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SEAFOOD PROCESSING

Safety and Health Programs in Alaska's Seafood Processing Industry: Interviews with Safety and Health Managers

LN Syron [a], VE Bovbjerg[b], CA Mendez-Luck[b], and LD Kincl[b]

[a]Western States Division, National Institute for Occupational Safety and Health, Spokane, WA, USA; [b]College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, USA

ABSTRACT

Background: The seafood processing industry is critical to Alaska's economy and hazardous to workers; however, limited research has addressed workers' safety and health. Safety and health program management is a decisive factor in preventing fatalities, injuries, and illnesses. We interviewed managers to gain their views on their safety and health programs.

Methods: Semi-structured interviews were conducted with 14 upper-level managers who oversaw programs for Alaskan worksites. Interviews were audio-recorded and transcribed. Qualitative content analysis techniques, including inductive coding, were utilized to explore participants' experiences and views regarding: management and workers' roles; hazard control systems; safety and health training; regulatory and economic factors; and programs' challenges and successes.

Results: The 14 participants represented 13 companies that operated 32 onshore plants and 30 vessels with processing capabilities. Participants reported managing programs for an estimated 68% of the Alaskan seafood processing industry's workforce. Based on participants' responses, we identified five factors that could be modified to improve safety and health industry-wide: manager training and knowledge sharing; worker training; organizational aspects related to safety culture; application of ergonomic principles; and work hours. Participants reported that fully engaging workers in programs was beneficial.

Conclusions: Industry members should more widely share their best practices for protecting workers' safety and health. Occupational safety and health practitioners and researchers should support the development and evaluation of (a) training for non/limited-English-speaking-workers, (b) ergonomic interventions, and (c) fatigue risk management systems. Future research should engage worksite managers and workers to characterize their safety and health experiences and needs.

KEYWORDS

Fish processing; food manufacturing; occupational safety and health programs; manager interviews

Introduction

Occupational safety and health (OSH) programs that proactively eliminate and control workplace hazards can prevent fatalities, injuries, and illnesses.[1] Although the seafood processing industry is vital to Alaska's economy and hazardous,[2–9] researchers have not engaged industry managers to explore their views regarding OSH programs. The Alaskan seafood processing industry comprises onshore and offshore factories in which workers eviscerate fish, peel and pack shellfish, and can and freeze seafood.[10] In 2016, the Alaska Division of Environmental Health approved seafood processing permits for 39 companies for 169 high-production worksites, including 86 onshore factories and 83 vessels with factories.[11]

During 2015, approximately 25,000 people worked in this industry; 30% were Alaskan residents and 22% worked year-round in the industry.[12,13] Workers are not unionized. Many worksites operate seasonally and are geographically remote. Out-of-state and foreign workers are frequently recruited to meet the labor demand. In remote locations and onboard vessels, employers provide room and board, either for free or a daily charge. While workers' wages vary by occupation and experience, many new workers make minimum wage. Jobs are physically and psychologically demanding, frequently requiring workers to perform repetitive tasks in cold and wet environments, oftentimes 12 to 18 hours per day, for weeks at a time.[14–16]

CONTACT LN Syron lsyron@cdc.gov College of Public Health and Human Sciences, Oregon State University, 101 Milam Hall, Corvallis, OR 97331, USA
***Present address**: National Institute for Occupational Safety and Health, 315 E Montgomery Ave, Spokane, WA 99207, USA

Federal and state OSH regulators have classified Alaska's seafood processing industry as highly-hazardous. The US Coast Guard and the Federal Occupational Safety and Health Administration (OSHA) share jurisdiction over regulating worker safety and health onboard vessels with factories.[4] For onshore factories, the State-run Alaska Occupational Safety and Health Section (AKOSH), has regulatory authority and provides consultation and training services to managers and workers.[5,6] The Coast Guard has identified safety and operational risks for vessels with factories, which require a sizeable crew, utilize processing and freezing machinery, and can operate in remote areas far from search and rescue support.[7] Likewise, Federal OSHA has determined that offshore seafood processing is a high-hazard industry and, therefore, developed a Local Emphasis Program in Alaska, which has been in effect for over a decade.[8] Local Emphasis Programs are enforcement strategies designed and implemented at the regional office level to address hazards that pose a particular risk to workers within that jurisdiction.[9] AKOSH has identified onshore seafood processing as a high-hazard industry and implemented a Local Emphasis Program for onshore factories as well.[17] By law, all workers have the same rights and responsibilities. For onshore factories, safety committees are a recommended component of safety and health programs, but are not required by law.[18]

