Author Manuscript
Author Manuscript
Author Manuscript
Author Manuscript

HHS Public Access
Author manuscript
J Safety Res. Author manuscript; available in PMC 2024 February 01.

Published in final edited form as:
J Safety Res. 2023 February ; 84: 204–211. doi:10.1016/j.jsr.2022.10.020.

A review of occupational safety and health research for American Indians and Alaska Natives

Kaitlin Wingate,
Elizabeth Dalsey*,
Deborah Poling Scott
National Institute for Occupational Safety and Health, Western States Division, United States

Abstract

Introduction: To better understand what is known about issues affecting American Indian and Alaska Native (AI/AN) workers, authors conducted a literature review of publications specific to AI/AN and occupational safety and health.

Methods: Search criteria included: (a) American Indian tribes and Alaska Native villages in the United States; (b) First Nations and aboriginals in Canada; and (c) occupational safety and health.

Results: Results of two identical searches in 2017 and 2019 identified 119 articles and 26 articles respectively, with references to AI/AN people and occupation. Of the 145 total articles, only 11 articles met the search criteria for addressing occupational safety and health research among AI/AN workers. Information from each article was abstracted and categorized according to National Occupational Research Agenda (NORA) sector, resulting in: four articles related to agriculture, forestry, and fishing; three related to mining; one related to manufacturing; and one related to services. Two articles reported on AI/AN people and occupational well-being in general.

Conclusions: The review was limited by the small number and age of relevant articles, reflecting the likelihood that findings could be out of date. General themes across the reviewed articles point to the need for increased overall awareness and education regarding injury prevention and risks associated with occupational injuries and fatalities among AI/AN workers. Similarly, increased use of personal protective equipment (PPE) is recommended for the agriculture, forestry, and fishing industries, as well as for workers exposed to metals dust.

Practical Applications: The lack of research in most NORA sectors indicates the need for heightened research efforts directed toward AI/AN workers.

Keywords

AI; AN; Occupational safety and health; Worker safety

---

* Corresponding author at: Western States Division, P.O. Box 25226, Denver, CO 80225, United States. edalsey@cdc.gov (E. Dalsey).

Conflict of Interest
The authors have no conflicts of interests to disclose.

Disclaimer
The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

1. Introduction

American Indian and Alaska Native (AI/AN) people accounted for 2% (5.8 million) of the total U.S. population in 2020 (U.S. Census Bureau, 2020). Little is known about the occupational safety and health of AI/AN workers. AI/AN people face a disproportionate burden of illness as well as a lower life expectancy than the total U.S. population. The leading causes of death for AI/AN people include heart disease, cancer, unintentional injuries, and diabetes. AI/AN people experience higher rates of these and other causes of death compared to the total U.S. population (Indian Health Service, 2019).

As sovereign nations, AI/AN tribes maintain a government-to-government relationship with the U.S. federal government (§ 4.01[1][a], 2017).Of the 5.8 million AI/AN, 2.7 million individuals report AI/AN as their only race, of which, over half (1,548,549) are active in the workforce (Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 2022; U.S. Census Bureau, 2020). Approximately 28% of people who identify as AI/AN lived on federal or state reservations or trust lands from 2016 to 2018. Of those, 52.0% were active in the labor force, compared to 63.6% of AI/AN people who did not live in AI/AN areas (Bureau of Labor Statistics, 2019). Table 1 describes AI/AN employment in the U.S. by National Occupational Research Agenda (NORA) sector, based upon the North American Industry Classification System (NAICS). These sectors include: agriculture, forestry, and fishing; construction; healthcare and social assistance; manufacturing; mining; oil and gas extraction; public safety; services; transportation, warehousing, and utilities; and wholesale and retail trade (National Occupational Research Agenda, 2018). The services sector has the highest number of AI/AN workers, followed by wholesale and retail trade and healthcare and social assistance.

Detailed data on AI/AN workers is scarce for several reasons. Race and ethnicity are not commonly collected in traditional occupational safety and health data sources. For example, the Occupational Safety and Health Administration's (OSHA) injury and illness recording requirements do not collect information on race or ethnicity (National Academies of Sciences, Engineering, and Medicine, 2018). Sources that do collect race and ethnicity, such as the Survey of Occupational Injuries and Illnesses, often do not require a response to these questions (Bureau of Labor Statistics, U.S. Department of Labor, 2021). Therefore, race and ethnicity data are frequently missing. Additionally, AI/AN workers may choose to not report or self-identify their race and ethnicity. Furthermore, no tribal surveillance systems or data sources collect this information.

AI/AN occupational fatalities are likely underestimated, as they are often not reported to OSHA when they occur on tribal lands and reservations (Hill, Reyes, & Dalsey, 2013). Despite the existence of tribal occupational safety and health programs and codes and laws, the scientific literature on AI/AN occupational health and safety is limited (Center for State, Tribal, Local, and Territorial Support, Centers for Disease Control and Prevention, 2017). An additional challenge when working with AI/AN data is that sources do not always specify whether AI/AN is reported as an individual's only race or a race in combination with another. The purpose of this review is to summarize what is documented in the peer-reviewed literature about AI/AN worker safety and health.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

