economics of art and culture.

Dr. John Keith Watson was an Associate Professor of Economics at the University of Louisiana at Lafayette from 1988 until his passing in 2017. His primary research area was labor economics.

References

Allen, S. G. (1981). An empirical model of work attendance. *The Review of Economics and Statistics*, *63*(1), 77–87.

Allen, S. G. (1983). How much does absenteeism cost? *The Journal of Human Resources*, *18*(3), 379–393.
Ault, R. W., Ekelund, R. B., Jackson, J. D., Saba, R. S., & Saurman, D. (1991). Smoking and absenteeism. *Applied Economics*, *23*(4), 743–754.
Barmby, T. A., Ercolani, M. G., & Treble, J. G. (2002). Sickness absence: An international comparison. *The Economic Journal*, *112*(480), 315–331.
De Boer, E. M., Bakker, A. B., Syroit, J. E., & Schaufeli, W. B. (2002). Unfairness at work as a predictor of absenteeism. *Journal of Organizational Behavior*, *23*(2), 181–197.
French, M. T., Roebuck, C. M., & Alexandre, P. K. (2001). Illicit drug use, employment, and labor force participation. *Southern Economic Journal*, *68*(2), 349–368.
French, M. T., Zarkin, G. A., Hartwell, T. D., & Bray, J. W. (1995). Prevalence and consequences of smoking, alcohol use, and illicit drug use at five worksites. *Public Health Reports*, *110*(5), 593–599.
Gill, A. M., & Michaels, R. J. (1992). Does drug use lower wages? *Industrial and Labor Relations Review*, *45*(3), 419–434.
Gu, Q., Dillon, C. F., & Burt, V. L. (2010). *Prescription drug use continues to increase: U.S. prescription drug data for 2007–2008*. Hyattsville, MD: Centers for Disease Control and Prevention (US).
Hammer, T., & Landau, J. (1981). Methodological issues in the use of absence data. *Journal of Applied Psychology*, *5*(74), 561–573
Hausman, J. (1978). Specification tests in econometrics. *Econometrica*, *46*(6), 1251–1271.
Heath, C., & Tversky, A. (1991). Preference and belief: Ambiguity and competence in choice under uncertainty. *Journal of Risk and Uncertainty*, *4*, 5–28.
Kaestner, R. (1991). The effect of illicit drug use on the wages of young adults. *Journal of Labor Economics*, *9*(4), 381–412.
Kaestner, R. (1994). The effect of illicit drug use on the labor supply of young adults. *The Journal of Human Resources*, *29*(1), 126–155.
Spencer, D. G., & Steers, R. M. (1980). The influence of personal factors and perceived work experiences on employee turnover and absenteeism. *The Academy of Management Journal*, *23* (3), 567–572.
US Department of Health and Services, National Institutes of Health. (2011). Prescription drug abuse. *MedlinePlus*.
Vistnes, J. P. (1997). Gender differences in days lost from work due to illness. *Industrial and Labor Relations Review*, *50*(2), 304–323.