Despite the industry's high-hazard classification, OSH information is limited. The Census of Fatal Occupational Injuries did not report any fatalities in the industry during 2015.[19] However, the risk of non-fatal injuries/illnesses is elevated compared to other Alaskan industries. The Survey of Occupational Injuries and Illnesses reported that in 2015, Alaska's broad "food manufacturing" industry (of which over 95% is seafood processing) experienced a rate of 8.3 injuries/illnesses per 100 full-time employees (FTEs), more than twice the state's all-industry rate of 4 per 100 FTEs.[20,21] Likewise, a recent study of Alaska's onshore seafood processing industry identified a high rate of workers' compensation claims.[22]Both this epidemiologic study and a recent analysis of traumatic injuries among offshore seafood processors in Alaska have identified ergonomic hazards as the leading cause of injury/illness.[22,23]

Qualitative studies can uncover stakeholders' knowledge, attitudes, and behaviors, an understanding of which is critical for developing effective OSH interventions.[24] No research to date has engaged stakeholders in the Alaskan seafood processing industry to explore their views regarding OSH programs, which can be a decisive factor in preventing fatalities, injuries, and illnesses. In an effort to help close this gap, the present study aimed to explore managers' views on their OSH programs for Alaskan seafood processing worksites, with the goals of identifying (a) modifiable workplace factors that could be improved industry-wide to protect workers' well-being, and (b) ways researchers and practitioners could support managers' efforts to protect workers' well-being.

Methods

A qualitative approach was chosen to explore the views of this previously unstudied population. This approach is well-suited for studying topics that lack a developed literature because it provides insight into the meanings that people assign to the events, processes, and structures of their surrounding social world.[25,26]

Sample

A purposive sampling strategy was utilized to recruit managers who oversaw OSH programs and worked for major seafood processing companies with high-production operations in Alaska. Purposive sampling is a nonprobability method in which researchers apply expert knowledge of a population to select a sample that represents a cross-section of that population.[27] This sampling strategy is subjective and generally considered most appropriate for small samples that are drawn from a limited geographic region and/or restricted population definition, [27] such as managers in this industry. For research utilizing non-probability sampling, there is growing evidence that interviewing 10–20 knowledgeable people within the population of interest is sufficient to uncover and understand the study's core categories.[28,29] Participant eligibility criteria included being at least 18 years of age, proficient in English, and having at least one year of experience directing/managing an OSH program in this industry. To recruit participants, the lead author

contacted companies by phone and email, providing the study recruitment flier and interview guide to key decision-makers and managers. Three stakeholder organizations assisted with recruitment efforts. Prior to the interviews, each participant had a chance to review the participant consent form and interview guide. The Oregon State University Institutional Review Board reviewed this study and determined it to be exempt from full board review (study number 7813). The study team followed all policies and procedures surrounding research ethics, including participant confidentiality and data security.

Data collection

One-time semi-structured interviews were conducted by the lead author from April to August 2017. Thirty open-ended interview questions covered participant characteristics; worksite characteristics; workforce characteristics; OSH program characteristics; regulatory and economic factors influencing programs; and program challenges and successes (Appendix A). Questions regarding program characteristics were based on the major elements in the Federal Occupational Safety and Health Administration's program management guidelines.[1,30] All but one of the interviews were conducted over the phone. One interview was conducted in-person, at a worksite conference room. The length of interviews ranged from approximately 30 to 90 minutes, with an average length of one hour. Interviews were audio recorded and transcribed.

Prior to data analysis, we used a member checking process. Participants were offered an opportunity to review their responses to ensure accuracy.[26,31] The lead author reviewed the verbatim transcripts and "streamlined" by editing grammar and condensing the narrative flow, while maintaining participants' actual words and sentence structure.[31] Participants who wished to review this streamlined transcript were asked to (a) correct any inaccuracies and (b) approve the language that had been highlighted for potential inclusion as direct quotes. This process allowed each participant the opportunity to remove identifiable information. Participants' revisions were then incorporated into the original, verbatim transcripts for analysis.

