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Shinobu Watanabe-Galloway

Christine Chasek
University of Nebraska at Omaha

Aaron M. Yoder

Jesse E. Bell

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Substance use disorders in the farming population: Scoping review

Shinobu Watanabe-Galloway, PhD[1], Christine Chasek, PhD[2], Arron M. Yoder, PhD[3], & Jesse E. Bell PhD[3]

[1] Department of Epidemiology, College of Public Health, University of Nebraska Medical Center, Omaha, Nebraska, USA
[2] Department of Counseling and School Psychology, University of Nebraska at Kearney, Kearney, Nebraska, USA
[3] Department of Environmental, Agricultural & Occupational Health, College of Public Health, University of Nebraska Medical Center, Omaha, Nebraska, USA

Abstract

Purpose: The purpose of this scoping review is to summarize the current knowledge base in order to make recommendations for prevention and treatment of substance use disorders among the farming populations.

Methods: We conducted a scoping review of peer-reviewed articles published between January 1989 and September 2019. The search yielded 3,426 citations and the final review was conducted on 42 articles. The full review was conducted by 4 authors to extract information about the target population, data collection methods, and main results.

Findings: There were 21 articles on farmers and 21 articles on farmworkers. The majority of the articles were about alcohol. Overall, farmers had higher prevalence of risky alcohol consumption patterns than nonfarmers. The prevalence of risky alcohol consumption was also high among farmworkers compared to the general population. Risk factors for risky alcohol consumption included male gender, lower socioeconomic status, and psychological problems (eg, depression). Recommendations for prevention and intervention of alcohol disorders included policy development and implementation to curb alcohol access by taxation, screening of alcohol-related problems, and alternative means of recreation instead of alcohol consumption.

Conclusions: This review confirmed that alcohol-related problems are prevalent among farmers and farmworkers. More population-based research is called for to understand the additional risk factors of alcohol disorders and the prevalence of other substance-related disorders. Also, interventions should be tailored to the unique culture of farmers and farmworkers.

Keywords:
Alcohol, farmer, farmworker, rural, substance abuse

Farmers in the United States and other countries have demanding and stressful jobs. They face a myriad of stressors—some that are ordinary and some that are unique to the rural way of life. Economic

uncertainty, vulnerability to weather events and government policies, financial pressures, extreme work conditions, excessive workloads, and isolation make up some of the unique factors that farmers face.[1–4] These types of stressors cause the most distress because they are out of the control of the individual, leading to serious physical and behavioral health issues. Despite these challenges, many farmers have a strong drive to take care of the land and to succeed at all costs. This drive, labeled by 1 researcher as the "agrarian imperative,"[5] often leads farmers to experience mental health and substance use issues.[1] This can be seen in the high rates of prescription drug use, excessive alcohol use, depression, and suicide in rural areas of the country.[6–9]

The American Farm Bureau Federation conducted a large-scale sur- vey in 2019 to better understand the factors associated with the mental health of farmers.[10] This national research poll highlighted the stressors and emotional impact that farming has on rural America. Farmers surveyed indicated that financial issues (91%), farm or business problems (88%), and fear of losing the farm (87%) had the biggest impact on their mental health.[10] There was also consensus that mental health among adults in rural communities is viewed as a growing problem; 2 in 5 of the respondents said that stress and mental health had become more of a problem in recent years with 48% of respondents saying they were personally experiencing more mental health challenges than they were a year ago.[9,10] Freeman et al. had previously reported on the mental health of Iowa farmers studying the farm- related stressors for this population.[11]

These stressors lead to more serious issues with depression and suicide.[1,3,4] Common factors for farmers at risk for suicide include financial stress, social isolation, physical injury, chronic pain, and access to lethal means, with firearms identified as the most frequent method used.[1,3,4,12] In addition, poor access to mental and health care ser- vices can be contributing factors.[13] In addition to higher rates of suicide in rural areas, higher rates of alcohol abuse, tobacco use, prescription drug abuse, and methamphetamine use have been noted in rural adults.[14] The United States Department of Agriculture Economic Research Service reported that mortality rates are also rising among working-age adults living in rural America due to the rising rates of prescription drug misuse and heroin use.[15] The CDC has also been monitoring the rates of drug overdose deaths and found that the rates of drug overdose deaths in rural areas now surpass rates in urban areas.[9]

There are approximately 1.15 million farmworkers in the United States, of which over 80% are Hispanic.[16,17] About 19% of these farm- workers are migrants.[16] Migrant workers are defined as persons "who reported jobs that were at least 75 miles apart or who reported moving more than 75 miles to obtain a farm job during a 12-month period."[16] Most farmworkers are immigrants, with limited formal education; 4% reported they had no formal education and 37% reported that they completed the 6th grade or lower.[16] Only about half (51%) had work authorization.[16] Farmworkers, especially migrant farmworkers, experience structural vulnerability, a social situation that results from eco- nomic exploitation and all forms

of social discrimination.[18] Farmworkers are often reluctant to complain about unsafe or hazardous work environments due to fear of job loss and deportation.[18] Stress is also common among farmworker populations. For example, a study con- ducted in Nebraska found that over 30% of migrant farmworkers responding to the survey were identified as having a high stress level and 45.8% were depressed.[19] Farmworkers have high prevalence of psychiatric disorders, average stress, and anxiety scores,[20,21] and it has been suggested that immigration-related stress may lead many Latino seasonal farmworkers to turn to alcohol for a coping mechanism.[18,22]

Worldwide, the prevalence of alcohol consumption among the rural population varies greatly, ranging from 1.4% to 64%,[23–30] and among farmers, the prevalence of high-risk alcohol consumption ranged from 18% to 43%.[26,29,31] Especially in the developing countries, such as South Africa, where the use of dop system, a form of remuneration whereby farmworkers are part-paid in kind with alcohol, has contributed to a wide dispersion of a culture of alcohol consumption in agricultural and rural communities.[32]

Taken together, all these issues create a need for understanding what is known about substance use in the farming population and what prevention and intervention efforts are needed. The purpose of this scoping review is to summarize the current knowledge base in order to make recommendations for prevention and treatment of substance use disorders among the farming populations. The overarching question was: What is known from the existing literature about substance use among farming populations? Two specific questions were: (1) What is the extent of high or risky alcohol consumption and substance use among farming populations? and (2) what are the risk factors for high or risky alcohol consumption patterns and drug use among farming populations?

METHODS

We conducted a scoping review to examine peer-reviewed articles on alcohol and drug use in the farming population. In step 1, a literature search was carried out in 6 databases: PubMed, Cochrane Central Registry of Controlled Trials, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycInfo, and Scopus. The search was limited to articles published in English between January 1989 and September 2019. Subject headings and key words related to substance use and farmers were included in the search strategies (see online Appendix). A medical librarian developed the search strategies in discussion with the team, searched the databases, and removed duplicate citations. The search yielded a total of 3,426 citations (Figure 1).

In step 2, we created a comprehensive table that included the full article citation and complete abstract along with the 4 components comprising a criterion checklist: (1) the study dealt with alcohol and/or substance use, (2) the study sample included farmers, (3) the study examined the burden of alcohol and/or substance use, and (4) the study examined the risk factors of alcohol and/or substance use. Two

authors reviewed the articles individually to determine which, if any, of the 4 were present and the overall inclusion criteria. For inclusion, reviewed articles had to meet the first 2 criteria and either the third or fourth criterion. Whenever the reviewers reached consensus for these 4 criteria, the article was either included or excluded. When there was a disagreement among the authors, the article was discussed by all 4 authors and final determination of inclusion or exclusion was made. During this process, we identified 1,055 potential articles that met the inclusion criteria.

In step 3, 2 reviewers paired up to review the full articles. During the full article review process, we discovered many articles were relevant to the overall purpose of the study. As shown in the flow chart, 974 studies were excluded for various reasons. In the end, a total of 42 studies were included in the analysis for this paper. A spreadsheet was created to extract the following information about the 42 studies: (1) author(s), (2) publication year, (3) data collection year(s), (4) target population, (5) data collection methods/sources, and (6) main results. The initial charting sheet was piloted with 5 publications and necessary modifications were made. Two authors independently developed: (1) a numerical summary of population-based measures of burden and (2) a list of risk factors. Then, the 2 authors got together to create a document to combine results.

