Opioids and Other Addictive Substances in the Manufacturing Environment: Challenges and Best Practices

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INTRODUCTION AND EXECUTIVE SUMMARY

Opioids—including prescription pain relievers, heroin, and synthetic opioids such as fentanyl—have justifiably received considerable attention in recent years.[1] Opioid use disorder has become a national epidemic, affecting public health and social and economic welfare.[2] For the past three years, life expectancy in the United States has declined, driven in part by a record number of drug overdose deaths.[3] The Centers for Disease Control and Prevention estimates that the total economic burden of prescription opioid misuse in the United States is $78.5 billion annually, including the costs of health care, lost productivity, addiction treatment, and criminal justice involvement.[4]

The manufacturing industry is particularly affected by the opioid epidemic. First, many manufacturing jobs are physical and repetitive in nature, and despite considerable ergonomic improvements in many plants, musculoskeletal disorders (e.g., low back pain) remain prevalent in the manufacturing industry.[5] Clinical guidelines state that opioids are not the first-line or routine therapy for chronic pain, yet current pain management still often deviates from recommended care.[6] This puts manufacturing workers at greater risk for exposure to prescription opioids.

Second, manufacturing's unemployment rate is currently 3.0%, well below full employment, and attracting and retaining a quality workforce is one of the top challenges facing the industry.[7,8] The opioid epidemic exacerbates this challenge. Workers with opioid use disorder (or who have family members with opioid use disorder) are less likely to apply for a position at a manufacturing company that requires pre-employment drug screening, and are more likely to show up late, miss work, quit suddenly, and change jobs often.[9,10] They are also are more likely to be involved in a workplace accident and file a worker's compensation claim.[11]

The opioid epidemic compounds the long-standing substance use disorder challenges that many employers have encountered, resulting in billions of dollars in additional expenses for health care, workplace injuries, disability, and productivity losses.[12] Further, it comes at a time when several states have legalized medical and recreational marijuana use, which raises several new legal and practical concerns for manufacturers. The goals of this study were to (1) describe the effect of opioid use disorders and other substance abuse issues on US manufacturers, (2) describe the strategies manufacturers have taken to address these issues, (3) identify evidence-based best practices for addressing substance use disorder in the workplace, and (4) identify ongoing needs of manufacturers with regard to substance use disorder support.

To meet these goals, we conducted telephone interviews with leaders from 22 diverse manufacturing companies and one state business association between April and July 2019. Additionally, we conducted

a literature review using systematic methods to collect and critically appraise research studies to identify evidence-based best practices for employers to undertake to address substance use disorder. Key findings include:

- The opioid epidemic has adversely affected manufacturing communities and companies, though the effect has not been consistent across all companies:
    - The opioid epidemic has exacerbated difficulties associated with hiring and retaining a reliable workforce, and in some areas, has led to increased wages as employers compete for limited population of workers who can pass a drug screen.
    - The epidemic has given rise to an increase in absenteeism and "presenteeism."
- The legalization of marijuana for medical and recreational use poses new legal and practical challenges for manufacturers. This is an area where respondents identified a need for more guidance to help establish company policies.
- Employers have implemented various interventions to prevent and address substance use disorder, most commonly education and training, random drug testing, and changes to health benefits; however, the impact of the interventions is not well known.
- Employers have also implemented or considered implementing additional interventions specific to the opioid epidemic. Those strategies include purchasing naloxone kits for manufacturing plants, assisting employees with prescription drug disposal, and encouraging physicians and pharmacists to revise care management and prescribing patterns for pain management.
- Although there have been several evaluations of employer-led interventions to prevent or address addiction, many suffer from methodological weaknesses, calling into question the validity of the results. Nevertheless, the evaluations suggest that some employer-led interventions (employee education, written workplace drug policy, employee assistance programs, and drug testing) may be successful in reducing drug use, accidents, and absences.
- Employers report numerous challenges regarding opioids and other substances, including the ability to reach employees with education interventions, the absence of good data on the extent and cost of addiction issues, and development of policies regarding the availability of naloxone on-site.
- Manufacturing leaders wish to learn about strategies that other companies are undertaking to address substance use disorder. Some also expressed a need for greater capacity within local rehabilitation facilities, many of which currently have long wait times for treatment.