Analysis

Transcripts were imported into ATLAS.ti 8.0 software for data management and analysis. Data on participants, worksites, and workforce characteristics were analyzed quantitatively. This involved identifying categories, organizing categories in a spreadsheet, and calculating frequency, percent, and range distributions. All other interview data were analyzed qualitatively, using a content analytic approach. Content analysis aims to identify and highlight the most relevant and meaningful aspects of interview transcripts by extracting data categories and then illustrating the variations found within those categories.[29,32] Content analysis examines and classifies large amounts of manifest and latent content in texts by reducing and summarizing the material into an efficient number of categories that represent similar meanings[33,34] and illustrates variations found within those categories.[29,32] Guided by this approach, the lead author: (a) read the transcripts multiple times to become immersed in the data; (b) while reading, wrote notes in the margins describing each section of the transcripts; (c) for each section, assigned inductive or "in vivo" codes and phrases from participants' actual language; (d) collected codes from all transcripts into a single spreadsheet; (e) grouped the codes under higher order headings; and (f) developed data-grounded categories that prioritized participants' voices.[35,36] Based on evidence in the scientific literature and subject matter expertise, the lead author determined which workplace factors were modifiable and could potentially improve OSH industry-wide. For example, while company leadership cannot change certain innate aspects of the industry (e.g., seasonality and remote worksite locations), they could potentially modify other factors (e.g., hazard control measures, management practices, etc.). A co-author (LK) independently reviewed and assessed the data underlying each category to validate the lead author's analytical decisions and assist with category construction and labeling.

Results

Twenty major companies operating seafood processing worksites in Alaska were approached to recruit study participants. Managers from 13 companies (65% of companies approached) consented to participate. Some companies that declined to participate were interested in the study, but (a) their OSH managers did not have spare time for interviews, or (b) they did not have well-established programs with a designated OSH director/manager. In total, 14 participants completed interviews. Twelve participants asked to review their interview transcripts. Of these, seven participants provided feedback. This feedback included only minor revisions, such as correcting the species processed at their facilities, correcting their years of experience in the industry, and removing trademarked names that could have identified their companies.

Participant, worksite, and workforce characteristics

All 14 participants managed OSH programs. Twelve were at the corporate level and two oversaw programs at the worksite-level. There was an even distribution of participants who oversaw programs for onshore versus offshore worksites. Participants' experience in this industry ranged from 1–37 years (median: 8.5 years). Their experience managing OSH ranged from 3–36 years (median: 23.5 years).

In total, participants managed programs for 32 onshore plants and 30 vessels. The onshore plants were located throughout the state, with some operating year-round and others during a single season. Vessels represented multiple fleets operating in Alaskan waters. Onshore and offshore factories processed pollock, salmon, cod, crab, halibut, sablefish, and flatfish.

Participants reported managing programs for a combined estimated 17,000 workers at peak season (80% onshore), which constituted approximately 68% of the Alaskan seafood processing industry's total workforce. Participants reported that workers' formal education varied widely, from less than high school to advanced college degrees. Most participants stressed the workforce's diversity, describing how workers came from around the United States and world. In addition to English, they reported the most frequently spoken languages were: Spanish; Tagalog; Samoan; French; Somali; and Arabic; as well as various Oceanic, African, Eastern European, and Alaska Native languages.

Modifiable workplace factors

Based on common findings across the various interview topics, which were reported frequently by multiple participants, we identified workplace factors that could potentially be modified to improve OSH industry-wide. Our content analysis yielded five modifiable workplace factors: (1) manager training and knowledge sharing; (2) worker training; (3) safety culture; (4) application of ergonomic principles; and (5) work hours. The following subsections describe each factor.

Manager training and knowledge sharing

Several participants reported a lack of OSH training among worksite managers as an issue, as illustrated in the participants' quotes presented in Table 1. For example, lack of training contributed to the misconception that following safety procedures would decrease productivity, and these worksite managers prioritized production speed over safety. Furthermore, not all worksites had managers trained in and devoted to OSH functions. In contrast, other participants noted that increasing worksite mangers' training

Table 1. Participant quotes regarding worksite manager training.