In step 4, all 4 authors participated in a meeting to identify notable time trends and subgroup differences and risk factors. In this meeting, the authors discussed potential recommendations and made a draft document to describe the recommendations. The recommendation draft document was circulated among all authors to make necessary changes to create the final list of recommendations, review the document, and make necessary changes.

RESULTS

Overview

Table 1 shows a summary of the 42 articles by publication year, geography, and population. There were 21 articles on farmers in the United States (n = 6), Europe (n = 6), South America (n = 1), Asia (n = 3), and Africa (n = 5). Of note, studies conducted in the United States were relatively old with 3 articles being published in 1989-1993. European studies are relatively more recent (ie, published in the 2010s). There were 21 articles on farmworkers with 16 studies about the US population. The study period spanned from the 1990s to the 2010s. In the following section, we report the findings for farmers and farmworkers separately.

FARMER POPULATION

Study methods

According to Table 2, all 21 studies focused on the adult population, although some samples included adolescents.[26,33–37] Most studies included both males and females in the study sample but some

articles exclusively studied males or the majority of the participants were males,[33,36,38–42] a reflection of the male-dominant farmer population. Random sampling methods were used in 7 studies, the census data were used in 2 studies, and remaining studies used convenience sampling methods. As for assessment of alcohol and drug use, 4 studies used the Alcohol Use Disorders Identification Test (AUDIT), 3 studies used the CAGE, 1 study used the Diagnostic Interview Schedule (DIS), and 1 study used the National Campaign Against Alcohol Drug Abuse (NACADA) assessment.

Comparison of farmers and nonfarmers on alcohol consumption

Three US studies found that the alcohol-related problems are more significantly common among farmers than nonfarmers, while 2 US studies found otherwise. Brooks and Harford,[34] who studied California statewide occupational mortality data, reported that the group that included farmers had the second highest age-adjusted cirrhosis mortality rate of 41.23 per 100,000 compared to the state average of 20.07 per 100,000 population. An analysis of North Dakota Behavioral Risk Factor Surveillance System data found that the age-standardized binge drinking prevalence was highest among farmers (37.1%).[43] Zwerling et al., who studied Iowa farmers and nonfarmers, found that there is no significant difference in the prevalence of alcohol abuse among farmers, rural nonfarmers, and townspeople except for the age group 45- 64 years. In this group, rural nonfarming men had significantly higher prevalence of alcohol abuse (15.8%) compared to farmers (3.2%).[44] Hsieh et al. examined the time trend of new cases of alcohol problems among farmers between 1978 and 1979 in Nebraska. The increasing trend in the new cases was observed for the entire sample, while the initial increase followed by a decrease was observed for the farmer sample.[45]

Three studies were conducted in Europe and Australia, which found the prevalence of alcohol use or alcohol-related problems to be higher among farmers than nonfarmers, while 1 European study and 1 South African study found otherwise. An Australian study of 1,792 participants of the Sustainable Farm Families program indicated that farmers had a significantly higher prevalence of short-term risky alcohol consumption compared to the national data (men: 56.9% vs 20.5%; women: 27.5% vs 16.9%).[29] Zhao et al. analyzed Spanish national follow-up data and found that among men, the prevalence ratio for excessive alcohol was higher among farmers than nonfarmers, but no statistically significant difference was reported for women.[46] On the other hand, the national follow-up study conducted in Sweden indicated that the age- adjusted alcohol-related mortality was lowest among farmers.[47] An analysis of New South Wales Population Adult Survey data indicated that alcohol use was comparable between male farmers and male non- farmers, while more nonfarm women (33.7%) drank 3 or more drinks on a day compared with farm women (25.7%, $P = .04$) and a higher proportion of nonfarm women (44.0%) had 5-6 alcohol drinks in a day in the past month compared with farm women (31.6%, $P = .04$).[26] The South African study of a sample of farmers and urban residents found that the prevalence of high-risk drinking based on CAGE and AUDIT was higher among urban residents than farmers.[48]

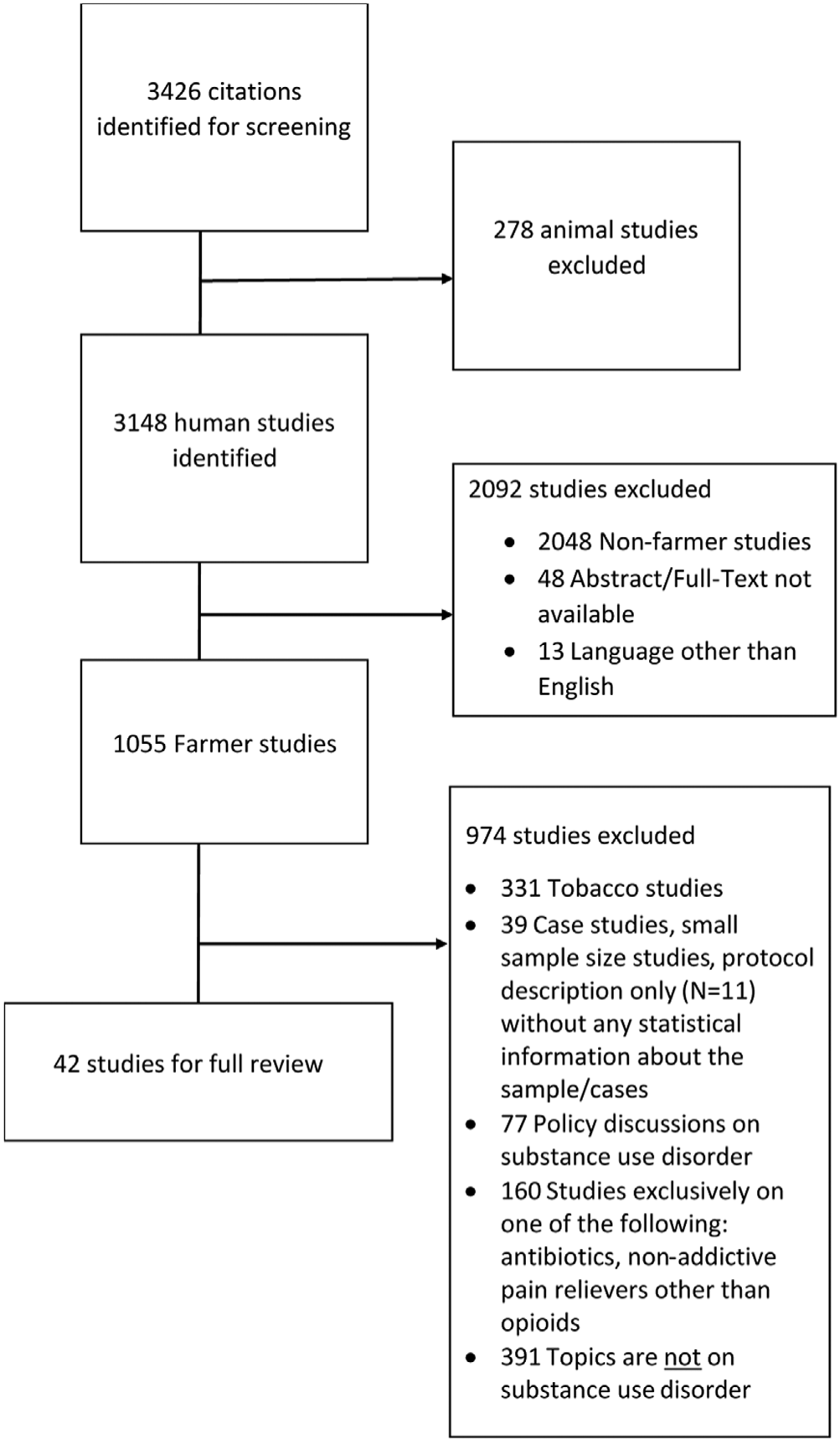

FIGURE 1 Flow chart of article selection

Studies that exclusively examined farmers' alcohol use

TABLE 1 Location and study period (N = 42)