AI/AN workers are often employed in hazardous occupations and were 42% more likely to be employed in high risk occupations than non-Hispanic White workers in 2010 (Steege, Baron, Marsh, Menendez, & Myers, 2014). High risk occupations are those whose “days away from work” illness or injury rates are more than twice the national average, such as construction workers and miners (Council of State and Territorial Epidemiologists, 2017). In 2019, 24% of AI/AN employees worked in occupations classified as having high morbidity risk, while only 16% of all U.S. employees worked in these occupations (Council of State and Territorial Epidemiologists, 2017; Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 2022). In 2020, 5,340 AI/AN workers suffered a nonfatal injury resulting in one or more days away from work, and 32 AI/AN workers were killed on the job (Bureau of Labor Statistics, U.S. Department of Labor, 2020; Bureau of Labor Statistics, U.S. Department of Labor, 2020). The occupational fatality rate for all U.S. workers in 2020 was 3.5 deaths per 100,000 workers, compared to 3.6 deaths per 100,000 AI/AN workers (Bureau of Labor Statistics, U.S. Department of Labor, 2020; Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 2022). It appears that AI/AN workers may face a high risk of occupational injury, and the nature of these risks may differ from that of workers of other races and ethnicities. AI/AN workers are an underserved worker population, and research on AI/AN people and occupational safety and health is limited.

2. Methods

Authors submitted a literature search request in 2017 and again in 2019 to the Centers for Disease Control and Prevention’s Public Health Library and Information Center Reference Team. Both searches included online databases MedLine, Embase, PsycInfo, CINAHL, and Scopus. To identify all possible articles, no date limits were placed on the search activities. Search criteria included: (a) American Indian tribes and Alaska Native villages in the United States; (b) First Nations/Aboriginal groups located in Canada; and (c) occupational health and safety. Search criteria excluded articles on other indigenous groups in Australia, Mexico, Central and South America, and migrant workers. The review also excluded articles related to environmental exposures, substance abuse, and child or civilian seatbelt safety and traffic laws, unless related to work activities. Search terms included: American Indians, Alaska Natives, Inuit, Native American, Native Alaskan, Tribal Nation, First Nations, Indian reservation, occupational safety, occupational health, occupational injuries, occupational fatalities, occupational health services, occupational medicine, occupational illnesses, workers’ compensation, epidemiology, population surveillance, participatory research, chemical exposures, hazardous chemicals, ergonomics, psychosocial, falls, accidents, construction, agriculture, farming, mining, fishing, motor vehicle, collisions, asthma, noise, National Institute for Occupational Safety and Health, and violence.

Results of the initial search in 2017 identified 119 articles, reports, and theses. An identical search limited to articles published since the initial search was requested in 2019 and identified 26 additional articles. Further inclusion criteria was used to focus on peer-reviewed journals, published after 2000, addressing AI/AN occupational safety and health. Fig. 1 illustrates the process used to select relevant articles for the literature review. Authors abstracted information from each relevant article and categorized them according

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

to NORA sector. Although many articles pertained to AI/AN people, most documented research unrelated to occupational safety and health.

3. Results

This review comprises 11 articles categorized by NORA sector including: four articles categorized into the agriculture, forestry, and fishing sector; one to manufacturing; three to mining; and one article to services. Two of the 11 articles did not fit within one specific sector but described research relating to the overall well-being of AI/AN workers. Authors categorized the article related to rodeo competitors to the agriculture, forestry, and fishing sector, even though the specific rodeo NAICS code falls under the Arts, Entertainment, and Recreation sector. Although Canada was included in the original search criteria, only articles about AI/AN workers in the United States met the inclusion criteria. The findings and themes presented in these articles are discussed by NORA sector below and referenced in Table 2.

3.1. Agriculture, forestry and, fishing

Four of the 11 articles found in the literature search were related to agriculture, forestry, and fishing. Of these four, two discussed farmworkers, one investigated professional rodeo competitors, and one focused on bison workers.

3.1.1. Objectives and methods—Among the four articles, three included discussion on work-related injuries among farmworkers and rodeo competitors. Goldcamp, Hendricks, Layne, and Myers analyzed previously collected data from the Minority Farm Operator Childhood Agricultural Injury Survey (M-CAIS), conducted in 2000, to examine nonfatal injuries among youth farmworkers (Goldcamp, Hendricks, Layne, & Myers, 2006). Crichlow, Williamson, Geurin, and Heggem administered a self-reported survey to 180 professional rodeo competitors to evaluate injuries and use of protective equipment (Crichlow, Williamson, Geurin, & Heggem, 2006). Lastly, Duysen et al. conducted observational audits and analyzed convenience surveys completed by herd managers in order to investigate the hazards of bison handling (Duysen, et al., 2017).

In the fourth article related to agriculture, forestry, and fishing, Helitzer, Hathorn, Benally, and Ortega conducted a five-year agricultural intervention based on a theoretical framework, the *Diffusion of Innovations Theory*, to develop a culturally relevant model to train American Indian farmers in New Mexico on the safe use of pesticides. The intervention trained six "model farmers" on safe pesticide use, and later implemented an intervention and delayed intervention across 830 Navajo family farms (Helitzer, Hathorn, Benally, & Ortega, 2014).

