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RESEARCH ARTICLE

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Workers' compensation reported injuries among distillery industry workers, 2010–2019

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Abstract

Background: The objective of this study was to identify the most frequent type, nature, and cause of work-related injuries among distillery workers and the contributing factors for these events to target interventions to reduce injuries.

Methods: Workers' compensation first reports of injury (FROI) from the years 2010 through 2019 were obtained. Variables were created for "occupational category" and "cause of injury" for evaluation of the injurious events. The ratchet circular scan test was used to assess seasonal variation in injury, and kernel density estimation to assess rates of injury by calendar year.

Results: A total of 974 FROIs were recorded over these 10 years; 908 of the injuries resulted in lost time, 65 resulted in no lost time, and 1 resulted in a fatality. The most common injuries reported were strains or tears, lacerations, and contusions (33.4%, 14.7%, and 13.5%, respectively). The most frequent anatomical sites of injury were the shoulders, fingers, and low back area (11.8%, 11.4%, and 8.9%, respectively). Barreling operation activities experienced the greatest frequency of work-related injury at 28.5% of all FROIs. A seasonal peak of injuries was observed during May and June.

Conclusions: Implementing ergonomic and safety solutions for transportation and work tasks associated with barreling operations may significantly reduce the rate of work-related injuries in distillery workers. Injury prevention interventions should particularly target strain or tear injuries caused by repetitive motion or bodily reaction and overexertion. Contact with objects or machinery accounted for one-third of distillery industry FROIs.

KEYWORDS
bourbon production, distilling, injury prevention, Kentucky, occupational injury, workers' compensation

1 | INTRODUCTION

The Kentucky distillery industry is a robust network of 68 licensed distilleries, which cumulatively produce 95% of the world's supply of bourbon whiskey, resulting in an estimated $8.6 billion industry.[1] In 2018, there were 12,026 persons employed under the North American Industry Classification System (NAICS) distillery classification code (NAICS = 312140) in Kentucky.[2] The Bureau of Labor Statistics (BLS) estimates 24% of those employed in the beverage manufacturing industry in the United States are women, and the median age of beverage manufacturers is 38.8 years of age.[3] At the federal level, the Occupational Safety and Health Administration

(OSHA) defines a distillery as "a plant [or portion of a plant] where flammable liquids produced by fermentation are concentrated and where the concentrated products may also be mixed, stored, or packaged."[4]

Industrial fermentation, specifically, the distilling of bourbon whiskey is a multistep process taking several years and extensive manpower.[5] The distilling process begins with the creation of distillable mash from corn, rye, wheat, and malted barley with water and yeast.[5,6] This mixture is heated and stirred in a vat for typically 1–2 weeks to fully ferment the mixture. Once fermentation is complete, the liquid ethanol is strained from the fermented solids. The distillation process purifies the liquid by heating and vaporizing it generally in copper pot stills, then collecting the vapor as it recondenses into a liquid—repeating the process two or three times. This distillation process boosts the alcohol content and removes impurities. Once the distillate bourbon reaches between 40% and 62.5% ethanol (80–125 proof), it is aged in a new charred oak barrel for at least 2 years; many barrels are aged several years longer. The charred layers of oak caramelize the sugars, contributing to the spirit′s distinct flavor and color. Finally, the aged product is diluted with filtered water and bottled for shipment.

Occupational injury accounts for a considerable number of injury-related disabilities and fatalities in the United States.[7,8] According to the BLS Survey of Occupational Injuries and Illness, approximately 2.8 million private industry employees were nonfatally injured in 2019, a rate of 2.8 per 100,000 full-time equivalent workers (FTE); the same rate was reported in both 2017 and 2018.[3] According to the BLS 2019 Census of Fatal Occupational Injuries, 5333 workers died as a result of work-related injury in 2019, the largest annual number of work-related fatalities since 2007.[9] Musculoskeletal Disorders (MSDs), a common work-related injury classification, results in approximately 320,000 "lost workday cases" each year, contributing to 29% of all lost work injury and illness workers′ compensation claims.[10,11] Costs associated with MSDs in the United States exceed that of cancer. The anatomical regions most often involved in MSDs include the low back area at 48% of all cases, and the shoulder region at 13%. These MSDs often reduce the ability of an individual to perform activities of daily life in addition to activities at work.[10,11]