Farmers (n = 21)	
1980s	US (California) 1978-81 US (Nebraska) 1978-86[45] US (California, Connecticut, North Carolina,Maryland, and Missouri) 1980-85[51] Sweden 1980-90[47]
1990s	Malawi (Zomba) 1990-92[36] US (Iowa) 1994[44] India (Madhya Pradesh) 1994[66]
2000s	Spain 2001-11[46] Australia 2003-09[29] US (North Dakota) 2004-05[43] Nigeria (Bayelsa Sate) 2006[33] Nigeria 2006[42] Nigeria 2007[50] Australia (New South Wales) 2008[26] China (Qiqihar) 2008[35] South Africa 2008-2010[48]
2010s	Brazil (Sao Lourenco do Sul) 2011[49] Ireland 2013[39] Kenya (Meru) 2013[41] Thailand (Phitsanulok and Nokorn Sawan provinces) 2015[40] United States, Canada, Israel, and western Europe (2012-2015)[38]
Farmworkers (n=21)	
1990s	South Africa (Western Cape)1993[61] US (Texas) 1995[55] US (East) 1998-99[65]
2000s	US (Northwest) 2002[68] US (Pennsylvania) 2002-07[64] South Africa (near Cape Town) 2004[32] US (North Carolina) 2003[60] US (North Carolina) 2007[54] US (North Carolina) 2007[53] Mexico 2008-09[67] US (California) 2008[62] US (Florida) 2008[56] South Africa 2008-15[62] US (North Carolina) 2009[69] US (South) 2009[63] US (South) 2009[70]
2010s	US (North Carolina) 2010[59] Mexico (Baja California) 2012[71] US (North Carolina) 2012[18] US (Florida) 2015[57] US (Nebraska) 2016[58]

In general, the studies we reviewed reported a high prevalence of heavy alcohol use among farmers. For example, a study of 314 Irish male farmers found that 49.8% of respondents drank 6 or more drinks per occasion in the past month.[39] A study of 2,452 tobacco farmers in Brazil reported that 30.8% of male farmers engaged in high-risk drinking, defined as having more than 2 doses of drinks per day.[49] An analysis of 2,050 Chinese farmers found that 39.9% of male farmers consumed alcohol at breakfast or lunch.[38] A study of 322 farmers in Nigeria reported that 33.2% of farmers abused alcohol in the past 12 months.[33]

Studies on drug use

Only 2 articles studied drug use among farmers. A study conducted in the United States, Canada, Israel, and 9 western European countries on 6,626 cannabis growers reported that 34.4% of medical growers used illicit drugs; the most commonly used illicit drugs were magic mush- room, ecstasy, and LSD.[38] A study of 196 farmers in Nigeria found that 78% of the sample had nonmedical use of prescription drugs and 29.1% used marijuana.[50]

Risk factors of alcohol abuse

One of the major risk factors of heavy or high-risk alcohol use is gender. All studies that included the female sample concluded that the prevalence of alcohol use was much higher among men than women.[26,33,41,45,48,51] Other consistent risk factors for alcohol use were age—younger farmers were more likely to engage in heavy or high-risk alcohol consumption[29,39,44,51] and had lower educational levels.[33,51]

FARMWORKER POPULATION

Study methods

According to Table 3, most of the studies focus on the adult population but some studies exclusively focused on adolescents or younger adults.[52–55] For example, Cooper et al. studied migrant farmworker middle and high school students.[55,58] Similar to the farmer studies, almost all studies included predominately male samples. Unlike farmer studies, the majority of studies used convenience sampling mainly because farmworkers are a hard-to-reach population and there is no ideal sampling frame. In many cases, researchers worked with community leaders or community organizations to recruit study participants.[52,56,57] The following standardized assessments were used in the reviewed articles: CAGE (7 studies), AUDIT (4 studies), Patient Health Questionnaire (PHQ) (1 study), Michigan Alcohol Screening Test (MAST) (1 study), and Rapid Alcohol Problems Screen (RPS4-QF) (1 study).

Quantitative studies on alcohol and drug use

A study of 276 Hispanic farmworkers and their spouses in Florida reported that 43.8% of the respondents had at-risk drinking.[56] In a sur- vey of 241 migrant workers in Nebraska, 38.2% of males and 10.8% of females were found to have a positive AUDIT-C score.[58] Another study of 371 male farmworkers in North Carolina found that 50.1% of the sample had an AUDIT-C score ≥ 4.[59] Hiott et al., who surveyed 125 male migrant farmworkers in Northern California, found that the prevalence of the CAGE score ≥ 2 to be 37.6%.[60] A study in North Carolina found that 37.9% of farmworkers compared to 16.0% of nonfarmworkers had a score of CAGE ≥ 2.[18] Another study in North Carolina found that 38.7% of farmworkers had a CAGE/4M score ≥ 1.53 CAGE/4M is the Spanish version of CAGE. The prevalence of alcohol-related problems was higher in the South African population.

Three studies of farmworkers found the proportion of farmworkers with a CAGE score ≥ 2 to range from 67.1% among female workers to 87% of male farmworkers.[32,61,62] Risk factors for high-risk alcohol use included younger age,[58,62] having 1 or more psychiatric conditions,[56] depression,[59] negative work safety climate,[58] and higher stress level.[18] An analysis of Youth Risk Behavioral Survey data from Texas found that 50.0% of migrant middle school students, compared to 35.3% of nonmigrant middle school students, had 1 or more drinks in the past month. About 7 in 10 (70.2%) of migrant high school, compared to 34.7% of nonmigrant high school students, had 1 or more drinks in the past month.[55] One study that examined drug use among farmworkers in the Southern US reported that 87.8% of the sample had used crack cocaine and 92.6% of the sample used marijuana at least once in their lifetime.[63] This study also reported a correlation between higher wage and drug use, especially cocaine.

Qualitative studies on alcohol and drug use

One of the general themes of the qualitative studies reviewed in this scoping review was that farmworker communities perceive alcohol as a problem. For example, a study of emancipated adolescent migrant workers in California reported that drinking and driving in this population group was a problem.[52] The study reported 3 reasons for the problem: (1) job demands of parents limiting their ability to supervise their children, (2) adolescents getting pressure to use drugs to fit into their social networks, and (3) easy access to drugs.

An ethnographic study of 15 adult Mexican migrant workers in Pennsylvania indicated that social anxiety and peer pressure are rea- sons for drinking.[64] The same study reported that life in the migrant camps is anxiety-ridden with little rest time between shifts—another reason for workers to turn to drinking. Another ethnographic study found that drug use onset in the agricultural population occurred in a locale of familiarity, meaning once the workers settled into a certain community for work, they resumed their drug use patterns.[65] A study of 127 farmworkers in the Southern US reported that poly drug use develops over time as workers learn what drugs give the most effect based on the physical labor demands and the use of multiple drugs for different purposes.[63]

DISCUSSION

Surprisingly, the majority of the studies reviewed in this paper were on alcohol, and only a few studies focused on other substances. Over- all, the literature indicates that farmers have a higher prevalence of alcohol consumption than nonfarmers. Also, quantitative studies conducted among the United States and shortened MAST score ≥ 5 were 87% and 65%, respectively.[61] As for risk factors, the studies reviewed in this paper indicated that being male,[26,33,41,44,48,51] being of a younger age,[29,39,44,49,51,62] being married,[18] having a lower educational level,[33,51] having less financial assets,[34] having a higher stress level,[18] and having depression[59] are factors associated with alcohol and substance use disorders among farmers and farmworkers. Qualitative research studies also indicated the following themes to be related to alcohol- and substance-use problems: social networks pressure,[57,64] easy access to drugs,[57] and lack of access to recreational activities to relieve anxiety and stress.[64]