THE IMPACT OF THE OPIOID EPIDEMIC IN THE MANUFACTURING ENVIRONMENT

Many respondents reported adverse effects of the opioid epidemic, both to the community and within manufacturing plants. One respondent said that the opioid epidemic created, "a mood of lethargy in the community, which has become the new normal." Similarly, another respondent noted that substance use disorder has become part of the culture of the community. For many of the companies that participated in the interviews, this environment has resulted in even greater difficulty hiring reliable workers. Indeed, several respondents noted that the pre-employment drug test eliminates many seemingly promising applicants:

> "Finding labor who are able to pass the drug test and who can be responsible and trustworthy in their roles, and who will show up, is the most significant challenge. We have had some people

who don't show up early on in their career with us, and it turns out they have an addiction. We've also had longer-term employees who have to leave to get help. Our area still has a high unemployment rate, but addiction is a real problem. They cannot fill the jobs."

As the pool of potential workers has diminished, some respondents noted that there is greater competition among employers for workers who can pass a drug test, which has resulted in upward pressure on wages. The labor market had become so tight that, according to a respondent, "some companies have stopped drug testing." However, in our interviews, only one respondent said that their company had ceased drug testing. Indeed, the company suspended drug testing in one of their two plants because they were unable to find enough workers to staff the plant. Another respondent said that some companies are offering signing bonuses for unskilled labor positions, bonuses for staying on a certain amount of time, and some companies are not checking criminal backgrounds. One respondent explained that they sometimes have to hire people who might not be suitable because they simply need workers, and "sometimes you just take the lumps." Overall, there was great concern expressed about filling open positions with a diminished pool of potential workers, especially as many manufacturing workers are older and likely to retire in the near future.

The opioid epidemic is also affecting the work inside the plant. Managers have become attuned to substance use issues and report seeing certain troubling patterns among their employees. "The typical pattern is that we do the pre-employment screening, have a great employee who performs well, but then over time we see a decline in performance." Another reported, "There are signs that are hard to miss. We find that they fall in with the wrong people, become over confident about their ability to not get addicted, and they have money from the job [to purchase the drugs]."

Opioid use disorder has major implications for productivity. Respondents most frequently described "huge" absentee problems related to substance use disorder. According to one respondent, "We keep more people on our payroll than we need to because of high absenteeism." Another respondent said that he had fired approximately 200 employees over the past five years due to substance use. Now that he has eliminated the poorest performers, he can get by with a much smaller workforce.

Another common problem was "presenteeism," or when employees are present but not fully functional. Employees with suspected substance abuse disorders were described as "lethargic," and that they "get behind," and are "not your star employees." Employees are also frequently distracted at work when they have a family member with a substance abuse disorder. More than one respondent noted that many employees rely on family members as childcare providers, and when those child care providers have a substance use disorder, it's particularly difficult and disruptive for employees. Respondents also emphasized the impact of such distractions on employees' ability to maintain the focus and precision needed in many manufacturing positions. A small mistake could mean having to shut down a production line or incurring higher rates of rework and scrap, which could result in a loss of tens of thousands of dollars. Additionally, some manufacturing positions are "safety sensitive," meaning that the performance of one employee can affect the safety of other employees or customers who ultimately use the final product.

Less frequently, respondents reported more serious, acute issues related to opioids. One respondent described an incident where an employee overdosed in a bathroom in the plant during the employee's shift. Incidents like these are rare, but can have a big impact on awareness and morale. Another reported "a high increase" in accidents in a plant located in a community that had been hard hit by the

opioid epidemic. The accidents have involved medical leave and long recoveries. Although the company could not attribute the accident specifically to opioids, there is a general assumption that it's tied to the epidemic.

At a small number of companies we interviewed, the opioid epidemic is overwhelming and dire. According to one respondent, "If we don't fix the issue, we would have to think about shutting down the plant and moving somewhere else. Right now, our problems are localized [in two plants]. We could outsource. We have plants outside the US. If the problem gets worse, it might be a choice we're forced to make."