Little data have been published pertaining to the enumeration of worker injuries and mortality in the distillery industry; however, among general beverage manufacturers, the BLS reports that workers experienced a rate of work-related injury at 5.2 per 100 FTE workers in 2017, 68% higher than the national average.[3] The most prevalent occupational hazards associated with distilling include proximity to hazardous equipment, noise, and chemicals as well as ergonomic, confined space, and explosion hazards.[4,12] A common source of occupational injury data is from workers′ compensation claims.[3,13] Although the information gathered through workers′ compensation insurance first reports of injury (FROI) and associated claims are administrative in nature, the standardized data collected across various industries has culminated in a database of useful injury and occupational health data, which may be employed by public health professionals in the surveillance and analysis of work-related injuries and the framing of injury prevention strategies.[14] In Kentucky, all employers with one or more employees are required to maintain workers′ compensation coverage, with an exemption for agricultural producers unless they elect coverage.[15] Kentucky employers are required to report employee FROIs (which is defined by at least one day of missed work) to their workers′ compensation insurance carrier within 1 week of the injurious work event.[15]

To our knowledge, there are no previous reports of work-related injury among distillery workers in the literature. However, other studies have sought to examine the frequency of injury, cost of injury, lost time, task performed before injury, and percent of disability through the use of workers′ compensation data.[16–20] Such studies were conducted to identify factors associated with occupational injuries, determine the subsequent monetary and physical consequences, and put forth recommendations for prevention. The purpose of this study was to use workers′ compensation data to identify the most frequent type, nature, and cause of work-related injury amongst distillery workers over time to help to target potential interventions.

2 | METHODS

2.1 | Data source

This study used injury and occupational disease data from Kentucky workers′ compensation FROI, for the time period January 1, 2010 through December 31, 2019. The data were obtained from the Kentucky Injury Prevention and Research Center in collaboration with the Kentucky Department of Workers′ Claims. The analytic data set was devoid of personal identifiers, but contained demographic information including age, sex, marital status, number of dependents, state of residence, hire date, date last worked, and occupational task description. Information pertaining to the injury event included injury date, return to work date, and date of death. The variables pertaining to specific injury: nature of injury, standard cause of injury, and body part injured were coded based on Workers′ Compensation Insurance Organization coding scheme under the International Association of Accident Boards and Commissions FROI umbrella.

Study inclusion criteria comprised of (1) all workers′ compensation FROI for Kentucky distillery workers, specified under the NAICS industry code: 312140 Distilleries, who had sustained an occupational injury between the years 2010 to 2019; (2) FROI, which were both open and closed; (3) all individuals who worked in Kentucky even though they may have resided in another state; (4) male and female claimants age 18 years and older. Workers′ compensation data exclude individuals who were self-employed, employed in agriculture, or persons′ employed in domestic services.

The variables job tenure, season of injury, month of injury, day of week injury occurred, and year of injury were created using the hire date, injury date, and last work date variables. The county of injury variable was excluded to protect worker confidentiality. Utilizing the

"occupation description" category and insight from leaders in the distillery industry, including two health and safety specialists from Beam Suntory, 15 occupational categories (including missing values) were created based on the assessment of the occupational descriptors. Similar job tasks were grouped into more generalized categories; for example, the category "Barreling" included "Barrel Raisers," "Stave Operators," and "Bilge Operators" among other related occupational descriptors. Additionally, an assessment of the text narrative for injury cause was conducted to determine the frequency of injury types through the creation of 10 injury cause categories, which were adapted from the BLS Occupational Injury and Illness Classification Manual Event or Exposure Code.[21]

A 2019 economic report by Coomes and Kornstein, in collaboration with the Kentucky Distillers' Association, provided the denominator number of distillery employees and number of barrels produced in Kentucky from the years 2010 to 2017 for calculation of injury rates.[1] Their data on the number of distillery employees was obtained from the US BLS, Quarterly Census of Employment and Wages, for the distilling industry (NAICS 31214).[22] The equation of the line from linear regression analysis of the number of barrels produced for the years 2010 through 2017 was used to estimate the number of barrels produced in 2018 and 2019.