Recommendations have been made on research directions and specific interventions to reduce substance use among farmers and farmworkers. Among the studies that look at farmers in the United States, Roberts and Lee, who conducted a multicommunity study, recommended to invest resources to increase early detection and intervention for alcohol and drug abuse problems.[51] Authors of a study con- ducted in North Dakota recommended policies, such as alcohol excise taxes and limiting the density of alcohol outlets and hours of sales to reduce substance abuse.[43] Two studies conducted in Australia recommended further qualitative research and comprehensive research on alcohol consumption patterns with a representative sample of Australian farmers.[26,29] A study conducted in India recommended that communities should involve their elders and educated youth in the decision-making process to come up with effective measures to deal with opium addiction and crop diversion.[66] Among the studies of farmers in Africa, many different recommendations have been made. For example, studies in Nigeria recommended sales restrictions of alcohol and increased taxation.[33,42] A study in South Africa recommended health workers talk to individuals about the effects of drinking during pregnancy.[48] Another study conducted in Kenya indicated the need for further research that uses longitudinal study design, adding assessment of African specific gender role adherence as well as other culturally pertinent psychosocial variables that influence substance abuse.[41]

In regards to the studies of farmworkers in the United States, a variety of recommendations regarding the interventions and research have been given. A study conducted among emancipated adolescent migrant farmworkers in California indicated the need for health care services that accommodate the farmworkers' mobility and addressing a range of issues including preventative care to workers' rights.[52] A study conducted among migrant farmworker students recommended targeted educational interventions and additional support for migrant students.[55] A study conducted among Hispanic seasonal workers recommended strict enforcement of rules and regulations that limit

access and marketing of marijuana to youths.[57] Another study of His- panic farmworkers in Southwest Florida recommended primary care brief alcohol interventions.[56] A study among male Latino migrant farmworkers in North Carolina recommended health outreach workers and health care providers should include alcohol screening in their standard activities and implement education programs.[18] A study conducted in Nebraska indicated the need for future research that explored how different types of machismo interact with work safety climate to affect alcohol consumption and its consequences on farmworkers.[58] Another study conducted among male farmworkers in North Carolina indicated that further research is needed to identify housing factors that could affect the mental health of farmworkers (eg, relationships with roommates, correlation between work organization and housing conditions).[59] Recommendations from the studies conducted in South America and Africa include making changes to living and working conditions that can have a positive impact on laborers' psychological distress[67] and promotion of a comprehensive intersectoral (ie, collaboration among different social groups) rural development strategy.[61]

As pointed out by some of the articles reviewed in this study, many research gaps exist in the alcohol- and other substance-related disorder research among farmer and farmworker populations. First, there needs to be more research conducted on drugs other than alcohol. Of the total of 21 articles on farmers, only 5 studies dealt with substance abuse (United States, India, Kenya, Malawi, Nigeria, and South Africa). Of the 21 articles on farmworkers, only 7 studies focused on substance abuse (all in the United States). With the reported increase in prescription drug misuse, methamphetamine use, and heroin use in rural areas of the United States,[16,17] there should be more efforts made to conduct a robust population-level study assessing the prevalence of the use of various substances among farmers and the farmworker population. We also note that alcohol-related studies among farmers conducted in the United States are outdated compared to the ones conducted elsewhere. The most recent study in the United States was the one in North Dakota where the data collection was conducted in 2004-2005.[46] One potential way to conduct a study among farmers is to include the survey at farm-related events (eg, farm shows) and farm-related education venues (eg, collaboration with the extension program). Another way to collect data is to conduct an ad-hoc study based on the existing agricultural surveys conducted by the National Institute for Occupational Safety and Health and the US Department of Agriculture. Lastly, by adding questions about the occupation in existing surveys, such as National Survey on Drug Use and Health and Behavioral Risk Factor Surveillance System, information about substance use and alcohol specific to farmers and farmworkers can be collected.

TABLE 2 Summary of articles on farmers

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
USA						
Brooks and Harford[34]	To determine if alcohol-related death is associated with occupation.	**California. 1978-1981**.N = 173,438. Employed individuals. Age: 16-64 years.	Secondary data analysis of the California Occupational Mortality Study data. 2% random sample of 1980 Census.	The group that includes farming had the **age-adjusted cirrhosis mortality rate** per 100,000 of 41.23 the second highest occupational group compared to the state average of 20.07.	Specific occupations with higher alcohol-related mortality rates **employ mostly men who are heavier and frequent drinkers than women**. These occupations usually **lack direct supervisions and individuals work in isolation, giving more opportunities to drink**.	NA
Roberts and Lee[51]	To examine the prevalence of depression, alcohol abuse, and drug abuse among different occupational groups in the United States.	**California** (L.A.), **Connecticut** (New Haven), **North Carolina** (Durham), **Maryland** (Baltimore), **Missouri** (St. Louis). **1980-1985**.N = 18,572 (132 farmers). Epidemiologic Catchment Area (ECA) study participants. Age: 18-64 years. 52% male.	Secondary data analysis of the ECA Wave I data. ECA used multistage probability sampling. In-person interviews using **DIS**.	Farming group had the third highest **prevalence of alcohol abuse / dependence** for 1 month (4.9%), 6 months (8.1%), 12 months (10.1%), and lifetime (24.1%).	For the entire study sample (that includes other occupations), **risk factors for alcohol abuse /dependence**: male, younger age, and lower educational level.	Resources to increase early detection and intervention are needed.
Zwerling et al.[44]	To determine the distribution of injury risk factors in a rural Iowa community and to identify the rural subgroups at highest risk for injury.	**Iowa** (Keokuk County). **1994**. N = 1,583. Participants of Round One Keokuk County Rural Health Study. Age: ≥25 years.	Secondary analysis of Keokuk County study data. Stratified random sampling of residents. In-person interviews using **CAGE** and environmental assessment.	**Among farmers Alcohol abuse** defined as answering 3-4 CAGE questions positively: male 3%-4% female 0%-1%. **Binge drinking** defined as 5 more drinks on 1 occasion within last 30 days: male 4%-35% female 0%-15%.	For the entire sample including farmers, rural nonfarmers, and town residents, **risk factors for binge drinking** were: male, younger age, living in town, or being farmers (compared to being rural nonfarmers).	NA
Hsieh et al.[45]	To test the stress hypothesis for alcoholism.	**Nebraska. 1978-1986**.N = 126,350 (5,268 farmers). Individuals referred to state-funded treatment for alcohol-related problems. Age: <21 years 14.1%, 21-39% 48%, 40-49 16.1%, 50-64 19%, ≥65 2.8%. 97.9% male.	Secondary data analysis of state-funded substance abuse treatment program data.	**Time trend of new cases of alcohol problem among farmers** shows an increase from 413 in 1978-79 to 833 in 1982-83 then a decline to 606 in 1985-86. The increase time trend was observed for the entire sample.	**Risk factors of alcohol problem**: The male to female ration was 3 to 1 for the total group and 49 to 1 for the farmers. The mean age of farmers with drinking problems was 36.2, significantly older than for the group as a whole (33.8).	NA

(Continues)