3.1.2. Findings—The three articles discussing work-related injuries first identified estimates for injuries at various work sites. The nonfatal injury rate for work-related injuries on Native American farms was 17.7 per 1,000 household youth, compared to a non-work injury rate of 13.8 per 1,000 household youth. This rate was even higher for youth under 10 years of age at 21.8 injuries per 1,000 working youth. Lacerations and fractures, generally to the arm and leg, were the most common work-related injuries reported among household

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

youth working on Native American-operated farms (Goldcamp, Hendricks, Layne, & Myers, 2006). Among rodeo competitors responding to a self-reported survey, the most common injuries were among the lower extremities, rather than the body core. The self-reported injury rate among competitors was 14 injuries per 100 rodeos. Injury history varied among rodeo events, ranging from 24% of tie-down ropers to 100% of bull riders. Additionally, 26% of the competitors had a history of rodeo injury that prevented them from working, leading to an average of 3.2 months away from competition (Crichlow, Williamson, Geurin, & Heggem, 2006). Injuries were also commonly observed at bison handling sites, which may be due to the high-stress handling that exists during bison roundups. These injuries were reportedly caused by equipment, tools, weather, bison, and ATV use. Additional safety concerns found through the observational audits include obsolete or broken equipment, poor facility designs, and inadequate barriers in the chutes (Duysen, et al., 2017).

A common theme among these articles was the lack of personal protective equipment (PPE) among workers in this sector. Among rodeo competitors, although past injuries were common, only 40% of athletes reported using PPE. The most widely used protective equipment were vests (Crichlow, Williamson, Geurin, & Heggem, 2006). Additionally, research has shown that safety equipement is rarely used at AI/AN bison worksites as well as at agriculture sites in general. Specifically, inappropriate footwear was reported by 27% of herd managers. PPE use was reportedly very low and deficiencies in the equipment such as dust masks and safety goggles were also reported (Duysen, et al., 2017). Authors recommended increased safety training, such as proper PPE, including targeted interventions related to the demographics of the worker population (Goldcamp, Hendricks, Layne, & Myers, 2006).

The fourth article analyzing a five-year agricultural intervention identified significant improvements in safe pesticide use, storage behaviors, and safety and pesticide application ownership. These knowledge improvements were maintained over time by the study group who received the immediate intervention, while the group who received the delayed intervention demonstrated a greater improvement in attitudes about pest management. Including the agricultural workers on the training development as well as a face-to-face training method and a culturally appropriate foundation led to success in this intervention (Helitzer, Hathorn, Benally, & Ortega, 2014).

3.2. Manufacturing

3.2.1. Objective and methods—Only one article related to manufacturing was identified. Gonzales et al. conducted a pilot study to inventory the materials used by Native American home-based jewelry makers in western New Mexico. Researchers compared surface concentrations of metals between 20 jewelry-making households and 20 control households where jewelry was not made (Gonzales, et al., 2004).

3.2.2. Findings—Within the jewelers' homes, metal dust concentrations were significantly higher in work areas than in living areas. Concentrations were also higher in living areas of jewelers' homes compared with the homes of non-jewelers. Additionally, use of ventilation varied depending on the metal. When ventilation was present in jewelry work areas, metal concentrations for a few metals were significantly reduced compared to concentrations where no ventilation was present (Gonzales, et al., 2004).

Gonzales et al. also reported that PPE was not commonly used among jewelry makers. For example, less than a quarter of participants reported using safety glasses, dust masks, or gloves. Even fewer jewelry makers reported using coveralls, and no participants reported ever using a face shield. Similarly, mechanical ventilation such as exhaust fans were used by less than half of jewelry makers. While natural ventilation like open doors or windows were used more frequently, many jewelry makers used no ventilation at all (Gonzales, et al., 2004).

3.3. Mining

3.3.1. Objectives and methods—Three articles highlighting mining were identified in the literature searches. Two of these articles discussed the Colorado Plateau cohort, a group of miners who were originally evaluated from 1950 through 1960 to investigate the association between radon and lung cancer as well as the risks of other diseases among miners (Schubauer-Berigan, Daniels, & Pinkerton, 2009). Schubauer-Berigan et al. used mortality data gathered from 1990 through 2005 that was linked to the National Death Index and the Social Security Administration's mortality file databases as well as the Renal Management Information System database. Jones also used these data, from 1960 through 2005, to conduct an economic cost analysis in order to understand the health costs associated with uranium mining. The value of a statistical life-year was calculated as $213,000 per year of life lost (Jones, 2017). The third article presented a case study of a 72-year-old Navajo male who spent 17 years working as an underground uranium miner (Mulloy, James, Mohs, & Kornfeld, 2001).

3.3.2. Findings—The Colorado Plateau cohort included 3,358 white uranium miners and 779 miners who were American Indian. Forty-five percent of the American Indian miners were current or former smokers, compared to 84% of white miners. Among all miners, lung cancer accounted for one in five deaths. The mortality data revealed that during the 1990 to 2005 time period, American Indian miners had a lung cancer standardized mortality ratio of 3.27 compared with the regional population; white miners had a ratio of 3.99 (Schubauer-Berigan, Daniels, & Pinkerton, 2009).

In Jones' analysis of the Colorado Plateau cohort, the median years of life lost was 13.3 for white uranium miners in the Colorado Plateau cohort and 13.9 for American Indian miners. Jones reported that $1.24 billion in health costs was created due to lung cancer mortality, and $127.9 million of the cost was for American Indian miners. The cost analysis further revealed that lung cancer accounted for 60% of total health costs for American Indian miners. Overall, $213.7 million of total mortality health costs were associated with American Indians. Additionally, a 6.9% larger excess death mortality health cost existed for American Indian miners compared to white miners. Jones argues that American Indian miners faced a disproportionate share of the social costs of mining in the Colorado Plateau, compared to white miners (Jones, 2017).