However, the effect of the opioid epidemic was not universal; indeed, respondents at most of the larger manufacturers reported experiencing problems in only a few locations. A smaller number of respondents reported that their companies had not yet been affected by the opioid epidemic. Some attributed this to their drug testing policies, noting that since applicants and employees know that the company requires pre-employment screening and random drug testing, they stay away from illegal addictive substances.

Few companies in our study had investigated the impact of the opioid epidemic on their health care spending. Many said that they simply did not have access to the data to assess opioid-related expenses. The exception was a company that contracted with a third party to examine whether the opioid epidemic was causing increased medical exposure or lost time. Results showed that opioids were not a driver of health care expenses, which was surprising to company representatives, because musculoskeletal claims were very high, and a driver of health expenses for the company.

OTHER ADDICTIVE SUBSTANCES, AND LEGALIZATION OF MARIJUANA

When asked about other addictive substances, some respondents identified alcohol and methamphetamines as bigger problems than opioids. For example, one respondent described alcohol as part of the culture in the community and among workers in the plant. "Alcohol is the drug of choice for many of the employees. We can walk across the parking lot, look into cars and count the 'empties'. There are Yeti coolers in some cars stocked with beer for the ride home. They're very open about it, they talk about, joke about it."

More commonly, respondents expressed concern about the legalization of marijuana, for both medical and recreational use, in most states. None of the companies that participated in this study reported changing their drug screening policies or drug free work policies due to the legalization of marijuana. However, respondents indicated that legalization raises important legal and practical issues. For example, respondents expressed concern about how to handle situations where an employee discloses having a medical marijuana card. As one respondent noted, "we don't want to violate anyone's rights, but we need to keep the plant safe." Recreational use of marijuana also poses concerns. Employees who use marijuana recreationally on their days off will not be able to pass a drug test, as a urine drug test may remain positive for several days after marijuana use. Respondents also expressed that they want to maintain the ability to fire an employee over marijuana use, but were concerned that their ability to do so is being diminished by state law. Several respondents expressed the sentiment that, "you cannot operate a forklift when you're high," and that restricting marijuana use was simply a matter of safety.

A small number of respondents also said that the legalization of recreational marijuana is also affecting their ability to recruit new talent, as many applicants fail the drug test due to marijuana use. One respondent said that the legalization of marijuana is one reason that his company decided to relocate a facility to a different state.

Overall, many respondents reported that they would like additional guidance on how to navigate the legalization of marijuana.

EMPLOYER INTERVENTIONS TO ADDRESS OPIOIDS AND OTHER ADDICTIVE SUBSTANCES

Over the past two decades, the National Safety Council, Occupational Safety and Health Administration, Substance Abuse and Mental Health Services Administration, and several other organizations from the public and private sectors have produced recommendations for employers aimed at reducing the impact of substance abuse disorders in the workplace.[13-15] The recommendations fall into six categories:

1. Employee education
2. Supervisor training
3. Written workplace drug-free policy
4. Employee assistance programs (EAPs)
5. Drug testing
6. Re-structuring of employee benefits

We asked respondents from the 22 companies about the strategies implemented by their companies to address the problem of opioids and other addictive substances.

1. Education. Respondents commonly described efforts to educate employees about opioids and substance abuse disorders, and resources available to them in the event that support or treatment is needed. They described sending information to employees in the mail and putting the information on television screens in the plants. One of the larger employers in our study described their educational efforts as follows:

> "It's a road show that we take to the plants. We show employees how to use Narcan [naloxone], and in some states we give them a Narcan kit. We also give them prescription bags so that they can lock up and keep their medications safe. We also give them charcoal bags that will help dissolve their pills. We know that pill misuse is a big problem, so we want to help them dispose of their pills properly. We've gone to nine plants so far, and given this two-hour session. We also have people from a recovery center come and talk about the recovery process. We also have law enforcement come in and talk about their experience, and the risk of highly addictive medication."