TABLE 2 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Jarman et al.[43]	To assess rates of binge drinking and frequent binge drinking among occupational groups in North Dakota.	**North Dakota. 2004-2005**.N = 7,055. BRFSS participants. Age: ≥18 years. 50% male.	Secondary analysis of BRFSS data. Disproportionate stratified sampling. BRFSS is a phone interview study.	**Binge drinking prevalence among farmers**: Crude 45.3%; age-standardized 37.1%--these are highest among occupation groups.	NA	Increasing alcohol excise taxes, limiting the density of alcohol outlets and hours of sale, and enforcing laws prohibiting the sale of alcohol people already intoxicate are recommended.
AUSTRALIA & EUROPE						
Hakkarainen et al.[38]	To compare the characteristics of recreational versus medical growers of marijuana.	**United States, Canada, Israel, and 9 western European countries. 2012, 2013, 2015**.N = 6,626. Cannabis growers. Age: ≥18 years. 93.2% male.	Sampling and recruitment methods vary by site. Convenience sampling. On-line survey with **International Cannabis Cultivation Questionnaire**.	In the past 12 months: **alcohol** 65.6%-85.9%, **ecstasy** 0%-32%, **amphetamine** 0%-24%, **cocaine** 0%-17.6%, **LSD** 0%-25.1%, **magic mushroom** 0%-53.4%, **opioids** 0%-19.6%, **benzodiazepines** 0%-19.2%, **synthetic cannabinoids** 0%-14.4%. **Daily use of cannabis** 21.4%-39.4%.	Medical growers were more likely to use cannabis daily compared to recreational growers.	Further qualitative research to explore mixed recreational and medical motivations and the relationships between therapeutic effect and pleasure is recommended.
Eather et al.[26]	To determine if alcohol consumption between farm and nonfarm residents varied.	**Australia** (New South Wales). **2008**.N = 10,296 (1,117 farmers). New South Wales Population Adult Survey respondents. Age: ≥16 years. 43.7% of the farmer sample male.	Stratified random sampling of households. Population-based phone survey.	**Male sample** **At-risk drinker** defined according to NHMRC guidelines: farmer 43.5% nonfarmer 39.1%. **High-risk drinker** defined according to NHMRC guidelines: farmer 11.5% nonfarmer 14.2%. **Female sample** **At-risk drinker** defined according to NHMRC guidelines: farmer 25.7% nonfarmer 30.3%.	**Risk factor for drinking**: male gender. (No statistically significant difference between farmers and nonfarmers.)	Further qualitative research to examine the way that farm residents use alcohol is recommended.

(Continues)

TABLE 2 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Brumby et al.[29]	To examine the relationship between farmers physical and mental health and their alcohol consumption.	**Australia. 2003-2009**.N = 1,792. Sustainable Farm Families (SSF) program participants. Age: 18-74 years. 53.4% male.	SSF program participants from 97 locations across Australia. Convenience sampling. Self-administered survey with **AUDIT** and health exam.	**Short-term risky alcohol consumption** defined as ≥6 drinks/occasion for men ≥4 drinks/sitting for women at least once a month: male farmer 56.9%, female farmer 27.5%, male Australian national sample 20.5%, female Australian national sample 16.9%.	**Predictors for risky alcohol consumption**: the entire sample including farmer: younger age, being farmer. Within the farmer sample: younger age.	Comprehensive research on alcohol consumption patterns with a representative sample of Australian farmers and further research on the culture around patterns of consumption and the impact on both mental and physical health risk factors are needed.
van Doorn et al.[39]	To examine the relationship between male farmers' self-reported health outcomes and health behaviors.	**Ireland. 2013**.N = 314. Male agricultural training course / meeting participants. Age: ≥18 years. 100% male.	Participants were recruited at a training course or a meeting. Convenience sampling. Self-administered survey.	**≥1 drink/week**: 22%. **≥6 drinks/occasion once or more times per month**: 50%.	Younger farmers (<45 years) more likely to engage in binge drinking.	NA
Zhao et al.[46]	To compare mortality by cancer sites and other specific causes of death, and the prevalence of risk behaviors in farmers and nonfarmers in Spain.	**Spain. 2001-2011**.N = 15,499,172 (620,311 farmers). Employed adults. Age: 20-64 years. 61.8% male.	The sample was taken from the national follow-up study of the Spanish population in the 2001 census linked with national health survey and population and mortality registry data.	MePnrevalence ratio for excessive alcohol consumption: 1.66 (significantly higher in farmers than in nonfarmers). WomePnrevalence ratio for excessive alcohol consumption: 0.23 (not significantly lower in farmers than in nonfarmers).	Among men, being a farmer was a risk factor for excessive alcohol consumption.	NA
Hemstrom[47]	To estimate the contribution of alcohol to socioeconomic mortality differences in Sweden.	**Sweden. 1980-1990**. 22,940,773 person years. Swedish residents. Age: 20-64 years. 49.4% male.	The sample was taken from a national follow-up study of the census linked with mortality data.	**Age-standardized alcohol-related mortality rate** per 100,000 for the entire sample was 69.56 for men and 15.16 for women. The rate was lowest among farmers (men: 15.62 and women: 6.52).	NA	NA

(Continues)

TABLE 2 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
South America						
Favero et al.[49]	To describe the prevalence of heavy drinking and high-risk alcohol consumption among tobacco farmers.	**Brazil** (Sao Lourenco do Sul). **2011**.N = 2,452. Tobacco farmers. Age: ≥18 years. 57.8% male.	A random sampling using tobacco sales data. In-person interviews with **CAGE**.	**High-risk alcohol consumption** was defined as >2 doses/day for men and >1 dosea day for women. 30.8% of males and 4.7% of females had high-risk consumption every day. **Heavy drinking** was defined as ≥15 doses/week for men and ≥8 doses/week for women. 4.8% of males and 1.1% of females were heavy drinkers. **Positive CAGE** score: males 4.7% females 0.1%.	**Factors associated with high-risk drinking**: Males: Younger age, not having a partner, lower % of income represented by tobacco, being an employee or lessee (vs owner), having a loan in 2010, selling the tobacco to a scammer, using pesticides for over 10 days, being a smoker, packed the tobacco, worked over 12 h a day during harvest. Females: Younger age, lower % of income represented by tobacco, not having a partner, being employees or lessees (vs owner), and been exposed to pesticides.	Healthcare and education services should be implemented.
ASIA						
Wang et al.[35]	To document Heilongjiang Province farmers' patterns of alcohol consumption and to examine the association between alcohol consumption and agricultural work-related injuries.	**China** (Qiqihar). **2008**.N = 2,050. Farmers: Age: 15-79 years. 52.4% male.	Systematic and cluster sampling used. In-person interviews.	**≥5 drinks/week**: male 32.2% female 3.2%. **Alcohol at breakfast / lunch**: male 39.2% female 5.7%. Agricultural injury was significantly associated with current drinking, a larger daily alcohol consumption, a higher number of drinking per weekend, and a longer duration of alcohol consumption.	**Predictors for past-month alcohol use**: male, 40-49 year range, Daur ethnic group farmer, widowed/divorced, higher education level, higher number of working on farms, using motor vehicles, and using agricultural machinery.	NA

(Continues)

TABLE 2 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Kongtip et al.[40]	To investigate the relationship between current occupational use of pesticides and metabolic and cardiovascular biomarker levels among organic and conventional farmers in Thailand.	**Thailand** (Phitsanulok and Nokorn Sawan provinces). **2015**.N = 214. Farmers. Age: ≥18 years. 74.3% male.	Participants recruited in 3 provinces. Convenience sampling. In-person interviews and physical exam.	**Current drinker**: Conventional Farmer 64%, Organic Farmer 41%. **Former drinker**: Conventional Farmer 3.3% Organic Farmer 20.5%. Note: Conventional farmers were more likely to be male	NA	NA
Smith and Kethineni[66]	To learn farmers' opium use, community attitudes toward addiction and trafficking, and knowledge of government-set opium prices and regulation.	**India** (Madhya Pradesh). **1994**.N = 50. Farmers: Age: 27-85 years.	Cross-sectional study. Convenience sampling of farmers within randomly selected villages. In-person interviews.	Uniformly, 50 farmers condemned opium addiction but for some, limited opium use was acceptable.	NA	Communities should involve their elders and educated youth in the decision-making process to come up with effective means to deal with opium addiction and crop diversion.
AFRICA						
Walt et al.[41]	To explore the links between gender, resource loss, and reports of substance abuse.	**Kenya** (Township of Meru, near the Eastern Provence). N = 186. Adults in farming communities. Age: 18-73 years. 91.9% male.	Convenience sampling. Those who were able to read the survey filled the survey on their own; for those who were not able to read, the researcher administered the survey. **NACADA**.	**Daily use: of local brew**Men 13.3% Women 2.6%; **bottled beer**Men 13.5% Women 2.6%. **Substance dependency score**: Men reported a significantly higher than women.	**Predictor for daily use, substance dependency score, alcohol abuse/dependence**: Male, resource loss.	Future projects may choose to target substance abusing samples, use longitudinal analysis, and add assessments of African specific gender role adherence as well as other culturally pertinent psychosocial variables.
Carr et al.[36]	To describe the characteristics of marijuana users admitted to a mental hospital.	**Malawi** (Zomba). **1990-1992**. N = 50. Patients admitted to mental hospital due to use of chamba (marijuana)-related problems. Age: 15-60 years. 98% male.	An in-person interview was administered to all in-patients at Zomba Mental Hospital.	The typical patient using marijuana was 27 and from a rural area, worked as a subsistence farmer with little or no income.	**Predictors of chamba abuse**: Chamba's availability, being from chamba-growing area.	A study of more detailed individual case histories may be conducted.