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

The third article presented a case study of a Navajo uranium miner and estimated his exposure to radon progeny at 506 working level months. The miner did not have any other significant occupational or environmental exposures, such as smoking. He developed lung cancer 22 years after leaving mining and died from pneumonia and respiratory failure. Unfortunately, lung function prediction equations, which use standards of physical characteristics such as age, sex, and height to determine a predicted lung function value, often lack specific variables for ethnicities or races. This can produce bias against Hispanic and American Indian miners. Additional difficulties include the lack of diagnostic resources for disease recognition and distance for primary care for American Indians in the Navajo Nation (Mulloy, James, Mohs, & Kornfeld, 2001).

3.4. Services

3.4.1. Objective and methods—One article about workers in the services sector was identified. Klepeis (2016) reported on efforts of a coalition of public health professionals working with casino management to conduct onsite studies of secondhand smoke (SHS) in a casino on a tribal reservation. The goal was to help provide guidance for future efforts of adopting smoke-free policies in casinos. During a seven-year period, the coalition members conducted air quality testing, collected surveys from casino employees and patrons, and held staff and community focus groups (Klepeis, et al., 2016).

3.4.2. Findings—Air quality evaluations revealed a range of only 8 to 12% of active smokers amongst all patrons throughout the casino; however, despite the small percentage of smoking patrons, elevated levels of urinary cotinine and airborne nicotine confirmed evidence of high levels of SHS. Survey responses indicated that over half of patrons would visit the casino about the same or more often if a smoke-free policy were enacted. Additionally, most of the casino employees preferred to work in a smoke-free environment. Based on these findings, Klepeis et al. reported that a 100% smoke-free policy be implemented in the casino. After the smoking ban was in effect, particle levels dropped by 98% in main smoking areas throughout the casino and by 51% in previously designated nonsmoking areas. After a reduction in revenue and complaints from smoking patrons, the smoke-free policy was amended to restrict smoking on 70% of the casino floor (Klepeis, et al., 2016).

3.5. Other

3.5.1. Objectives and methods—Two articles were identified through the literature searches that did not focus on a specific industry sector, but rather on AI/AN worker exposures and overall well-being. Redwood et al. analyzed previously collected data from over 11,000 participants in the Education and Research Towards Health (EARTH) Study. They investigated self-reported occupational and environmental hazard exposures among participants in Alaska, of which 95% were Alaska Native, and Navajo participants living in the Southwest United States. Nine environmental hazards of concern were identified by tribal leadership and a study advisory board: petroleum, pesticides, welding/silversmithing, asbestos, military chemicals, mining dust, heavy metals, lead, and radioactive materials. Study participants were asked to indicate possible exposures to these hazards (Redwood, et al., 2012). Christiansen et al. conducted in-person interviews and focus groups with 89

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

females living in tribal communities in the Southwest and Upper Midwest to investigate work-related themes including structural characteristics, role stressors, and the influence of social support (Christiansen, Gadhoke, Pardilla, & Gittelsohn, 2019).

3.5.2. Findings—Among Navajo workers, 64% of all study participants reported no hazardous exposure to the nine environmental hazards of concern, while 28% reported exposure to one to two hazards, and 8% reported exposure to three or more hazards. Among AI/AN participants living in Alaska, the top three most commonly reported hazards were petroleum products, military chemicals, and asbestos. Among Navajo participants living in the Southwest United States, the top three most commonly reported hazards were pesticides, petroleum, and welding/silversmithing. Among all study participants, reported exposures were higher among male participants, participants aged 40 through 59, and individuals living in the Southwest compared to Alaska. Additionally, Redwood et al. identified a higher likelihood of reported hazard exposure for participants who spoke an AI/AN language at home compared to participants who spoke only English at home, as well as for participants with lower educational attainment (Redwood, et al., 2012).

For females living in tribal communities, Christiansen et al. identified common issues related to structural characteristics, including unemployment, seasonal employment, and low-wage work opportunities. The proximity to worksites as well as social and medical services was also commonly discussed among females as males were more likely to have to travel long distances for work. As a result, females experienced the burden of being sole caregiver for their family. Some females also described being both the caregiver and breadwinner for their family when their partners were incarcerated or involved with drugs or alcohol. Workplace wellness programs and incentives as well as relationships with coworkers highlighted some ways that employed females engaged in healthy activities in the workplace. Conversely, some females noted that these opportunities were not always available or their work duties made it impossible to participate (Christiansen, Gadhoke, Pardilla, & Gittelsohn, 2019).

4. Conclusion

This review captures the available literature on occupational health and safety among AI/AN workers. Out of 145 articles, only 11 were peer-reviewed and dealt specifically with occupational health and safety among AI/AN people in the past 20 years. Of the 11 articles: four addressed agriculture, forestry, and fishing; three addressed mining; one addressed each of manufacturing and services. Lastly, two focused on AI/AN people and occupational exposures or well-being in general. It is interesting to note that the two smallest workforce sectors (agriculture, forestry, and fishing, 28,877; and mining, 16,408) have been the subject of the most research, likely attributable to high risk rates as well as congressionally appropriated funds for mining research. Other sectors with much larger workforces, such as healthcare and social assistance (211,576), services (695,309), and wholesale and retail trade (236,624) are virtually unexplored. The lack of representative research across NORA sectors underscores gaps in knowledge and the need for additional research.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Limitations of this review were the small number of articles identified and in some cases the age of the article, reflecting the likelihood that findings could be out of date. The absence of relevant literature may also be due to other priorities or lack of resources for tribes to collect data or conduct research themselves. Tribes also may choose to operationalize their sovereign status and safeguard their data and stories, which may have been mishandled, misinterpreted, and even misused in the past. For example, tribes may choose to not publish in mainstream publications or may not allow non-tribal entities to conduct research on AI/AN workers.