Another company reported training a group of union stewards, making sure that they are familiar with the resources available to employees through the employee assistance program and health benefits to help fellow employees in need. Representatives from several companies also described a very personal approach to employee education. In one company, one of the leaders is very open about discussing his son's opioid use disorder with employees, and encourages anyone who is struggling to come talk to him. He wants employees to know that there are people at the plant who understand substance abuse disorder who can be supportive. A leader of a smaller company reported that he tries to "stay very

personally involved with everyone," with the thought that it will be easier to intervene in the event of a problem if he has personal relationships with employees.

2. Supervisor Training. Supervisor training was another approach commonly described by respondents. Managers and plant-level human resources staff receive training on how to identify substance abuse disorders and the resources available to assist employees. Respondents also said that supervisors are trained on company drug testing policies. For example, some of the companies have "reasonable suspicion testing" policies, which mean that an employee may be subject to a drug test if the employee is involved in dangerous behavior that could compromise safety and performance or the employee has said or done something to indicate that he/she might be under the influence. However, supervisors must adhere to legal and company protocols if they decide to exercise reasonable suspicion testing.

3. ***Written Workplace Drug Free Policy***. Many respondents mentioned that their company is a drug free workplace and written guidelines are included in the employee handbook. Some respondents reported that these policies were helpful to "screen out" potential employees with substance abuse disorders. "They're not going to want to work here if they have a drug problem," according to one respondent. However, a couple of respondents reported that their companies are considering a change in policy to give employees another chance if they fail a drug test, but in at least one case, leadership support of the policy change has been mixed. Another respondent said that they recently amended their zero tolerance policy to indicate that the company will provide some assistance to the employee to seek help and potentially give the employee a second chance. At least a few respondents viewed substance abuse disorder, particularly opioid use disorder, as a sickness and expressed empathy for those who struggled.

4. Employee Assistance Program. An Employee Assistance Program (EAP) is an employee benefit that provides a range of services and resources to help employees and family members with personal or work-related stressors that may impact their performance, health, and well-being. When employees elect to use EAP services (e.g., for counseling, referrals), the use of services is confidential.

Respondents from larger companies reported relying heavily on their EAPs to provide employees with substance use treatment resources. Much of the educational interventions targeted at employees was focused on encouraging the use of the EAP. One respondent said that he "personally hands EAP cards to employees and encourages them to make the call." Some plants have EAP representatives on site with the hope that employees will be more likely to take advantage of the services. One respondent from a smaller company said that although they do not have an EAP, they were considering it.

5. Random Drug Testing. Overwhelmingly, respondents noted that they conduct pre-employment drug testing; however, fewer respondents said that they employed random drug testing. Some respondents from companies that do conduct random drug testing said that if the test is positive, the employee is immediately terminated. One respondent said that he's had employees that simply walk off the job rather than submit to a random drug test, knowing that they would fail and be fired. Others reported creating a "pathway" for employees who fail a random drug test to eventually return to work. At one company, the employee has to agree to counseling and monthly drug tests. If they test positive a second time, they are terminated. At yet another company, the owner and a union representative seek permission to talk to the employee's physician to discuss a course of action. The employee is put on a strict two-year probationary period. Respondents reported that relapse is common among employees who have been given a second chance.

Overwhelmingly, respondents described their companies' willingness to help and support employees who voluntarily "come forward" if they are struggling with substance use disorder. For example, one respondent reported, "We've offered help to people who come to us before they [are selected for] random testing. We don't have a program or pay for all rehab, but we do try to assist employees who come to us voluntarily. We will hold their job, keep their vacation and holiday pay and years of service. But if someone fails the random test, it's automatic termination." Another company has a benefit where people can go out on medical leave to get help, if they volunteer that they have a problem. As described by one respondent, "We are a values driven organization, and if an employee [voluntarily] goes to get treatment, we will hold their job. We will do almost anything we can to get people healthy. I'm not sure that our employees know or understand that."

The notion of giving employees a second chance after a failed drug test or working collaboratively with an employee with an admitted substance use disorder was described as controversial among leadership at a small number of companies. While some leaders believe that giving employees a second chance is the "right" thing to do, others argued that it is inconsistent with a drug free workplace policy.