2.2 | Statistical analysis

Descriptive statistics were calculated for continuous and categorical variables. The continuous variables age and job tenure were divided into quartiles. Categorical variables included season of injury, month of injury, day of week injury occurred, year of injury, occupational category, nature of injury, body part injured, injury cause, county of injury, state of residence, gender, injury cause, and extent of injury. Statistical Analysis System (SAS) version 9.4, Microsoft Excel, and the statistical package PEPI-for-Windows (WINPEPI) were used for data analysis.[23,24]

The frequency distribution and seasonal variation of worker injury by month of injury were assessed through the use of the ratchet circular scan test.[24] The proportion of injuries, and the corresponding confidence intervals, were determined to assess the range of injury within demographic and injury-event subgroups. The χ^2 goodness-of-fit test was then used to assess differences in observed injury frequencies from expected; for the univariate analysis, the expected is a uniform distribution. The rate of injury, and 95% confidence interval, was calculated from an estimate of number of persons employed in the distillery industry and number of bourbon barrels produced by calendar year. Annual rates of injury are presented as crude rates and smoothed rates (using a kernel density smoothing approach); however, the year "2010" was excluded from analysis due to the small numerator of workers' compensation FROIs ($n = 3$). We are unsure why such a small number of injuries were recorded in 2010. In 2010, the workers' compensation coding system changed from a standardized occupation data field to a free-text occupation data field. The changeover most likely affected reporting in 2010, thus data from that year was not included in the study.

3 | RESULTS

3.1 | Demographic characteristics

Between 2010 and 2019 there were 974 FROI recorded by the Kentucky Department of Workers' Claims under the distillery industry classification (NAICS = 312140), with 908 (93.2%) of them resulting in lost time, and one worker fatality. Table 1 presents the characteristics of these injury events. The ages of the distillery employees ranged from 18 to 77 years, with a mean of 42 years (SD: ±13.4). The greatest frequency of FROI was in the age range 45–64 years with 388 FROI (39.8%). Approximately 80% of the injury events occurred among males as it reflects the sex distribution of workers in the beverage manufacturing industry. Job tenure ranged from less than 1 year of employment to 46 years, with a mean of 11.3 years (SD: ±10.7), indicative of a right-skewed distribution with only about 25% of these injury events occurring among workers having a tenure of 15 years or more. However, job tenure was missing for 214 (22%) distillery employee FROI.

The proportion of injuries was similar across the seasons, but the summer months had a slightly higher frequency of injuries—279 (28.7%)—with June representing the greatest number of FROI at 106 (10.9%) of all injuries. Through the ratchet circular scan test a 2-month seasonal peak was identified in May and June, in which 19.9% of the injury events occurred; however, this seasonal variation was not statistically significant ($p = 0.10$). Although many distilleries operate on Saturdays and Sundays, not all do, or they operate with reduced staff; only 7.3% of the injuries occurred on weekend days. Monday had the highest proportion of the injuries—220 (24.4%)—excluding Saturday and Sunday. The year with the greatest number of FROI was 2016 with 152 FROI (15.6%). The number of injuries increased dramatically after 2013, which was associated with the beginning of an expansion of the distillery industry in recent years (Figure 1).

Information on occupation was missing for 68 (7%) of the distillery industry FROI. The number of FROIs by 15 occupational categories are reported in Table 2. The occupational category that reported the highest number of workers' compensation FROI was barreling—258 (28.5%). In regard to proportion of FROI by occupational category, barreling was followed by: general laborer 115 (12.7%), operator 114 (12.6%), and bottling 113 (12.5%)—all of which had a similar number of FROIs reported. These four job categories accounted for approximately two-thirds of all FROIs.