- "Production still trumps safety to a large extent and it's very disappointing to be fighting those battles. Part of this is lack of education of our upper management people; they've never been in the OSHA classes to get a good grasp on the issues. […] Hopefully, with this additional manager training, we'll have more accountability and develop ownership in the program."
- "In fact, we don't have dedicated HSE [health, safety, and environment] people at any of the plants. It's not a focused position like I'd like it to be."
- "We've had training for managerial personnel and the department heads to understand different techniques for doing root cause analysis and trying to get at the underlying factors. They've gone through the hierarchy of controls. They've actually shown marked improvement in the last few years at getting better corrective action to remove hazards rather than have controls to work around hazards."

had improved OSH outcomes. A few participants described sharing information with their professional counterparts at other companies about best practices. While their companies were competitive in certain respects, of course, they appreciated that OSH was an area that involved collaboration.

Worker training

The most commonly reported challenge was handling language barriers among a global workforce that often had limited or no English-language skills (Table 2). Only one participant did not cite language barriers as a challenge, because their company verified prospective workers' English language proficiency during the recruitment and hiring process. Most participants noted that language barriers especially presented difficulties during training. Therefore, participants agreed that visual and demonstration training techniques were essential. Written materials and verbal instructions were sometimes translated from English into other languages. Translators included bilingual managers and workers who assisted each other. Participants expressed concerns over both the utility of visual instruction strategies, as well as the reliability of informal translations. Others described how they confirmed workers' comprehension of, and comfort level with, performing new tasks safely by providing hands-on training and direct supervision. For onshore plants, a participant described how their method for teaching job hazard analysis techniques mainly used pictures, with a maximum of five words. Likewise, another participant discussed the process for analyzing risks on vessels, and cited the benefit of limiting the process to five steps.

Many participants reported encouraging proactive safety mindsets and behaviors among workers during training. Participants also noted that workers had to be self-reliant while working in remote environments, especially in terms of emergency preparedness and response, because outside assistance would take a long time to arrive. Given that many workers traveled to their remote onshore worksites, or arrived to their vessels very shortly before leaving shore, some participants cited logistical difficulties in finding time for training before production activities began. Other participants wished for additional time and support to provide more small-group, hands-on training sessions.

Table 2. Participant quotes regarding worker training.

- "When I do the trainings, it's mainly picture-based. More pictures than words, so that when I go through the [presentation], everybody understands. Then we do a lot of hands-on training. If its blood-borne pathogens training, I have people come up and put on all the equipment – the face mask and all that – so they can see how they put it on. They practice it and then we do games afterwards to make sure they understand the information and to reiterate that training."
- "There's a lot of value in using visuals, but there's also a lot of room for misunderstanding when all you're using is pictures. I've worked in a number of multicultural businesses, and in my experience, translators – particularly company employees – are not always reliable. You get a lot of nodding, 'Yes, I understand,' and there really isn't the comprehension that you need."
- "When that first bag of fish arrives, those new crewmembers have somebody with them and are shown the job step-by-step, until they're ready to say, 'Okay I can do this now.'"
- "We rely heavily on a simple risk assessment, which is … [a] template that workers will rely upon to go through a checklist that has five steps to identify risks and potential controls that they execute in a habitual manner. Five is a good number because that's how many fingers you have on your hand. And we want everybody to keep all their fingers. They get used to counting it off on their fingers."
- "Everybody is responsible for not only their own personal safety, but the safety of those around them, and for the conditions that we work in. I try to emphasize in our training and face-to-face sessions that we're each responsible for our environment. If you see something, don't just say something, but do something about it."
- "If we're in full production it's hard to pull people away from the lines to provide training. Now, if we're not producing fish, then they're not here. I can't provide the training if they're not here."

Safety culture

Participants commonly referred to "safety culture" when discussing management's and workers' commitment to safety, and their subsequent decision-making and behavior (Table 3). Although participants did not explicitly define this multidimensional term, their discussions suggested it referred to leadership's commitment to safety, trust between management and workers, workers' engagement in the OSH programs, and a mindset that prioritized OSH.

There was consensus that company leadership – owners, executives, and high-level directors/managers – set the tone for safety. Some participants emphasized the corporate-level support for their programs, and how leadership valued workers' well-being. Building trust between management and workers was described as essential for an effective program, and participants acknowledged

Table 3. Participant quotes regarding safety culture.