Additional limitations include the inability to compare injury rates across various publications, as the populations included and methodologies used varied widely. Specifically, it is difficult at times to compare findings across AI/AN communities as conclusions for one tribe may not be generalizable to all tribal communities. Finally, it is difficult to classify exposures as occupationally-related, which may lead to many occupational health and safety risks being underreported or ignored.

5. Practical Applications

General themes across these publications point to the need for increased overall awareness and education regarding injury prevention and risks associated with occupational injuries and fatalities. It is important that recommendations and interventions related to education be culturally appropriate and tailored specifically to AI/AN communities at risk. Including AI/AN workers in the development of worker safety and health materials and trainings would ensure that these interventions are culturally appropriate. Differentiating between AI/AN workers who live on tribal lands and those who live in the general population is also important in order to understand the unique needs of those who live and work on tribal lands. It is also important to acknowledge and honor tribal uniqueness and practices.

Increased use of PPE is recommended specifically for agriculture and fishing, as well as those exposed to metal dust. Addressing adherence to safety protocols, including the use of PPE, is also necessary in order to reduce occupational injury risk. According to the hierarchy of controls, PPE is considered the least effective at protecting workers. Therefore, it is important that additional research investigates interventions and evaluations for elimination, engineering, and administrative controls for AI/AN workers, as well as all workers in these industries.

Improving occupational health and safety surveillance systems to accurately identify worker race and ethnicity is vital to better understanding the safety and health trends among AI/AN workers. The inclusion of AI/AN as a race category is necessary in all data collection methods, not just those related to occupational health and safety. Requiring responses for race and ethnicity in surveillance systems is also important to help identify vulnerable worker populations (National Academies of Sciences, Engineering, and Medicine, 2018). Furthermore, collecting tribal affiliation could be extremely valuable with 574 federally recognized tribes and non-federally recognized tribes in the United States (National Conference of State Legislatures, 2020; Bureau of Labor Statistics, 2019). Future research could utilize community-based participatory research strategies in order to identify

Author Manuscript
Author Manuscript
Author Manuscript
Author Manuscript

additional issues in worker safety and health and approaches that may be unique to AI/AN communities. Utilizing already available data, such as Web-Cident, My Tribal Data, and state health departments, beyond traditional worker data sources to further explore AI/AN worker safety and health trends is also necessary.

Lastly, additional research is needed to fully understand the socioeconomic inequities experienced by AI/AN people resulting from structural racism, such as living in poverty, lacking a high school degree, and lacking access to health insurance (Sequist, 2021). These disparities related to social determinants of health may also contribute to inequalities AI/AN people face in the workforce, such as larger numbers of young workers and workers in the service sector, that are too complicated to be addressed through this literature review analysis. Considering the role of social determinants of health as well as AI/AN culture and social contexts in occupational health research and prevention measures is one way to examine work-related risks and outcomes unique to AI/AN workers (Flynn, Check, Steege, Siven, & Syron, 2022). Gaps in occupational safety and health research for AI/AN workers indicate the need for additional and renewed efforts to identify workplace disparities and to educate workers and employers regarding effective interventions and prevention strategies.

Biographies

Kait Wingate is an epidemiologist at the National Institute for Occupational Safety and Health (NIOSH). She works on data analysis and manuscript writing for research pertaining to the NIOSH Oil and Gas Sector Extraction program. She also helps to manage the NIOSH Fatalities in Oil and Gas database. She has a Master of Public Health degree in Global Epidemiology from the Emory University Rollins School of Public Health.

Elizabeth Dalsey is a Health Communication Specialist in the NIOSH Western States Division in Denver, CO. She conducts communication activities and outreach for the Division to promote NIOSH knowledge, interventions, and technologies. Elizabeth also manages the NIOSH American Indian/Alaska Native Initiative. She began work at NIOSH in 2006 after receiving her Master of Arts in Communication from Michigan State University.

Deborah Scott received a Master of Public Health in Health Promotion and Evaluation from the University of Texas, School of Public Health. As the President of Sage Associates, Inc, Deborah is a founding officer of the Native American Health Coalition, a community-based organization serving American Indians and Alaska Natives living in the southeast Texas area. She has also served as a consultant for the NIOSH, the National Native American AIDS Prevention, and the National Indian Women's Health Resource Center.

References

§ 4.01[1][a]. (2017). In Newton NJ (Ed.), Cohen's Handbook of Federal Indian Law.

Bureau of Labor Statistics. (2019). American Indians and Alaska Natives in the U.S. labor force. Retrieved from Monthly Labor Review: https://www.bls.gov/opub/mlr/2019/article/american-indians-and-alaska-natives-in-the-u-s-labor-force.htm.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Bureau of Labor Statistics, U.S. Department of Labor. (2020). Census of Fatal Occupational Injuries, Table A-7, Fatal Occupational Injuries by Worker Characteristics and Event or Exposure, All United States, 2020. Retrieved from https://www.bls.gov/iif/oshwc/cfoi/cftb0342.htm.