3.2 | Injury event characteristics

The frequency of injury by nature of injury, body part injured, and cause of injury are presented in Table 3. The most common type of injuries were strains or tears, 325 (33.4%); lacerations, 142 (14.7%); and contusions, 131 (13.5%). These types of injuries accounted for over 60% of all injury types. The most common body parts injured were the shoulder, 115 FROI (11.8%); fingers, 111 claims (11.4%),

TABLE 1 Characteristics of distillery industry workers' compensation first reports of injuries, 2010–2019 ($N = 974$)

	N (%)	χ^2 goodness-of-fit p value
Age (years)		<0.0001
18–29	178 (18.2)	
30–44	381 (39.1)	
45–64	388 (39.8)	
65+	27 (2.8)	
Gender		<0.0001**
Male	775 (79.6)	
Female	196 (20.1)	
Job tenure (years)		<0.0001**
<1–4	230 (30.3)	
5–14	340 (44.7)	
15–29	122 (16.1)	
30+	68 (9.0)	
Season of injury		0.0663
Spring	234 (24.0)	
Summer	279 (28.7)	
Autumn	236 (24.2)	
Winter	225 (23.1)	
Day of week of injury		0.0074*
Sunday	20 (2.1)	
Monday	220 (22.6)	
Tuesday	172 (17.7)	
Wednesday	187 (19.2)	
Thursday	171 (17.6)	
Friday	153 (15.7)	
Saturday	51 (5.2)	
Year of injury		0.10
2010	3 (0.3)	
2011	21 (2.2)	
2012	38 (3.9)	
2013	81 (8.3)	
2014	130 (13.4)	
2015	147 (15.1)	
2016	152 (15.6)	
2017	129 (13.2)	
2018	141 (14.5)	
2019	132 (13.6)	

Note: χ^2 goodness-of-fit for univariate analysis compared to a uniform distribution within the categories of the variable.

Abbreviation: SD, standard deviation.

*Saturday and Sunday excluded from χ^2 analysis.

**Missing values: job tenure ($n = 214$) and gender ($n = 3$) were excluded from χ^2 analysis.

and the lower back area, including the lumbar and lumbosacral region, at a frequency of 87 (8.9%). Strain or injury, not otherwise classified (NOC) was the most frequent cause of injury at 96 FROI (9.9%). Strain or injury by pushing or pulling was the second most common cause of injury in 91 (9.3%) FROI, and strain or injury by lifting represented the third most frequent cause of injury with a respective frequency of 71 (7.3%) distillery employee FROI.

Stratifying by occupational category showed that the relative frequencies of the nature of injury and the cause of injury remained consistent across occupational categories. The most common natures of injury involved strains or tears, contusions, and lacerations and contact with objects/machinery and bodily reaction and exertion were the most common causes. However, workers in the barreling job category experienced strains or tears, injury by contact with objects and machinery, and overexertion more than double the number of injuries compared to any other job.

An assessment of categories of the illness or injury event from the narrative description in the FROI revealed that the three most frequent injury cause types were contact with objects/machinery in 351 FROI (36.2%), bodily reaction and overexertion at a frequency of 317 (32.7%), and slips, trips, and falls at 138 FROI (14.2%) (Table 4).

The one fatality occurred when a distiller and a distiller apprentice were producing a batch of moonshine and the pot still ruptured covering them with 200°F mash. Both employees were severely burned by the hot mash and the apprentice distiller died 17 days later due to complications from infection resulting from burns to 86% of his body.[25]

3.3 | Rate of distillery employee injury

The number of distillery workers in Kentucky gradually rose between 2011 and 2019, indicating a steady increase in the industry. The injury rate per 10,000 distillery workers also rose until 2015, plateaued, and then began to decrease after 2016 (Figure 1). The number of bourbon barrels produced also dramatically increased between 2011 and 2019. The rate of worker injury calculated per 100,000 barrels showed a rise in injury rate until 2013 and then a steady decrease in injury rate per 100,000 barrels produced since that year (Figure 2). This indicates that as production increased, the injury rate also did not increase. Using kernel density smoothing, the distribution for both rates of injury by calendar time is displayed in Figures 1 and 2.