- "I'm fortunate that the president and CEO understand the value of safety, not just bottom-line dollars and cents, but that our people are our best asset and we don't want them to get hurt."
- "Really, integrity is your stock and trade. If somebody comes to you for help and you blow them off, they're not going to come to you again. […] Involve everybody from the bottom up. That way, there's opportunity for voices to be heard."
- "We want to give them the tools and training, and also encourage them to speak up when something's not right. We explain that there's not going to be any reprimand, because they come from other companies, and sometimes there's a few people who are afraid to speak up."
- "Having people come up to me and report safety concerns, and then following through on addressing those concerns, that makes for nice processes where workers feel comfortable bringing issues to me and knowing that I'll resolve them the best that I can."
- "We invite workers to attend safety meetings and provide us feedback on any improvement we can do to our safety program. Most of the time, great recommendations are coming from our front-line employees."
- "They look out for themselves and take a preventative approach. It is a very active environment. It is by its nature a 'get it done, get it done, get it done' process and environment. But, I can see over 20-some years that I've been involved in the industry, that it has gone from 'get it done' to 'get it done safely, get it done right.' The culture has changed."
- "The culture change that we're looking for is the mindset of being safe. It doesn't matter where they come from, some people just get that production mindset, 'Have to get it done as quickly as possible,' not realizing you need to be safe as well. I'd rather have you go home with all your fingers and toes and your life."

that trust had to be earned over time. One participant described developing trust with workers who had negative experiences in the past with other companies when they tried to bring up safety issues. Participants agreed that managers and supervisors being accountable to workers was an essential element of an effective program and contributed to a positive safety culture.

In certain instances, the extent of workers' roles in the program depended on the length of their employment. Whereas year-round workers might have an active role in the program, participants found it more challenging to fully involve workers who were only onsite for short seasons, which might last two months. Across companies and worksites, there was great variation in the extent to which workers were engaged in the programs, ranging from basic compliance with standards to full partnerships between management and workers. For example, not all worksites had formal – or fully established – safety committees. Some participants hoped to create committees in the future. For a worksite at which there was a safety committee, a participant cited the importance of worker feedback. Participants stressed the value of open communication and collaboration with workers, which created opportunities for improvements.

Finally, participants described a "production mindset" that clashed with valuing safety, either as a previous problem or an ongoing concern. For a vessel, a participant noted that despite being seasonal and drawing labor from all over the world, workers' depth and breadth of safety knowledge was quite good, and the shift in emphasis from production to safety had occurred. In contrast, a second participant described that their onshore facility was still struggling with this type of transformation from a production-oriented mindset to a safety mindset.

Table 4. Participant quotes regarding application of ergonomic principles.

- "We're trying to develop strategies for dealing with these muscle strains and sprains but it's a tough nut to crack. They're very complicated."
- "When you're only running for two months, it's tough to justify spending half a million dollars on some machine that's going to automatically palletize something. […]Certainly you want to protect your employees. But if this half million dollars is not going to get paid back for 20 years, well, then you find a different way to do it that maybe isn't as effective."
- "We took a broader look at it to see what we could do, hired an ergonomic consultant, and redesigned the [vessel's] whole bagging area. We blew out a wall and put in conveyor belts and squeezers to help eliminate the lifting hazards. Before, the crew were lifting a bag, which might weigh 77 pounds apiece, seven times. They do roughly 6,000 bags per trip. Now they are only lifting a bag to stack it, put it on the conveyor belt, and then offload it. So we eliminated four of the seven lifts."
- "Depending on the crewmember, most could handle [lifting the screw press] on their own, but some are smaller and are unable to do that. They decided that regardless of a person's size, that it's a two-person job, period. The smaller or less strong individual has the assistance necessary and it's taken care of so it won't cause a problem."
- "All of these older boats were conversions – they were built to be something else; most of them were not purpose-built to be at-sea processors. So, as we purpose-build fishing vessels and design them the right way to do business from the front end, I think it's going to make some big, dramatic improvements. Safety through design is a challenge with older boats. Let's do it smarter, do it right the first time, so we build it safely for the people that are using it, and mitigate hazards through elimination rather than administrative controls."