(Continues)

TABLE 2 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Fiki[50]	To raise awareness of rural alcohol and drug problem.	**Nigeria**.N = 196. Farmers. Age male: >40 years, female: 20-35. 78.1% male.	Random sampling from 2 communities. Mixed methods - focus group, document search, inventory of amenities, questionnaire, and structured personal interviews.	**Recent use of**: Nonmedical use of prescription drugs 78%; alcohol 45.4%-53.5%; marijuana 29.1%. The use of multiple drugs common.	**Reasons for drug and alcohol use**: pleasure and relaxation.	It is needed to understand the convergence of rural trends and the pattern of the urban drug scene.
Brisibe and Ordinioha[33]	To describe the prevalence, pattern, and factors associated with alcohol use in a typical Ijaw community.	**Nigeria (Bayelsa Sate). 2006**. N = 322. Adults in a farming community. Age: 16-65 years. 64.49% male.	Systematic sampling of households. In-person interview with **AUIDT**. and physical exam.	**Harmful drinkers** defined by AUDIT ≥8: 33%; **alcohol dependence** defined by AUDIT >20: 12.7%. **12-months prevalence of alcohol abuse**: 33.23%.	**Predictors of alcohol abuse**: male, polygamous marriage, lower educational status, practitioners of the traditional religion or Christians who attend spiritual churches, and engaged in palm wine tapping.	Sales restrictions might be needed as the drinking habits of members of the community change with urbanization.
Brisibe et al.[42]	To determine if alcohol use is a significant factor in IPVm in south zone of Nigeria where violence is prevalent	**Nigeria. 2006**.N = 346. Married or cohabitating adults in a farming community. Age: 16-65 years. 74.4% male.	Systematic sampling. In-person interview with **AUDIT**.	55.8% respondents reported to have physically assaulted their intimate partners during the past 12 months. The perpetrators of the violence were often male alcohol abusers.	NA	Behavioral change communication, increased taxation on alcoholic beverage, and the restriction of alcohol sale are recommended.
Gossage et al.[48]	To assess the health/substance use of the population in the prevention and comparison communities, determine knowledge and attitude toward risky drinking, and assess responses to policy on substance use.	**South Africa** (Western Cape province)**. 2008-2010**.N = 593 Adults living on farms (n = 384) and in urban communities (n = 209). Age: 18-64 years. 31.3% male.	Cluster random sampling from 9 municipal wards. In-person interview with **AUDIT** and **CAGE**.	**CAGE ≥2**: Farm Male 20% Farm Women 11.4% Urban Men 47.5% Urban Women 16.9%. **AUDIT 8-15**: Farm Male 21.7% Farm Women 10.3% Urban Men 26.2% Urban Women 12.9%. **AUDIT ≥16**: Farm Male 10.8% Farm Women 5.7% Urban Men 30% Urban Women 6.5%.	Higher drinking levels in men as compared to women, higher drinking in urban communities, more permissive attitudes toward drinking in farming communities.	There is an obvious need for health workers to talk to men and women about the effects of drinking during pregnancy and to discuss FASD in general.

TABLE 3 Summary of articles on farmworkers

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
USA						
Peoples et al.[52]	To examine the perception of health, health-seeking behavior, access to information and resources, work-related hazards, substance abuse, and social support of emancipated migrant youth.	**California** (Gilroy). **2008.** N = 29. Emancipated adolescent migrant farmworkers. Age: 13-22 years. 72% male.	Community partners recruited youths from migrant campuses and a housing complex. Semi-structured small group interviews.	**Theme related to alcohol use** was "alcohol and drinking and driving are problems in the migrant farmworker community."	NA	Health care services designed to accommodate their mobility and addressing a range of issues, from preventive care to workers' rights, educational opportunities, and job training are needed.
Cherry and Rost[56]	To determine rates of alcohol misuse, depression, anxiety, somatization, and cigarette use in low-income Hispanic farmworkers and spouses.	Southwest **Florida. 2008.** N = 276. Hispanic, farmworker, and spouse of farmworker sought care at a rural community clinic. Age average 34.3; SD 12.5 years. 23.2% male.	Research assistant approached eligible patients. Convenience sampling. Audio computer-assisted self-interview using **RPS4-QF**, PHQ-15, PHQ-9, GAD-7, MEC tobacco questionnaire.	**At-risk drinking** defined as those who screened positive as harmful or hazardous drinkers: 43.8%. **Harmful drinking** defined as those who meet criteria for alcohol abuse but not dependent: 24.6%. **Hazardous drinking** defined as those who do not meet criteria for alcohol abuse or dependence but who drink more than the recommended limit: 19.2%.	**At-risk drinking risk factors**: farmworkers (compared to spouse of farmworkers), having 1 or more psychiatric comorbidities.	Evaluation of primary care brief alcohol interventions is needed.
Kanamori[57]	To examine the perception of adolescent children's marijuana use and its consequences in the Hispanic seasonal farmworking community.	**South Florida. 2015**.N = 29. Hispanic female seasonal workers. Age: ≥18 years. 0% male.	Community organization members recruited participants at health fairs. Convenience sampling. Semi-structured group interview.	**Themes related to burden** were: (1) adolescent children consumed alcohol and nonmedical use of prescription medications (NMUPM) in combination with marijuana; and (2) low grades in school are a consequence of marijuana.	**Themes related to risk factors** were: (1) job demands and the time they have at work limits their (parents) ability to supervise children; (2) the members of the social networks pressure newer members to use marijuana as a means of fitting in; (3) easy access to marijuana in schools; and (4) marijuana use is more common in boys than in girls.	Strict enforcement of rules and regulations that limit access and marketing and advertising of marijuana to youth should be implemented. There is also a need for ongoing surveillance of marijuana use by children.

(Continues)

TABLE 3 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Ramos et al.[58]	To describe drinking behavior, evaluate associations between alcohol consumption and negative consequences from alcohol use, assess contextual and interpersonal predictors of alcohol consumption and negative consequences.	**Nebraska. 2016.** N = 241. Migrant farmworkers. Age: ≥19 years. 78.8% male.	Research team members recruited participants at farmworker camps. Convenience sampling. In-person interviews using **AUDIT-C.**	**≥4 drinks/week**: male 6.3%, female 0%. **≥10 drinks/day**: male 6.5%, female 0%. **Heavy drinking** defined as ≥6 on1 occasion **on a weekly basis**: male 4.3% female 0%. **Positive AUDIT-C** defined as ≥4 for men and ≥3 for women: male 38.2% female 10.8%.	**Risk factors for alcohol consumption**: work safety climate and age. **Predictors of negative consequences from alcohol use**: being married or in a relationship, work safety climate.	Future research should use objective measures of work safety climate and assess differences between objective measures and subjective worker reports. Research should explore how different types of machismo interact with work safety climate to affect alcohol consumption and its consequences on the lives of farmworkers. Studies assessing the role of caballerismo on alcohol use frequency and severity are needed.
Hiott et al.[60]	To determine which stressors inherent in farmwork and lifestyle that contribute to poor mental health.	East central **North Carolina. 2003.** N = 125. Male migrant farmworkers born in Mexico or Central America. Age: ≥18 years. 100% male.	A part of NIOSHA-funded project *Casa y Campo*. Respondents were recruited at 26 sites including farm labor campus, trailer parks, and rooming houses. Convenience sampling. In-person interviews using **CAGE.**	**Alcohol dependence** defined as CAGE ≥2: 37.6%.	**Authors speculated that:** "This high incidence of depressive and anxiety symptoms and alcohol use may result from these immigrants having moved to a region that does not have an established Latino community to facilitate and aid the transition."	Providing access to telephones in residential camps so farmworkers can call family members to relieve social isolation. Facilitating interaction and community through activities such as faith groups may have a positive effect on stress and reduce symptoms of depression and anxiety.
Duke and Cunradi[69]	To understand intimate partner violence (IPV) among farmworkers and determine the prevalence.	**North Carolina** (San Diego County)**. 2009.** N = 100. Farmworkers married or living with a romantic partner. Age: ≥18 years. 37% male.	Respondents were recruited at work sites and farmworker communities. Convenience sampling. In-person interviews with **AUDIT,** Revised Conflict Tactics Scale, Migrant Farm, and Work Stress Inventory	**AUDIT Mean (SD)**: male 5.49 (6.77) female 0.61 (1.58). Significant. Drinking among males was associated with IPV.	NA	Community health educators and promotores may highlight the connection between heavy drinking and IPV when conducting IPV prevention programs in farmworker settings.