4 | DISCUSSION

The bourbon distillery industry has been growing nationwide for the past 10 years. Because of its long legacy in the production of bourbon spirits, Kentucky ranks first in the United States in distillery industry production and employment, with 31% of national distilling employment and 33% of national output.[1] This makes Kentucky the

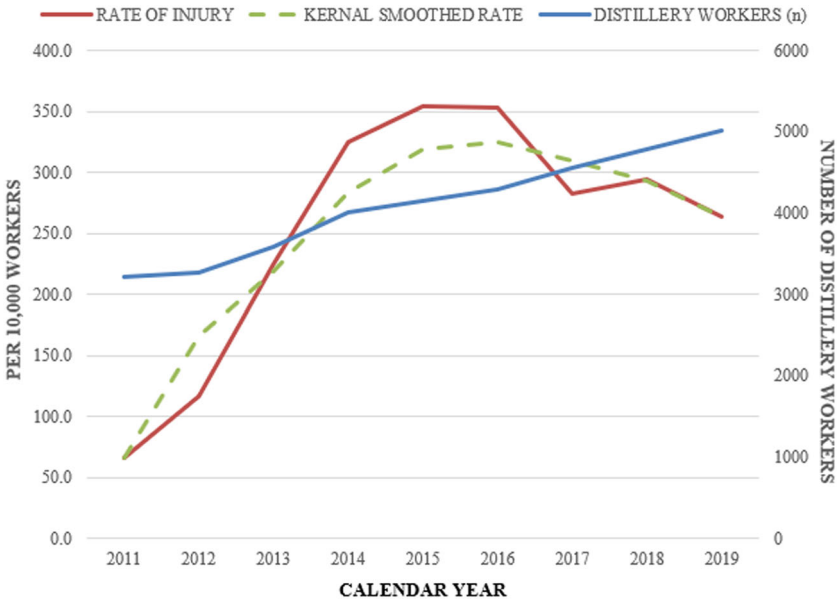

FIGURE 1 Distillery industry worker numbers and rates of injury per 10,000 distillery industry workers, 2011–2019

prime state for investigating the characteristics and causes of injuries in this industry of rising economic importance.

The most common injuries recorded in FROI in the distillery industry were injuries of mild severity, including strains or tears, lacerations, and contusions, and through the narrative analysis of the injury cause, it was shown that many of the injuries were due to contact with objects or machinery, such as barrels, and bodily reaction and overexertion in which the employee pushed beyond their physical capabilities to complete a work task. The most frequent body parts injured include the shoulders, fingers, low back area, and knees, all of which are involved in the physiological task of lifting, pushing, and pulling objects.

The distillery occupation with the greatest number of work-related FROI was barreling, involved in the cleaning, filling, and transportation of bourbon barrels as well as other maturation warehouse tasks. The most common cause of FROI for barreling employees was a strain or tear through repetitive motion. Barreling is a very active, strenuous job and with over one-quarter of the FROI associated with this job. Therefore, barreling work activities may be recommended for targeted safety interventions to reduce injuries.

An analysis of workers′ compensation FROI over an extended study period revealed that as the number of employees and barrel production increased, the number of injuries also increased for a time but then the number of injury FROI remained fairly stable at approximately 140 claims per year between 2014 and 2019. Therefore, the increase in the number of employees and production in the distillery industry was not correlated with an increase in the number of workers′ compensation FROI.

The analysis of these data may be used to guide future distillery worker safety efforts. For example, the number of FROI appears to increase in the summer months. This is perhaps due to occupational heat exposure and the nature of distillery work.[26] Additionally, the number of FROI appears to be somewhat higher on Mondays, which has been observed by other investigators in other industries and is reported to be associated with lack of sleep and schedule change.[27] Bodily reaction and overexertion and contacts with objects and machinery cause the highest number of claims indicating injury causes for focused interventions.

Potential solutions to control the most common injury events vary across the distillery industry. Some engineering controls that have been employed include the use of mechanical devices—hydraulic lifts or hoists, pulley systems, and conveyors—to assist in the handling of heavy objects such as barrels and other controls to reduce bodily exertion injury.[28] Additionally, providing distillery workers with adequate rest breaks and encouraging job rotation between jobs with varying exposures and risks could assist in reducing the frequency of repetitive motion injuries.[29] In regard to accounting for the frequency of workers who had suffered an injury due to contact with objects or machinery, regular continuing education training could be implemented to assist workers in identifying hazards and mitigation strategies.