Application of ergonomic principles

Participants frequently cited ergonomic hazards as an area of concern (Table 4). Many tried to follow the hierarchy of hazard controls to address material handling activities. However, they also noted that identifying the most protective controls for ergonomic hazards and finding feasible and affordable solutions were sometimes challenging.

Participants discussed how engineering controls, when feasible, were the most protective solutions, but that there could be difficulties with implementation. Especially for smaller companies and those that operated during short seasons, there were economic challenges to implementing engineering controls. One participant highlighted how their company had made a substantial investment to eliminate hazards in their vessel's fishmeal bagging room. Another participant discussed an administrative control onboard a vessel that had effectively reduced an ergonomic hazard when crewmembers lifted a screw press for cleaning. Finally, a participant noted that designing new vessels for improved safety would likely lead to benefits.

Work hours

Participants explained that reducing work hours and changing work shift schedules had reduced worker fatigue and thus improved safety. For example, one participant explained that their company limited work shifts to 12 hours, because experience had shown that shifts over 12 hours were associated with injuries. Another participant reported that, in the past, the seafood processors on their vessels had worked 16.5 hour days, because they needed more people in the factory; however, ten years ago they changed the schedule to rolling eight-hour rounds. This participant stated, "Because [the factory workers] are getting more rest, the safety improved quite a bit. That could be one of the reasons other vessels within the industry are having safety problems. Adjusting the amount of hours worked to prevent fatigue is helpful."

Discussion

This study successfully engaged managers to characterize their views on OSH programs in Alaska's seafood processing industry. Participants reported managing programs for an estimated 68% of the 25,000 workers in this industry. Based on participants' responses, we identified five factors that could be modified to improve OSH industry-wide. In this section, we discuss these factors in relation to the scientific literature and provide evidence-based recommendations.

Manager training and knowledge sharing

Participants described how worksite managers had varying levels of OSH education, including injury/illnesses prevention. Investing in OSH leadership among middle managers positively influences outcomes.[37,38] Middle managers are role models for workers, with workers relying on their instructions and social cues to decide what to value and prioritize.[37] Training supervisors to (1) improve their responses to workers' concerns, including early mentions of musculoskeletal discomfort, and (2) communicate proactively with workers about ergonomic risk factors, can substantially reduce workers' compensation claims for musculoskeletal injuries and disability.[38] Finally, a few participants noted appreciating how OSH was a collaborative endeavor between some companies, in an otherwise competitive industry. Best practices could be shared more widely.

Worker training

All but one participant noted that language barriers among the global workforce presented communication difficulties, especially during trainings. Participants frequently noted that bilingual workers served as informal interpreters. These results are consistent with findings from previous studies in other industries. O'Connor et al. (2014) discussed the challenges involved in training limited/non-English-speaking workers. For example, they state that interpreters are often bilingual intermediaries who "may have the best of intentions, but often have limited abilities in the face of complex challenges of interpretation." Therefore, it is far better to hire a professional interpreter when financially feasible. Alternatively, "train-the-trainer programs" involve organizations investing in the education and ongoing support/coaching of

trusted individuals ("worker-trainers") who in turn provide training to their peers.[39] Seafood processing companies could make an intentional effort to develop bilingual infrastructure by finding or developing bilingual managers, potentially from the countries where they recruit workers within their current workforce.

Participants described translating materials from English to workers' first languages. However, straight translation from English to other languages does not necessarily guarantee literacy, language, or cultural appropriateness.[40] Guidelines for developing educational materials for limited/non-English-speaking workers include (a) using native-speaking translators who have in-depth knowledge of the topic; (b) keeping materials at a limited literacy level; (c) using clear and realistic illustrations/graphics/photographs; (d) conducting pilot tests with workers; and (e) including basic education on OSH laws and workers' rights.[41]

Participants also noted that providing hands-on training was beneficial. There is evidence that training is more effective at improving safety knowledge and performance when it involves higher learner-engagement methods (e.g., behavioral modeling, simulation, and hands-on training) versus low-engagement methods (e.g., lecture, video, and pamphlets).[42] Beyond designated training sessions, managers should ensure that workers have the ability to communicate their questions, concerns, and feedback at any time.