Bureau of Labor Statistics, U.S. Department of Labor. (2020). Fatal occupational injuries, total hours worked, and rates of fatal occupational injuries by selected worker characteristics, occupations, and industries, civilian workers, 2019. Retrieved from Current Population Survey, Census of Fatal Occupational Injuries: https://www.bls.gov/iif/oshwc/cfoi/cfoi_rates_2019hb.xlsx.

Bureau of Labor Statistics, U.S. Department of Labor. (2020). Number of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and race or ethnicity, All U.S., all ownerships, 2020. Retrieved from Occupational Injuries/Illnesses and Fatal Injuries Profiles: https://data.bls.gov/gqt/InitialPage.

Bureau of Labor Statistics, U.S. Department of Labor. (2021). Survey of Occupational Injuries, 2021. Retrieved from https://www.bls.gov/respondents/iif/forms/soii-sy2021-long-form-omb.pdf.

Center for State, Tribal, Local, and Territorial Support, Centers for Disease Control and Prevention. (2017). Public Health Law. Retrieved from Selected Tribal Laws Related to Occupational Safety and Health: https://www.cdc.gov/phlp/docs/menu-tribalosh.pdf.

Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. (2022). Retrieved from Employed Labor Force Query System: https://wwwn.cdc.gov/wisards/cps/default.aspx.

Christiansen K, Gadhoke P, Pardilla M, & Gittelsohn J (2019). Work, worksites, and wellbeing among North American Indian women: A qualitative study. Ethnicity & Health, 24(1), 24–43. 10.1080/13557858.2017.1313964. [PubMed: 28393559]

Council of State and Territorial Epidemiologists. (2017). Occupational health indicators: A guide for tracking occupational health conditions and their determinants. Retrieved from https://cdn.ymaws.com/www.cste.org/resource/resmgr/pdfs/pdfs2/2017_OHI_Guidance_Manual_201.pdf.

Crichlow R, Williamson S, Geurin M, & Heggem H (2006). Self-reported injury history in Native American professional rodeo competitors. Clinical Journal of Sport Medicine, 16(4), 152–154. 10.1097/00042752-200607000-00012.

Duysen E, Irvine K, Yoder A, Topliff C, Kelling C, & Rajaram S (2017). Assessment of tribal bison worker hazards using trusted research facilitators. Journal of Agromedicine, 22(4), 337–346. 10.1080/1059924X.2017.1353937. [PubMed: 28704160]

Flynn MA, Check P, Steege AL, Siven JM, & Syron LN (2022). Health Equity and a Paradigm Shift in Occupational Safety and Health. International Journal of Environmental Research and Public Health, 19(1), 349. 10.3390/ijerph19010349.

Goldcamp EM, Hendricks KJ, Layne LA, & Myers JR (2006). Nonfatal injuries to household youth on Native American operated farms in the U.S., 2000. Journal of Agromedicine, 11(3–4), 61–69. 10.1300/J096v11n03_07. [PubMed: 19274898]

Gonzales M, Shah V, Bobelu A, Qualls C, Natachu K, Bobelu J, … Zager P (2004). Concentrations of Surface-Dust Metals in Native American Jewelry-Making Homes in Zuni Pueblo, New Mexico. Archives of Environmental and Occupational Health, 59(5), 245–249. 10.3200/AEOH.59.5.245-249.

Helitzer DL, Hathorn G, Benally J, & Ortega C (2014). Culturally relevant model program to prevent and reduce agricultural injuries. Journal of Agricultural Safety and Health, 20(3), 175–198. 10.13031/jash.20.10333. [PubMed: 25174150]

Hill RD, Reyes ED, & Dalsey EJ (2013, December). NIOSH Launches Worker Safety and Health Initiative for American Indians and Alaska Natives. The IHS Primary Care Provider, 38(12). Retrieved from https://www.ihs.gov/sites/provider/themes/responsive2017/display_objects/documents/2010_2019/PROV1213.pdf.

Indian Health Service. (2019, October). Disparities. Retrieved from Indian Health Service: https://www.ihs.gov/newsroom/factsheets/disparities/.

Jones BA (2017). The social costs of uranium mining in the US Colorado Plateau cohort, 1960–2005. International Journal of Public Health, 62(4), 471–478. 10.1007/s00038-017-0943-z. [PubMed: 28251247]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Klepeis NE, Dhaliwal N, Hayward G, Acevedo-Bolton V, Ott WR, Read N, … Moore RS. (2016). Measuring indoor air quality and engaging California Indian stakeholders at the Win-River Resort and Casino: Collaborative Smoke-Free Policy Development. International Journal of Environmental Research and Public Health, 13(1), 143. 10.3390/ijerph13010143. [PubMed: 26805860]

Mulloy KB, James DS, Mohs K, & Kornfeld M (2001). Lung cancer in a nonsmoking underground uranium miner Retrieved from. Environmental Health Perspectives, 109(3), 305–309 https://www.jstor.org/stable/3434701. [PubMed: 11333194]

National Academies of Sciences, Engineering, and Medicine. (2018). Appendix A, Recommendations. In A Smarter National Surveillance System for Occupational Safety and Health in the 21st Century. Washington, DC: National Academies Press (US).