Limitations of this study include uncertainty in the estimation of the number of distillery employees from BLS data for the denominator of workers from which the FROI data were obtained.[22] Therefore, the calculated rates in Figures 1 and 2 are estimates based on the proposed number of workers and barrels produced during the years studied; however, they are likely fairly accurate estimates, which allow for a comparison of a change in injury rates over time. Additionally, the stratification of rates by occupational category or job tenure was unable to be performed due to a lack of publicly available denominator data by job category. Another limitation is the ambiguity of the "occupation description" variable, which, for example, classified some claimants as "operator" or "laborer" without specifying the type of work tasks they were involved in and which part of the distillery their work occurred. Misclassification of

TABLE 2 Nature, body part, and cause of injury among distillery industry workers' first reports of injuries, 2010–2019 ($N = 974$)

	n (%)
Nature of injury	
Strain or tear	325 (33.4)
Laceration	142 (14.6)
Contusion	131 (13.5)
Sprain or tear	86 (8.8)
Foreign body	49 (5.0)
Fracture	48 (4.9)
All other specific injuries, NOC	28 (2.9)
Burn	25 (2.6)
Crushing	25 (2.6)
All other cumulative injuries	22 (2.3)
Other nature categories	93 (9.5)
Body part injured	
Shoulder(s)	115 (11.8)
Finger(s)	111 (11.4)
Low back area[a]	87 (8.9)
Knee	68 (7.0)
Hand	66 (6.8)
Eye(s)	45 (4.6)
Lower leg	45 (4.6)
Wrist	45 (4.6)
Lower arm	39 (4.0)
Ankle	33 (3.4)
Other injured body part categories	320 (32.9)
Cause of injury	
Strain or injury, NOC	96 (9.9)
Strain or injury by pushing or pulling	91 (9.3)
Strain or injury by lifting	71 (7.3)
Strain or injury by repetitive motion	63 (6.5)
Caught in, under, or between objects handled	42 (4.3)
Fall, slip, or trip, NOC	39 (4.0)
Fall, slip, or trip on the same level	37 (3.8)
Cut, puncture, or scrape, NOC	36 (3.7)
Foreign body in the eye	36 (3.7)
Struck or injured by falling or flying object	34 (3.5)
Other causes of injury	429 (44.0)

Note: NOC, "not otherwise classified" in reference to the injury event.
[a]Including lumbar and lumbosacral.

TABLE 3 Number of injured distillery industry workers' first reports of injuries by occupational category, 2010–2019

Occupational category	*n* (%)
Administration	33 (3.6)
Barreling[a]	258 (28.5)
Bottling	113 (12.5)
Cooperage[b]	76 (8.4)
Customer service	24 (2.7)
Driver	22 (2.4)
Food/beverage services	17 (1.9)
Inspection	20 (2.2)
Laboratory services	7 (0.8)
Laborer	115 (12.7)
Maintenance	82 (9.1)
Operator	114 (12.6)
Security/fire prevention	9 (1.0)
Shipping/receiving	16 (1.8)

Note: Sixty-eight missing values of 906 first reports of injuries.
[a]Involved in the cleaning, filling, inspection, and transport of barrels and warehouse operation.
[b]Involved in the production and repair of barrels and staves.

TABLE 4 Cause of injury in distillery industry workers' first reports of injuries, 2010–2019

Cause of injury	*n* (%)
Bodily reaction/overexertion	317 (32.7)
Burn	15 (1.5)
Contact with objects/machinery	351 (36.2)
Exposure to harmful substances	53 (5.5)
Hearing loss	7 (0.7)
Insect/animal bite	15 (1.5)
Repetitive motion	62 (6.4)
Slips/trips/falls	138 (14.2)
Weather-related illness	5 (0.5)
Other events	8 (0.8)

Note: Three missing values; adapted from BLS Occupational Injury and Illness Classification Manual Event or Exposure Code.[21]

variables in the workers' compensation data for some workers may have occurred potentially diminishing the accuracy of our findings. This analysis for a single-state study of FROI among distillery employees may not be generalizable to distilleries in other states.[17]