Safety culture

Although participants did not provide their definition of the term "safety culture" (and conceptions likely varied), they frequently referred to safety culture when discussing management's and workers' decision-making, behavior, and commitment to the programs. Participants emphasized that building trust between management and workers was essential for an effective program. They also described examples of their successes and challenges in moving from an exclusive "production mindset" to a mindset that also valued safety. Prior research assessing occupational safety and health programs in small businesses found that participants most frequently cited production pressures and other time constraints as a major barrier to program success.[43] In this study, one participant noted that some workers had been reprimanded for bringing up safety concerns while employed at other companies in the past, and therefore it was necessary to actively encourage open communication and demonstrate that reporting hazards, near-misses, and incidents would not be punished.

Safety culture may be a leading indicator of OSH outcomes. In other industries, there is evidence that safety culture is significantly correlated with workers' safety knowledge, performance, and outcomes.[44,45] Through sustained effort, company leadership and managers can foster positive organizational traits, such as developing a fair culture in which managers do not punish worker errors or incidents to "obscure systemic deficiencies and to blame one of the victims".[46]

Application of ergonomic principles

Participants cited ergonomic hazards as a major issue. They described challenges (e.g., affordability) and successes implementing interventions. Ergonomics is the science of fitting workplace conditions and job demands to worker capabilities.[47] Redesign of factories and/or processes can improve the safety of material handling tasks, when feasible. Administrative controls alone, such as training workers to use safe lifting techniques, are not as effective at preventing musculoskeletal injuries/illnesses. The concept of "prevention through design" involves eliminating hazards as early as possible in the life cycle of equipment and workplaces.[48] One participant explained that designing new vessels to incorporate worker safety and health considerations will be more effective at preventing injuries than retrofitting the older vessels, which were not designed to be factories. Historically, modernizing vessels that have factories onboard (many of which were built in the 1970s and 1980s), either through major upgrades or new builds, has occurred fairly infrequently, at less than one vessel per year. The pace of modernizing, however, has increased since 2000, and this positive trend is projected to continue.[23,49,50] With a global workforce, seafood processing companies may have to account for wide variation in workers' stature (e.g., height and reach) when retrofitting and designing equipment and workplaces.[51,52]

To prevent musculoskeletal injuries/illnesses, managers should implement all of the elements

of effective ergonomic programs.[47] Participatory ergonomic interventions involve engaging workers in problem solving, as well as providing workers with sufficient background/technical knowledge to understand ergonomic principles and the power to influence their own work activities. There is evidence that participatory ergonomic interventions have a positive impact on reducing musculoskeletal symptoms and injuries, workers' compensation claims, and days away from work.[53,54]

Work hours

A couple of participants mentioned that long hours negatively affected OSH. In a study by Garcia and de Castro (2017), interviews with Filipino seafood processors in Alaska identified challenges related to insufficient time allowances for rest breaks and sleep disruptions in employer-provided dormitory rooms. Nevertheless, these interviewees reported that their company was much better to work for than others in Alaska, and noted that shifts being limited to 12 hours was preferable to 15- to 18-hour shifts.[55]

Long hours and shift work increase OSH risks and decrease productivity.[56] With very long shifts, and when 12-hour shifts combine with more than 40 hours of work a week, workers' physiological performance deteriorates and they experience increased injury rates and more illness.[56] Therefore, companies should implement fatigue risk management systems.[57] When scheduling shifts, managers should consider that the average person requires 8 hours of sleep to prevent fatigue. Therefore, non-work time should last longer than 8 hours, in order to allow for "true sleep opportunity," after workers have engaged in necessary personal activities, such as eating and personal hygiene.[56] Strategies for reducing fatigue-related risks include (a) allowing workers to have input on the design of their schedules; (b) providing frequent and adequate rest breaks; (c) scheduling short naps; (d) breaking up monotonous tasks; and (e) providing training on basic sleep information, circadian rhythm, fatigue physiology, and good sleep practices.[58]

Limitations

Information was self-reported during interviews and is therefore subject to recall and social desirability bias. Additionally, it was possible that participants' responses were influenced by discussing interview questions with others beforehand, or by having additional time to consider their responses.