(Continues)

TABLE 3 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Arcury et al.[18]	To (1) compare alcohol use between male Latino migrant farmworkers and other Latino men; (2) determine risk factors for AUD in Latino immigrant workers.	**North Carolina. 2012.** N = 447 (235 farm workers). Latino male migrant farmworkers. Age: 30-70 years. 100% male.	Secondary analysis of PACE4 study. Cross-sectional study. Farmworkers were recruited at campus and nonfarmworkers were recruited through community organization. Convenience sampling. In-person interviews with **CAGE.**	**≥5 drinks/day**: Farmworkers 34.9% Nonfarmworkers 31.6%. **At least 2 occasions of heavy episodic drinking (HPD)** defined as ≥5 drinks for men: Farmworkers 23.8% Nonfarmworkers 21.1%. **Alcohol dependence** defined as CAGE ≥2: Farmworkers 37.9% Nonfarmworkers 16%.	**Risk factors for alcohol dependence**: Married / living as married (vs not married), stress level, farmworker (vs nonfarmworker).	Health outreach workers and health care providers should include alcohol screening in their standard activities, and implement education programs addressing the direct risks of alcohol consumption and the indirect risks of unsafe sex and violence. Culturally appropriate interventions to reduce alcohol dependence need to be developed. Recreational activities other than alcohol consumption should be made available.
Kim-Godwin et al.[53]	To identify the predictors of depression and intimate partner violence among Latinos in rural Southeastern North Carolina.	Southeastern **North Carolina. 2007.** N = 291. Latino-migrant and farm workers. Age: 16-68 years. 53.1% male.	Respondents recruited at migrant campus/houses, local health department clinic. Convenience sampling. In-person interviews with **CAGE/4M.**	**CAGE/4M mean (SD)**: 0.98 (1.38). **Alcohol abuse** defined as CAGE/4M ≥1: 38.7%.	NA	Stress reduction programs could be implemented preagricultural season.
Kim-Godwin and Fox[54]	To assess intimate partner violence (IPV) and alcohol use among Latino migrant and seasonal farmworkers.	Southeastern **North Carolina. 2007.** N = 291. Latino-migrant and farm workers. Age: 16-68 years. 53.1% male.	Respondents recruited at migrant campus/houses, local health department clinic. Convenience sampling. In-person interviews with **CAGE/4M.**	**CAGE/4M mean**: male 1.63 female 0.23. A strong positive relationship between the total IPV score and alcohol use (CAGE/4M; $r = 0.92$).	Several variables of IPV perception were associated with an increase in drinking behaviors. They were likely engaged in drinking behavior if they blamed their partners for causing violence.	Programs educating men and women about IPV should be community based. Screening and education programs on alcohol abuse and IPV need to be available at the migrant camps or in neighboring communities with transportation and interpreters provided.
Mora et al.[59]	To examine the association of housing conditions with mental health among migrant farmworkers.	**North Carolina. 2010.** N = 371. Male farmworkers living in housing camps. Age: ≥18 years. 100% male.	Respondents recruited at campus in 16 counties. Convenience sampling. Cross-sectional study. In-person interviews with **AUDIT-C.**	**Alcohol misuse** defined as AUDIT-C≥4: 50.1%.	A significant positive association between depression and alcohol misuse.	Further research is needed to identify other housing factors that could affect the mental health of farmworkers (ie, relationships with roommates, correlation between work organization, housing conditions, and mental health).

(Continues)

TABLE 3 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Garcia[64]	To understand factors in the United States and Mexico that contribute to drug and alcohol use among transnational immigrants.	**Pennsylvania. 2002-2007.** N = 15. Mexican migrant workers in the mushroom industry. Age: 19-67 years. 100% male.	The article is based on community ethnography, observations, informal interviews with key informants, 2 focus groups,12 case studies. Convenience sampling.	The case study participants and their housing mates **drink everyday.** The work regime determines the weekly drinking pattern with binge drinking starts on Friday afternoon through Saturday night. Binge drinkers were categorized into recreational, habitual, and episodic.	Life in the campus can be anxiety-ridden experience with little rest time between work shifts and no recreational activities to relieve anxiety and stress, leading migrants turn to drinking. Social anxiety and peer pressure were also identified as reasons for drinking. Younger men are more likely to binge drink than older men.	The factors identified in the binational social ecology model should be considered in research projects addressing substance abuse among the transnational migrant populations.
Cooper et al.[55]	To compare substance use, employment, and injury data for migrant and nonmigrant youth.	South **Texas. 1995.** N = 10,867 (545 migrant farmworker students). Middle and high school students from migrant farmworker and nonmigrant backgrounds. 2/3 of migrant students and 1/2 of nonmigrant students are males.	Cross-sectional self-administered survey. In schools with ≥ 200 students, classes were randomly selected by grade and in schools with >200, all students were surveyed. **YRBS.**	**≥1 day drinking in the past 1 month**: middle school migrant 50% versus nonmigrant 35.3%; high school migrant 70.2% versus nonmigrant 34.7% **≥1 day snuff in the past 1 month**: middle school migrant 23.6% versus nonmigrant 8.6%; high school migrant 34.4% versus nonmigrant 19.1%	NA	Targeted educational interventions and additional support for migrant students, research into the evaluation and increased delivery of effective rural substance abuse programs, and enhancement of child labor laws are needed.
Bletzer[65]	To determine the spatial dimensions of the onset of substance use, that is, the geographic location outside of urban environments.	**Eastern US 1998-1999.** N = 127. Adults with experience in farm labor who also have drug/alcohol problems.	Ethnography. Convenience sampling. Interviews.	Drug use onset in the agricultural population occurred in a locale of familiarity as compared to a temporally location, continuation of substance use does occur when "traveling."	NA	Future research should consider the meaning of familiarity from the perspective of habitut'es who perform agricultural labor, and how they explain this pattern of choices limited to locales of lengthy residence versus situations of temporary accommodations.