6. Restructuring Employee Benefits. Several respondents reported that they had made changes to their health benefits recently, specifically to address or prevent opioid addiction. A common example was limiting opioid prescriptions, typically to seven days. Others said that they encouraged physician practices to implement point-of-care alerts that remind physicians to consider alternatives to opioids and/or limit the number of pills per prescription. Some respondents reported that the company worked with pharmacy benefit management companies to manage abuses of prescription pain management and to control refills.

Other respondents, typically from smaller companies, said that they relied on their health insurance carriers to manage these issues. One respondent said that they were looking at prescribing patterns of local physicians and identifying "high quality" physicians who avoid prescribing addictive medications for pain management, and encouraging employees to seek care from those physicians. The same respondent said that they are also piloting alternative pain management devices, for example, a device that provides electrical stimulation to reduce pain.

7. Other Interventions. Respondents identified additional interventions that their companies were undertaking – or considering undertaking – in response to the opioid epidemic. First, several respondents described efforts to prevent musculoskeletal injuries, thereby reducing the need for pain management. For example, one respondent said that the company recently began requiring employees to rotate work stations to prevent repetitive injuries; another said that they have retained a rehabilitative pain management group that delivers presentations about the proper way to stand, move, and lift and have referred employees to the group.

Second, a few respondents reported that they were exploring obtaining naloxone for their plants. Again, this was controversial in some companies, as some company leaders believed that having naloxone on site was contradictory to the companies' drug free workplace policies. Additionally, some expressed concern about the legal implications of administering naloxone, or administering it incorrectly. One respondent said that the physicians at the on-site clinic said that naloxone should only be available in the clinics, but not the plants. Nevertheless, at least two of our respondents reported advocating for the

purchase of naloxone for plants. "As far as I'm concerned, Narcan is a no-brainer, but that's not a universally held thought."

Respondents also reported a variety of other strategies to address opioids and other addictive substances, for example:

- Hiring full time employees who will be subject to random drug tests, rather than temporary employees who are not subject to random drug tests
- Restricting employees from going to their cars during break times, in an effort to cut off use of alcohol and drugs
- Launching a campaign "designed to integrate community speakers and to reach individuals within the community, particularly dependents"

Overall, it was the large companies that reported implementing more novel interventions, for example, piloting an alternative pain management device (a machine that "gives pulses to reduce individuals' pain") and providing drug disposal charcoal bags to employees. At least five companies reported that they had not undertaken any interventions related to substance use disorders. These are the companies that had not yet been affected by the opioid epidemic. A larger number of companies had not established any intervention on their own, but rather relied upon their EAP and health plans to address substance use issues. Few companies reported working with community partners, including public health agencies.

Impact of the Interventions. Many respondents described various interventions that their companies implemented to prevent or reduce addiction and its harmful effects, but few could offer evidence of impact. There were two exceptions. One company's efforts to limit opioid prescriptions reportedly resulted in an "enormous" decline in fentanyl prescriptions. According to another respondent, recently adopted point-of-care alerts in physician offices resulted in a 25 percent decline in costs for short-acting opioids, but an increase in costs for long acting opioids for employees and family members receiving pain management treatment.

EVIDENCE-BASED INTERVENTIONS

There have been several studies that have evaluated the effectiveness of employer-led interventions to reduce the impact of opioids and other major addictive drugs in the workplace. To determine the effectiveness of these interventions, we conducted a systematic review of the published literature, searching through 11 databases to identify these studies. We screened over 13,000 titles and abstracts, of which 27 were relevant to our purposes, meaning that they presented results of an employer-led intervention to reduce the negative effects of drug use or other substance use disorders. Of the 27 articles, 17 (63%) tested individual interventions including employee education, development of a written workplace drug policy, establishment of an employee assistance program, and employee drug testing. Often the articles described the effect of the intervention on employee drug use, workplace injuries, or absences. Twenty-three of the articles were based on interventions in the US; the others were from Australia, Canada, Portugal, and Spain. Unfortunately, many of the queried research articles were poorly designed to identify the true effect of the interventions, meaning that the overall quality of the evidence is weak.