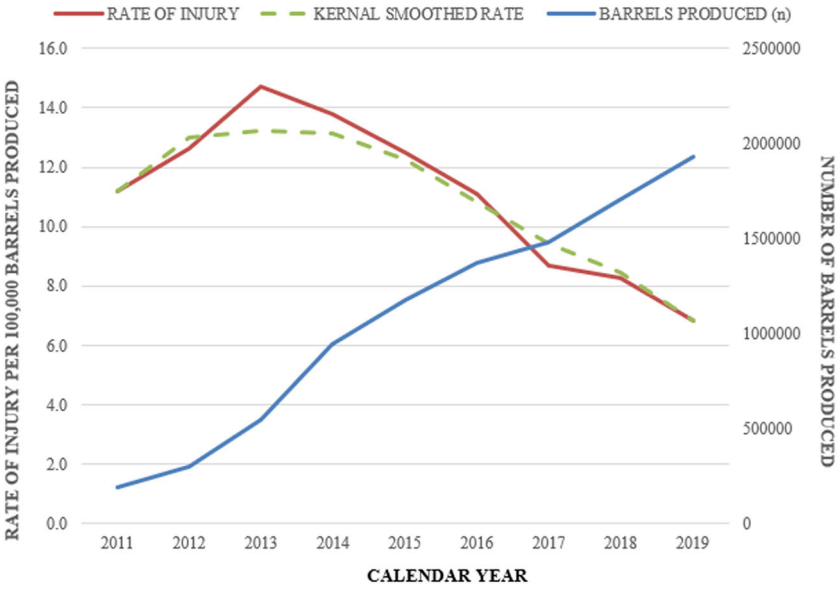

FIGURE 2 Numbers and rates of distillery industry injuries per bourbon barrels produced, 2011–2019

Finally, data pertaining to distillery employee FROI used a limited coding schema to describe worker injuries lacking a more detailed coding structure and characterization of the working conditions, potential exposure risks, and causes of the injuries.

Many studies have used workers' compensation FROI in the context of injury cause and monetary impact.[18–20] However, no known study has used worker's compensation FROI data to assess occupational injury in the distillery industry. Because Kentucky is home to approximately one-third of the distillery workers and bourbon production, it serves as the ideal state for an evaluation of Workers' Compensation claims concerning this workforce.

What was gleaned from this study was the most frequent type, nature, and mechanism of distillery injury as well as a general exploration of factors that may have contributed to the precipitation of the injurious event. These findings may serve as a research to practice base for occupational health professionals associated with the distillery industry in their work to develop interventions or continuing education subject matter. As the bourbon distilling industry of Kentucky continues to expand, focusing on distillery worker injury prevention must remain a priority. As evidenced by the occupational category, injury cause, and mechanism of injury, improving, and implementing ergonomic solutions to everyday work tasks including the pushing, pulling, and in general transporting of barrels may have a positive influence on the rate of work-related injury in the proceeding years of distillery industry production.

AUTHOR CONTRIBUTIONS

All authors participated in the conception and design of the work. Terry Bunn was primarily responsible for data acquisition and interpretation of the results of the data analysis. Mira Mirzaian, Wayne Sanderson, and Steven Browning were responsible for data analysis, presentation, and interpretation of the results. All authors contributed to the writing, editing, and preparation of the manuscript for publication. The authors agree to the final content of the manuscript and approve the version to be published; the authors agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The authors and the Kentucky Injury Prevention Research Center (KIPRC) do not own the authorized data resource (workers compensation first reports of injuries) that was used to perform this epidemiological study. We performed secondary data analysis of existing data that is owned and managed by the Kentucky

Department of Workers' Claims. The authorized data source provider must be contacted by interested users to obtain their data. All published results will be available for information sharing by direct request from other researchers or the general public. Data are subject to third party restrictions. Data are available upon request to the Kentucky Department of Workers' Claims

DISCLOSURE BY AJIM EDITOR OF RECORD

John Meyer declares that he has no conflict of interest in the review and publication decision regarding this article.

ETHICS APPROVAL AND INFORMED CONSENT

The University of Kentucky Institutional Review Board for the Protection of Human Subjects provided written approval for the Kentucky Occupational Safety and Health Surveillance program and protocol number 44741 through which this study was performed.

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