Although the study design and sample size were appropriate for utilizing a content analysis approach to identify categories in the data, the design and sample size were not sufficient to reach theoretical saturation or to conduct a thematic analysis. Smaller companies, and those with less-developed programs that did not have a designated OSH manager available to interview, were not represented in this study.

As corporate and high-level managers, participants' views might have differed from those of other managers within their own companies, such as onsite department heads or line-level supervisors. Workers likely have unique views on programs, including facing challenges not identified by study participants. This study was only a first step to engage industry stakeholders. Further research is needed to engage worksite-level managers and workers (who are the experts on their jobs) to gain a more comprehensive understanding of the safety culture and working conditions.

Conclusions

This was the first study to engage OSH program managers in Alaska's seafood processing industry. Despite the variations across programs, we identified commonalities between companies and worksites, and uncovered areas in which multiple participants were making efforts to address challenges and improve their programs. Workplace factors that could be modified to improve OSH industry-wide include (1) manager training and knowledge sharing; (2) worker training; (3) organizational aspects related to safety culture; (4) application of ergonomic principles; and (5) work hours.

For Alaska's seafood processing industry, future studies on (a) training for non- and limited-English-speaking workers, (b) ergonomic interventions, and (c) fatigue risk management systems would be beneficial for improving OSH industry-wide. Researchers, OSH practitioners, and regulators should help industry members address their challenges in protecting workers' well-being. Future research is needed to

characterize worksite managers' and workers' experiences and views. Workers have unique experiences and views on OSH programs, including facing challenges that were not identified by the study participants. Incorporating workers' concerns and suggestions will likely improve the feasibility and effectiveness of injury/illness prevention strategies. Workers' observations, combined with managers' views, such as those interviewed for this study, might provide the best approach to identifying OSH challenges and potential solutions.

Author affiliation and disclaimer

This research was conducted at Oregon State University. Since that time, the corresponding author's affiliation has changed to the National Institute for Occupational Safety and Health. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

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Ethics

The Oregon State University Institutional Review Board reviewed this study and determined it to be exempt from full board review (study number 7813).

ORCID

LN Syron http://orcid.org/0000-0003-1477-996X

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Appendix A. Interview Guide

I. Participant Background
1. What is your job title?
2. How long have you worked in this industry?
3. How long have you held positions involving occupational safety and health?
4. What types of education, training, and/or on-the-job experience have prepared you for handling occupational safety and health issues?
5. Are you involved with an occupational safety and health program for onshore facilities and/or onboard vessels? How many worksites do you cover?

II. Worksite Characteristics
6. Which species are processed at your facility?
7. During which months of the year does your facility operate?
8. During peak season, how many workers total are onsite/onboard?
9. During peak season, approximately how many workers perform seafood processing and packaging tasks?

III. Safety & Health Program
10. What is the management team's role in the safety and health program?
11. What is the worker's role in your health and safety program?
12. How are worksite hazards identified and analyzed?
13. Is there a system for workers to report hazards? If so, what type?
14. Following an injury or illness, what is the program's protocol, or method, for addressing it?
15. Could you tell me about one or two examples of a hazard control measure that your program has implemented that have been very effective?
16. Could you tell me about one or two examples of a hazard control measure that your program has tried, but that have been less effective than you expected?

17. What safety and health training is provided for workers?
18. How often is safety and health training provided for workers?
19. In what language(s) is the training provided?

IV. Program Challenges & Successes

20. What are the two biggest difficulties or challenges facing your safety and health program?
21. What are two of your safety and health program's most important successes?

V. Regulatory & Economic Factors

For these next questions, examples of regulations could be from OSHA, the EPA, the FDA, etc.

22. Do any regulations negatively influence your worker safety and health program? If so, how?
23. Do any regulations positively influence the program? If so, how?
24. Do economic factors influence your safety and health program? If so, how?

VI. Workforce Characteristics

For the following questions, please provide estimates or general impressions:

25. What is the age range for workers?
26. What percentage of workers are men versus women?
27. What are workers' educational backgrounds? For example, categories could be: less than a high school degree, a high school degree, or some college and college degrees.
28. What languages are spoken among workers?
29. What are workers' racial or ethnic backgrounds?
30. What is the worker turn-over rate?

Is there anything else that you would like to mention related to protecting workers' safety and health in your industry?