National Conference of State Legislatures. (2020, March). Federal and State Recognized Tribes. Retrieved from National Conference of State Legislatures: https://www.ncsl.org/research/state-tribal-institute/list-of-federal-and-state-recognized-tribes.aspx.

National Occupational Research Agenda. (2018). Sector-Based Approach - Sectors. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/nora/sectorapproach.html.

Redwood D, Lanier AP, Brubaker M, Orell L, Tom-Orme L, George C, … Slattery M. (2012). Occupational and environmental exposures among Alaska Native and American Indian people living in Alaska and the Southwest United States. Journal of Environmental Health, 74(9), 22–28.

Schubauer-Berigan MK, Daniels RD, & Pinkerton LE (2009). Radon exposure and mortality among white and American Indian uranium miners: An update of the Colorado Plateau cohort. American Journal of Epidemiology, 169(6), 718–730. 10.1093/aje/kwn406. [PubMed: 19208723]

Sequist TD (2021). Improving the Health of the American Indian and Alaska Native Population. JAMA, 325(11), 1035–1036. 10.1001/jama.2021.0521. [PubMed: 33724330]

Steege AL, Baron SL, Marsh SM, Menendez CC, & Myers JR (2014). Examining occupational health and safety disparities using national data: A cause for continuing concern. American Journal of Industrial Medicine, 57, 527–538. 10.1002/ajim.22297. [PubMed: 24436156]

U.S. Census Bureau. (2020). 2016–2020 American Community Survey 5-Year Demographic and Housing Estimates. Retrieved from https://data.census.gov/cedsci/table?q=DP05&y=2020.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

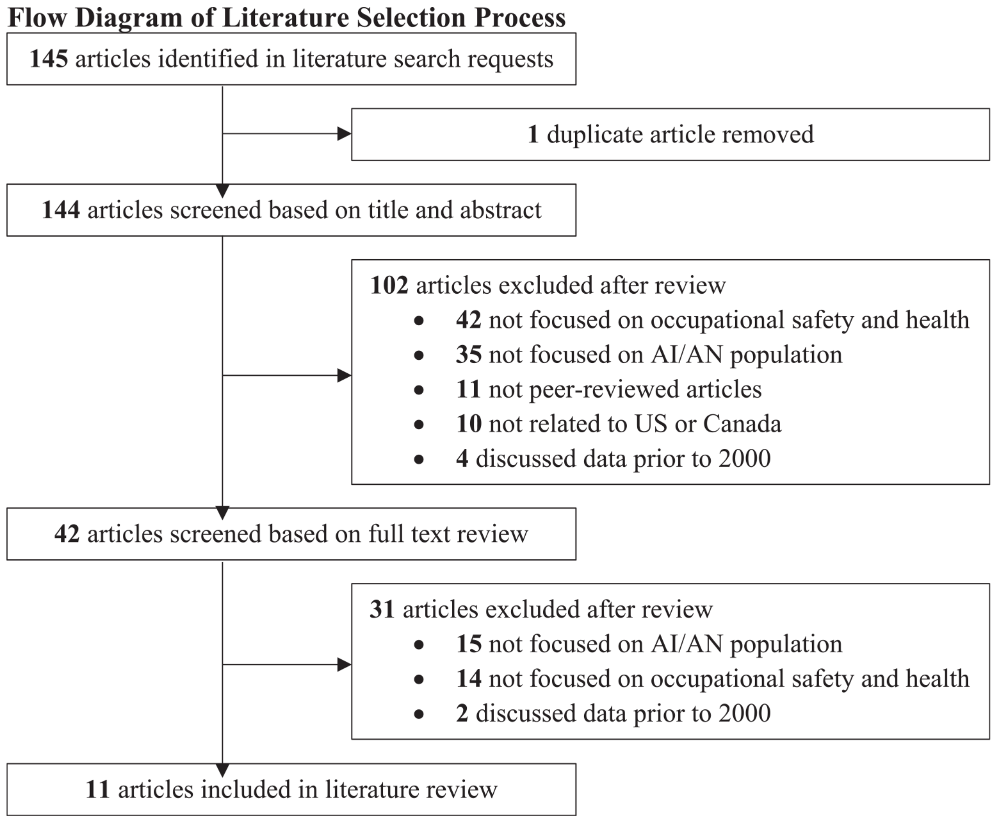

Fig. 1.

Flow diagram of literature selection process.

Author Manuscript
Author Manuscript
Author Manuscript
Author Manuscript

Table 1

American Indian and Alaska native employment by national occupational research agenda sector, 2020.

National Occupational Research Agenda (NORA) Sectors	AI/AN People in Workforce (n = 1,548,549)
Agriculture, Forestry, and Fishing	28,877
Construction	144,847
Healthcare and Social Assistance	211,576
Manufacturing	132,012
Mining (includes Oil and Gas Extraction)	16,408
Services (includes Public Safety)	695,309
Transportation, Warehousing, and Utilities	82,896
Wholesale and Retail Trade	236,624

Note: The Employed Labor Force Query System is based on data from the Bureau of Labor Statistics Current Population Survey, which uses Bureau of Census Industry Codes. These codes can not be directly matched with the North American Industry Classification System, which organizes the current NORA sectors. As a result, the table includes the population for the NORA sector, Oil and Gas Extraction, in the Mining category. Similarly, it includes the population for the Public Safety sector in the Services category.

Source: Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. (2020). Retrieved from Employed Labor Force Query System: https://wwwn.cdc.gov/wisards/cps/default.aspx.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Table 2

Summary of articles by NORA sector.