(Continues)

TABLE 3 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
Boiko et al.[68]	To evaluate a tool that assesses for immigrant mental health and substance use across variable literacy rates.	**Northwestern US 2002.** N = 310. Adult Hispanic immigrant farm workers. 49.7% male.	Participants were recruited at 11 migrant campus in 3 states. Convenience sampling. Self-administered survey using the audio tool and in-person interview with **PHQ**.	**Alcohol abuse /dependence** defined as PHQ ≥1: 6% versus 9.7% based on the audio tool rate.	NA	NA
Bletzer[63]	To identify reasons for poly substance use in rural, agricultural labor populations; studying the interplay of substance use and labor organization.	**Southern US** N = 127. Individuals with experience in farm labor who also have drug/alcohol problems. Age: 21-39 years. 79% male.	Ethnographic research. Convenience sampling.	Poly drug use develops over time as ag users learn what drugs give the most effect based on the physical labor demands, and sporadic work; ag workers take steps to meet the harsh demands of the work by using multiple substances for different purposes.	NA	NA
Bletzer and Weatherby[70]	To identify factors that lead to high rates of use of substances among ag workers in high wage seasonal ag industries.	**Southern US** N = 140 for the initiation study and N = 681 for the risk study. Agricultural laborers. Age: 80% of the participants were between the ages of 21 and 45. 83%-87% male.	Data were extracted and blended from 2 studies (epidemiologic investigation) and ethnographic study. Convenience sampling.	**Lifetime crack-cocaine** 87.8%, **alcohol** 86.9%, **marijuana** 92.6%. Most frequent substance used, alcohol, marijuana and crack cocaine, drinking was reported most frequently. The higher the wage earned the higher the amount of substances used. The more money available drug use changed to crack cocaine.	NA	Programs for intervention need to be developed to consider variation in risk by season and crop, as well as labor intensity. The content for these programs should consider utilizing aspects of corresponding cultures of work and recreation that mix and celebrate physical prowess with drug and alcohol use, which are intertwined with performance of agricultural field labor, for low pay, under harsh and demanding and monetarily unrewarding conditions.

(Continues)

TABLE 3 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
SOUTH AMERICA						
Valdez et al.[67]	To assess the influence of housing and working conditions on alcohol use in migrant farmworkers in Mexico.	**Mexico. 2008-2009.** N = 3,132. Migrant farmworkers. Mean age (SD): 36 (14.1). 81.3% male.	Secondary analysis of data from 2008 to 2009 ENJO, National Agricultural Worker's Survey. Random sampling of respondents from employee lists in 689 municipals. In-person interviews.	13% reported alcohol consumption.	**Predictors of higher alcohol consumption**: Living in employer provided housing, better housing situation, experienced work-related hazards, and suffered work-related injuries.	Growers and agricultural labor contractors alike should consider making changes to living and working conditions that can have a positive impact on laborers' psychological distress.
Lopez et al.[71]	To examine the prevalence of alcohol and other risk factors for intimate partner violence in adult women in a migrant farmworker community.	**Mexico** (Baja California)**. 2012.** N = 68. Women ina migrant farmworker community. Age: ≥18 years. 0% male.	At a clinic, all eligible patients were invited to participate (2-day recruitment). Also, households were randomly selected and door-to-door recruitment was done. In-person interviews.	**Any alcohol consumption**: self 30% partner **50%. ≥5 drinks/occasion** among partners: 17%. Women's alcohol prevalence higher than the national average but partner prevalence was lower.	NA	Future studies should assess SES via open-ended questions, and/or provide income categories that accurately reflect the population. Evaluating the partner's education level would be beneficial. It is recommended that future studies evaluate financial control of household finances since IPV also includes economic abuse.
Africa						
London[61]	To assess levels of alcohol consumption and abuse, and to explore the impact of the DOP system (workers paid in part with alcohol).	**South Africa** (Western Cape). **1993.** N = 247. Male farmers of deciduous fruit industry belonging to local cooperatives. 100% male.	For every 2 spraymen, 1 nonsprayman selected matched on age and education level from 3 local farming cooperatives. In-person interview with **CAGE, MAST (shortened).**	**CAGE Mean (SD)**: 2.8 (1.3). **Shortened MAST Mean (SD)**: 7.5 (5.9). **Potential alcohol problem** defined as CAGE ≥2 and Shortened MAST≥5 were 87% and 65%. Close to half of the sample consumed more grams of alcohol per week than considered safe drinking (210 g) and 9.3% consumed amounts in excess of dangerous drinking (\490 g/week).	19.4% of workers interviewed reported current use of the DOP system, and 47.8% of workers had experience of 1 or more farms in the past where the DOP system had been used. Workers with past experience of the DOP system were 9.8 times less likely to be abstainers than colleagues without exposure to the DOP system.	The promotion of a comprehensive and intersectoral rural development strategy for disadvantaged groups as in the implementation of health sector-specific interventions aimed at addressing alcohol abuse is needed.

(Continues)

TABLE 3 (Continued)

Author(s) (year)	Objective(s)	Location, time, sample	Methods	Results: burden	Results: risk factors	Intervention recommendations
McLoughlin et al.[32]	To describe the prevalence of alcohol and papsak consumption, problem drinking, and their association among farm workers in the Western Cape region.	**South Africa** (near Cape Town). **2004. N = 461.** Farm workers employed and resident on farms in 2 communities. Age: 18-64 years. 75.3% male.	Cluster random sampling. In-person interviews with **CAGE.**	**Current drinker**: men 71.5% women 61.4%. Among drinkers, **CAGE ≥2** men 74.6% women 67.1%.	**Predictors for current drinking**: less financial asset and other occupation (vs laborer). **Predictors for CAGE ≥2**: prefer papsak drink to other drink, laborer (vs other), housing provided by employer (vs rented).	Removal of papsak, which could raise the price of alcohol, can deter alcohol consumption. Because papsak may be a pathway to alcohol problem, banning papsak may reduce the prevalence of alcohol problems.
Gossage et al.[48]	To link historical perspective with more recent information on harmful use of alcohol by farm workers.	**South Africa. 2008-2015.** N = 591 (82 farm workers). Adults in 9 municipal wards. Age: 18-64 years. 34.5% male.	Cluster random sampling from 9 municipal wards. In-person interview with **AUDIT** and **CAGE.**	**Drank past year**: Farm Workers 83.1% Other Workers 66.8% Men 75.1% Women 65.8%. **AUDIT ≥8**: Farm Workers 67.1% Other Workers 18.9% Men 42.1% Women 16.7%. **CAGE ≥2**: Farm Workers 75.4% Other Workers 25.1% Men 45.3% Women 7.2%.	**Predictors of higher CAGE**: Non-white group and younger age (18-34 years).	NA

Another research gap is the examination of risk factors. Most of the articles reviewed in this study only examined sociodemographic factors. While stress has been identified as a potential reason for alcohol and substance-related problems among farmers and rural populations,[1,4,10] none of the articles on farmers reviewed in this study looked at stress levels, suicidality, and other mental illness (eg, depression and anxiety) in relation to alcohol or substance use. Many articles reviewed in this study discussed the importance of understanding the unique culture of farmers and farmworkers. From prevention and intervention perspectives, it is important to understand the lifestyle and life perspectives of this population group. For example, the culture of resilience is a hallmark of farmers, which means that often farmers who are under a lot of stress do not seek needed care and support. Alcohol and other substances may be used as a coping method.

LIMITATIONS

This review was not without limitations. First, the lifestyle of farmers and farmworkers changed over time, which means that contextual fac- tors that are contributing toward alcohol- and substance-related problems may have changed. Another limitation of the study was the lack of articles on substance-related problems. Largely, the conclusions made in this study are based on articles related to alcohol consumption and alcohol-related problems. Presently, we lack data on substance-related disorders, especially among farmers.

CONCLUSION

While this scoping review revealed that male farmers who are younger, have high stress levels or psychiatric disorders such as depression, and who have financial difficulties are at increased risk of substance use disorders, it is hard to generalize these results due to the age of the studies found and the farming populations studied. After an extensive search and sorting process to find relevant studies on farming and substance use, the articles found were several years old; many dating back to the farm crisis of the 1980s. There were also several studies that looked at the migrant population exclusively. This is a distinct group within the agricultural field and results are hard to generalize to the larger population of farmworkers due to the specific cultural and work environments in which they work. What is clear, however, is that the farming population, both farmers and farmworkers, are at high risk for substance use disorders, stress-related disorders, and possible serious mental health problems, calling for more research to help craft preventative and interventive strategies for this critical segment of the workforce.

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ORCID

Shinobu Watanabe-Galloway PhD https://orcid.org/0000-0001- 5080-9842

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.