Table 1 summarizes the results from the systematic review. We identified studies suggesting that each of the four interventions can reduce drug use, workplace injuries, or absences; however, some interventions were more consistently associated with benefits. The majority of studies on written workplace drug policy (3 of 4) and drug testing (4 of 5) reported reduction in drug use. Drug testing was also associated with lower workplace injuries in 6 out of 9 studies. Education had less convincing evidence with just 1 out of 7 studies finding significant reduction in drug use due to this intervention. Use of an EAP showed mixed results, although few studies were found to have evaluated EAPs.

Table 1. Number and Percent of Articles showing Benefits of Employer-Led Interventions to reduce the impact of opioids and other addictive drugs in the workplace

		Interventions			
		Employee Education	Written Workplace Drug Policy	Employee Assistance Program (EAP)	Drug Testing
Outcomes	Reduction in Drug Use	1/7 (14%)	3/4 (75%)	1/2 (50%)	4/5 (80%)
	Reduction in Workplace Injuries	1/1 (100%)	0/2 (0%)	1/2 (50%)	6/9 (66.7%)
	Reduction in Absences	-	0/1 (0%)	0/1 (0%)	1/3 (33%)

Results lend support to the notion that some employer-led interventions may be effective in reducing the negative impact of opioids and other addictive substances in the workplace. However, due to the overall low quality of the research designs in these studies, there is a need for more rigorous investigations of employer-led interventions to reduce the impact of opioids and other addictive drugs in the workplace.

GREATEST CHALLENGES

We asked respondents about the greatest challenges they encountered as they planned or implemented strategies to address substance use disorders. The responses varied considerably, but the legalization of marijuana was the most common challenge identified by respondents.

One respondent said that it was hard to find good resources to help the company address opioid addiction. “Vendors come to us with diabetes management programs, but no opioid programs.” Two respondents described difficulties “reaching” employees quickly and efficiently with educational messages. They described difficulty getting employees to understand the resources available to support them and the development of clear messages that resonate with employees. One respondent added that many employees were “technology illiterate,” noting that e-mail was not an effective way of reaching employees.

Another respondent discussed the difficulty of educating both employees and company leadership on substance abuse disorder generally, and naloxone specifically. This respondent was an advocate for having naloxone on site, and she encountered resistance from executives and the company's health team who expressed concern that having naloxone on site signals that the company condones drug use. The respondent also reported that it was challenging to figure out how to purchase a large number of naloxone kits and distribute them to the company's plants around the country.

Several respondents reported that the absence of data on the extent of the opioid problem within the company was a challenge. Respondents reported that they didn't know how many employees or their family members were struggling with substance use disorders, nor how it is affecting the company's health care costs. As one respondent noted, "Internally, I can get help if I can show [that] the issue is bad. Right now I don't have the data to substantiate that. I need to prove how bad the addiction problem is. This is my biggest challenge." Another respondent said that he wished that he could know specifically, through insurance claims, who was struggling with substance use disorders so that they could reach out to those employees. The respondent expressed concern that "too many employees were dealing with addiction silently."

RESOURCES AND NEEDS

When asked about what resources would be helpful, respondents commonly expressed a desire for more guidance on how to structure company policies in the wake of legalization of marijuana. Many respondents also expressed an interest in learning about how other companies were structuring their workplace policies around opioid and other substance addiction. Finally, two respondents said that more local rehabilitation facilities were needed. In some areas, there is a considerable wait list for treatment. One respondent said that an employee had to seek rehabilitation at a facility located 260 miles away.

CONCLUSION

Many manufacturing companies are struggling with long-standing addiction issues among employees, coupled with new challenges related to the opioid epidemic and legalization of marijuana. These new challenges are particularly troubling for companies as they attempted to recruit capable, effective workers during a time of low unemployment. Many companies adopted strategies to prevent or address addiction, including education and training, drug testing, and development of a written drug workplace policy. However, few could identify the specific impact of those strategies. Our interviews were conducted at a time of rapid change in the legalization of marijuana at the state level and rising awareness of the opioid epidemic and the addictive nature of opioids. Our findings suggest that there may be a gradual shift in company attitudes about substance use disorders, and perhaps movement away from strict zero-tolerance policies, as several respondents mentioned second chances for struggling employees.

A review of the published literature revealed considerable weaknesses concerning the evidence of effectiveness of employer-led interventions. Nevertheless, the published literature provides some suggestion that certain employer-led interventions may be effective in reducing drug use, accidents, and absences under some circumstances. Manufacturing leaders would like to learn about what other companies are doing to address the issue, and in particular, would welcome guidance on how to respond to the legalization of marijuana.

METHODOLOGICAL APPENDIX

In 2017, the U.S. Department of Health and Human Services declared the opioid crisis a public health emergency. Building on our prior work examining the link between community health and manufacturing, we partnered with the Manufacturing Institute to (1) describe the effect of opioids and other substance use issues on US manufacturers, (2) describe the strategies manufacturers have taken to address these issues, (3) identify evidence-based best practices for addressing substance abuse in the workplace, and (4) identify ongoing needs of manufacturers with regard to substance use support. The study involved two components: interviews with leaders of manufacturing companies and a systematic literature review.

Interviews with Leaders of Manufacturing Companies. We conducted telephone interviews with leaders of manufacturing companies between April and June 2019. The Manufacturing Institute provided a list of contacts from 83 companies, and each company representative received up to 5 invitations to participate via email. Ultimately, representatives from 22 companies and one state business association agreed to an interview. Their titles included President/CEO; vice president (labor and employee relations; communications and public affairs); chief human resources officer; director of government relations; and manager (workers compensation, disability & occupational health; talent acquisition). Participating companies were diverse – producers of steel, paper, plastics, automobiles and automotive components, aircraft, electronic components, bedding, crop protection products, treated wood, and more. The companies also varied by size: four were small companies with fewer than 100 workers; there were 6 mid-size companies with 100-500 employees; 12 large companies employed over 500 people; and the state business association represented roughly 1,500 companies, many hailing from the manufacturing sector.

The interviews were guided by a semi-structured interview protocol (below), which included questions about how opioid and other substance use by employees and/or close family members affects productivity, workforce issues, and health care costs; the strategies companies have undertaken to address the issue; and useful and needed resources. Interviews typically lasted 30 minutes and were digitally recorded with each participant's permission.

Two team members conducted the interviews, and using a rapid analysis method, listened to the interview recordings and organized responses in an Excel table based on the questions in the interview protocol and emergent themes and concepts. Data collection was approved by Northwestern University's Institutional Review Board.

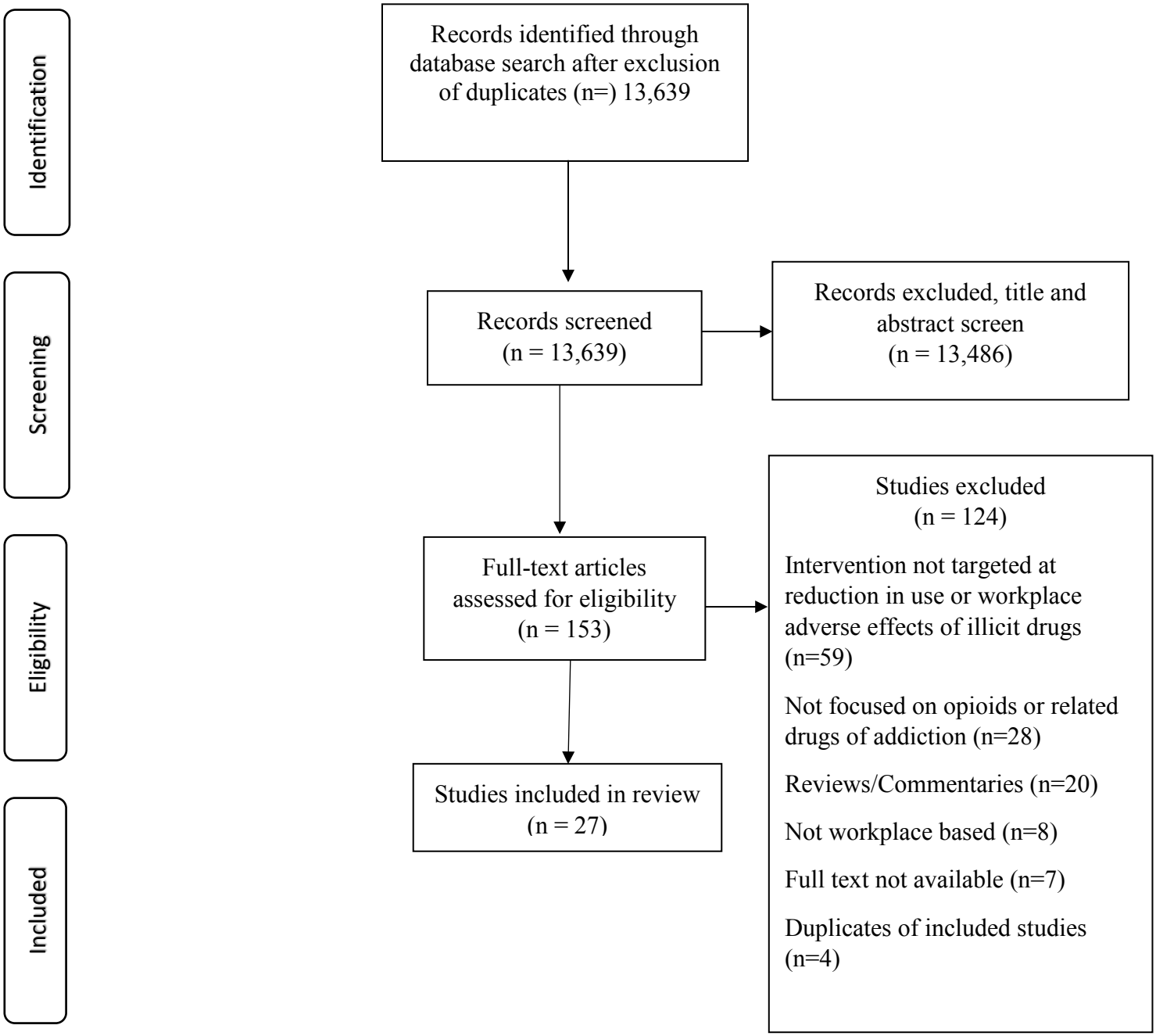
Systematic Literature Review

To determine the effectiveness of interventions aimed at addressing the problem of opioid use in the workplace we conducted a systematic review of published literature. PubMed MEDLINE, Embase (embase.com), PsycINFO (Ebsco), ABI Inform Global, Business Source Premier, EconLit, CENTRAL Register

of Controlled Trials, Web of Science (Thomson Reuters), Scopus (Elsevier), Proquest Dissertations, and Epistemonikos were searched from inception through May 8, 2019, with no date or language restrictions. Search terms included workplace, employer, employee, substance-related disorders, substance abuse, substance misuse and interventions. We included randomized controlled trials, quasi-experimental studies, cohort studies, cross-sectional studies and pre-post studies which investigated the effectiveness of an employer-initiated intervention to reduce the adverse effects of opioids and/ or other drugs of addiction on the workforce or productivity. Recommended employer initiated interventions include: employee education, supervisor training, written drug-free workplace policy, employee assistance programs (EAPs), random drug testing and re-structuring of employee health benefit plans. Papers that investigated workplace interventions for alcohol abuse or tobacco use were excluded. Also excluded were interventions which were not employer-initiated. Case reports, case series, editorials, and commentaries were excluded. Although systematic reviews were excluded, they were used as source documents to identify relevant studies.

Search results were saved into Endnote files by the librarian. All EndNote files were collated and transferred into Covidence 7 for subsequent processing. Three reviewers independently reviewed the titles and abstracts. Conflicts were resolved by consensus. Extraction of data from included studies was carried out independently by three reviewers (two reviewers per article) using a data extraction template designed by the investigators and embedded into Covidence. Information extracted included study identification, year of publication, country, study design, study sample, number of participants, intervention type, outcome measures, and efficacy of the interventions. The methodological rigor of the included studies were assessed using the modified Down and Black checklist. This checklist reliably assesses the quality of randomized controlled trials as well as non-randomized studies.

Figure 1: PRISMA Flow diagram of study selection



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