Sector	Author(s) and Title	Objective	Study Type	Findings
Agriculture, Forestry, and Fishing	Goldcamp, E. M., et al. (2006) Nonfatal injuries to household youth on Native American operated farms in the U.S., 2000.	Identify characteristics of work and non-work-related farming injuries to Native American youth	Cross-sectional survey; self-administered by 9,556 racial minority-operated farms	There were an estimated 177 nonfatal injuries of youth living on Native American operated farms in 2000. The injury rate was 17.7 per 1,000 Native American working youth, compared to 13.8 per 1,000 non-working youth.
Agriculture, Forestry, and Fishing	Crichlow, R. et al. (2006) Self-reported injury history in Native American professional rodeo competitors.	Evaluate rodeo injury and use of protective equipment.	Cross-sectional survey; self-administered to 180 competitors	14 injuries per 100 rodeos were reported, ranging from 100% of bull riders to 24% of tie-down ropers. Only 40% reported use of protective equipment.
Agriculture, Forestry, and Fishing	Duysen, E., et al. (2017) Assessment of tribal bison worker hazards using trusted research facilitators.	Identify hazards of bison handling in American Indians	Cross-sectional survey; collaborative pilot research project with observational audits and convenience surveys	A lack of safety equipment was observed at worksites. Bison injuries occurred at 9 out of 10 sites, and worker injuries occurred at 3 out of 10 sites.
Agriculture, Forestry, and Fishing	Helitzer, D. L., et al. (2014) Culturally relevant model program to prevent and reduce agricultural injuries.	Describe a pesticide injury prevention program among AI farmers based on Diffusion of Innovations theory	Longitudinal study of injury prevention intervention using train the trainer for two groups: intervention and delayed intervention	There was an increase in pesticides stored out of reach of children ($G = 15.5$, $p < 0.001$; $G = 7.7$, $p < 0.05$)[1] as well as owning safety equipment ($G = 64.8$, $p < 0.001$; $G = 12.5$, $p < 0.005$)[1] and knowledge of safe pesticide application ($t = 5.479$, $p < 0.001$; $t = 8.559$, $p < 0.05$)[2].
Manufacturing	Gonzales, M. et al. (2004) Concentrations of surface-dust metals in Native American jewelry-making homes in Zuni Pueblo, New Mexico.	Identify and quantify metals used by home-based AI jewelers	Cross-sectional exposure survey; in-person interviews with 40 participants	Metal dust concentrations were significantly higher in jewelers' homes compared to homes of non-jewelers ($p < 0.02$).
Mining	Schubauer-Berigan, M. K., Daniels, R. D., and Pinkerton, L. E. (2009) Radon exposure and mortality among white and American Indian uranium miners: an update of the Colorado Plateau cohort.	Follow-up study of 4,137 uranium miners on the U.S. Colorado Plateau	Prospective cohort study; analysis of linked databases	Silicosis, tuberculosis and other lung diseases remained highly elevated among American Indian miners compared to white miners.
Mining	Jones, B. (2017) The social costs of uranium mining in the US Colorado Plateau cohort, 1960–2005.	Estimated health costs associated with mining in Colorado Plateau	Cost analysis of prospective cohort study	Over $2 billion in health costs over 1960–2005 existed due to uranium mining. Native Americans had larger costs per elevated death.
Mining	Mulloy, K. B., et al. (2001) Lung cancer in a nonsmoking underground uranium miner.	Illustrate the effects of increased risk of lung cancer among uranium miners	Case report of 72-year-old Navajo male who worked as uranium miner for 17 years	The uranium miner's radon exposure was estimated at 506 months of work with no other exposures. His risk of lung cancer was 100 times greater than if he never mined. He was treated for pneumonia and died from respiratory failure.
Service	Klepeis, N. E., et al. (2016) Measuring indoor air quality and engaging California Indian stakeholders at the Win-River Resort and Casino: collaborative smoke-free policy development.	Describe efforts to institute smoke-free policies in AI casino	Formative evaluation using air testing, surveys, and focus groups	Increased exposures to secondhand smoke existed in the casino. 100% Smoke-free policies were implemented in 2014 and amended to permit smoking on 30% of the casino floor in 2015.
Other	Redwood, D., et al. (2012) Occupational and environmental exposures among Alaska	Report on prevalence of self-reported exposure to 9 occupational and environmental	Prospective cohort study; self- and interviewer-	28% of participants reported exposure to 1 to 2 hazards and 8% were exposed to 3 or more. Exposures were higher for

Sector	Author(s) and Title	Objective	Study Type	Findings
	Native and American Indian people living in Alaska and the Southwest United States.	hazards in a large cohort of AI/AN living in AK and Southwest U.S.	administered questionnaire to 11,326	men, those ages 40–59, and those living in the Southwest ($p < 0.05$).
Other	Christiansen, K., et al. (2017) Work, worksites, and wellbeing among North American Indian women: a qualitative study.	Identify factors contributing to work-family balance and health behaviors among American Indian women	Cross-sectional study; interviews and focus groups with 89 women in 4 tribal communities	Shift and seasonal work make healthy lifestyles difficult for AI/AN women. Men have to travel farther for work, leaving women to take care of the home.

[1] G = test statistics from log-likelihood goodness-of-fit test.

[2] t = test statistic from paired-sample t-test.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript