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From Knowledge to Action: Engaging Washington's Commercial Fishing Community in Substance Use Awareness and Prevention

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ABSTRACT

Objectives: Commercial fishing is among the most hazardous occupations in the United States, with high rates of injury, chronic pain, and opioid-related overdose deaths. Washington's fishing community has expressed concern about substance use, highlighting the need for practical, industry-specific training.

Methods: This project applied the Knowledge to Action (KTA) framework to adapt and implement an overdose response training within the Fishermen First Aid and Safety Training (FFAST) program in Washington state. Training combined a didactic presentation, hands-on naloxone (NARCAN®) administration practice, and distribution of harm reduction materials.

Results: There were 25 commercial fishermen who participated, primarily shellfish harvesters. In pre-training, 54% reported knowledge of naloxone (NARCAN®) administration, yet 91% did not carry naloxone (NARCAN®) on their vessels, revealing a gap between knowledge and practical application. Post-training, 100% reported increased knowledge and confidence, and 70% indicated plans to include naloxone (NARCAN®) in their first aid kits. Participants emphasized the value of hands-on practice and identified several barriers, including occupational isolation, limited access to healthcare, and stigma.

Conclusions: Integrating overdose response into established safety programs provides a feasible, community-driven strategy to address opioid risk among fishermen. This training improves emergency preparedness and highlights the importance of translating theoretical knowledge into action within high-risk, remote occupational settings such as commercial fishing vessels.

KEYWORDS

Commercial fishing; fishermen safety; fishing industry; harm reduction; knowledge to action framework; naloxone training; occupational health; occupational injury prevention; opioid overdose; safety training programs

Introduction

Historically, commercial fishing is among the most hazardous occupations in the United States, with a fatality rate more than 40 times the national average occupational fatality rate as of 2019.[1–3] Globally, it is estimated that over 100,000 fishing-related deaths occur each year, equivalent to nearly 300 fishers dying each day.[4,5] Fatalities are attributed to vessel disasters, falls overboard, and injuries sustained while performing job duties, with an increase in the occurrence of non-operational fatalities, including suicide, homicide, and unintentional drug overdose, occurring in 35% of deaths from 2000 to 2019.[6,7] An exploratory analysis of synthetic opioid stimulant co-involved overdose deaths in 2022 found agriculture, forestry, fishing, and hunting had the second-highest percentage (39%) of fatal synthetic opioid – involved overdoses in a single industry group.[8] There is growing interest within the commercial fishing industry to understand substance use among workers.[9] Efforts are also increasing to expand access to rescue medications, recovery services, and training for fishermen, as well as for personnel involved in first aid and safety training, such as drill instructors.[9–12]

The literature reports that opioid-related overdose deaths affect fishermen at a disproportionate rate.[6,13–15] A retrospective mortality analysis describing deaths from drug overdoses in 2020 of U.S. residents in 46 States and New York City found among individual occupations, the highest proportionate mortality ratio (PMR) was observed among decedents who worked as fishers and related fishing workers with a PMR of 193.1 per 100,000 workers.[13] Fishers and fish-related workers had an elevated drug overdose PMR when

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assessed as an individual occupation relative to all drug overdose deaths.[13] Other studies found opioid poisonings were more than four times as likely to have occurred among fishermen when compared to non-fishermen, while workers in farming, fishing, and forestry occupations had an opioid-related overdose death rate (OROD) more than 5.5 times that of all workers.[6,14] A retrospective analysis of death certificates found several occupations had significantly elevated rate ratios (RRs) for drug poisonings, with farming, fishing, and forestry occupations having an RR of 6.55.[15]

There is coastal variation in reported opioid-related overdose deaths, with fewer reported cases occurring in the Western region of the United States.[16–18] In the years 2015–2019, Alaska and the East Coast Region had the highest number of overdose deaths in commercial fishing.[17,18] There are several challenges to accurate reporting of occupational fatalities, including unlinked and siloed data collection and reporting systems, variations in cause of death codes, occupational and industry groupings and other variables on death certificates, dismantling of public health infrastructure, and delays in federal publications.[19] Reporting may be more nuanced on the West Coast due to the presence of distant water fishermen who reside in Washington but travel to work in Alaska, making jurisdiction and case reporting more challenging.

Commercial fishermen are exposed to a number of risk factors associated with poor health and safety, including high injury rates, lack of job security, absence of paid sick leave, and long working hours.[2,7,11,20,21] Commercial fishermen experience an injury rate that exceeds the national average at 189/10,000 full-time equivalent (FTE) versus 104/10,000 FTE as of 2015,[22] and some injuries go unreported to clinicians or the U.S. Coast Guard (USCG).[23]

The high prevalence of musculoskeletal pain and injuries and high rates of work-related musculoskeletal disorders (MSD or WMSD) noted in this population can occur from ergonomic factors and repetitive job tasks.[12,24–26] Fishing tasks can contribute to significant biomechanical loads, with asymmetrical movements causing increased spinal compression, unbalanced muscle overuse, and postural instability.[25–27] The nature of work associated with different fisheries affects workers' physical health and injury risk, as variations in characteristics such as distance from shore, equipment used, and ergonomic stressors are determined by the specific fishery.[6,28–31] Upper extremity injuries, including the shoulder, arm, hand, and elbow, are commonly reported, as well as low back and neck injuries.[12,25,29] Fractures are a commonly reported serious injury.[23,29] Workers who experience MSDs and acute or chronic pain may be prescribed opioid medications, which is a risk factor for developing an opioid use disorder.[6,9] In particular, Johnson et al. [32] found fishermen reported the need to work through injuries and manage acute and chronic pain on their own, creating a concerning cycle of injury, self-medication, and potential dependency. Barriers to adequate pain management noted are factors such as avoidance of medical care, poor interactions with healthcare providers, and lack of health insurance.[32] Chronic pain and injury are nearly universal aspects of life as a fisherman, compounded by insufficient pain management, despite clear medical need and barriers to obtaining primary healthcare.[33]

Barriers to receiving healthcare and rates of underinsured fishermen hinder access to care following injury, and receiving adequate pain management may contribute to substance use.[12,28,32,33] Noted barriers that result in increased emergency or urgent care utilization, or formal healthcare not being sought altogether, include incompatible schedules of primary care clinics and fragmented care systems.[28,33] In addition, regulations regarding the prescription of medications may make it difficult to obtain and carry enough medication during a trip, presenting a challenge to adequate pain management. State-specific differences in healthcare policies, availability of harm reduction resources, opioid prescription regulations, or availability of substances are inconsistent and may all influence opioid-related overdose death risk in this population.[33,34] Last, job insecurity and lack of paid sick leave have been shown to increase the likelihood that an injured worker will return to work prematurely or work through an injury, which potentially increases the likelihood of prescription medication misuse and nonprescription substance use to manage pain.[13]

Recognizing the rise in opioid misuse across various industries, workplaces have increasingly implemented educational training to raise awareness among workers. However, implementing occupational health and safety programs in the workplace as is typically done can be challenging for certain industries, because the workplace is less traditional and more transient. Commercial fishing exemplifies this challenge, as work is performed in remote locations, with fishing vessels operating independently on the water.[21]

In response to reports that first aid courses were overgeneralized and not relevant to this population, the Fishermen First Aid Safety Training (FFAST) was created, based on wilderness medicine training but adapted to the setting of fishing vessels.[21,35] It combines lectures, hands-on skill development, and scenarios designed to put together knowledge and skills in response to simulated events.[21] FFAST presented an opportunity to teach fishermen about overdose response and naloxone (NARCAN®) administration. By integrating overdose response training into an existing training curriculum that is well received by fishermen, FFAST can address the unique challenges of medical response faced at sea, when immediate medical assistance is not readily available. Practical, hands-on training can help to normalize this life-saving intervention, reduce stigma, and foster a culture of safety and support among fishermen.

Addressing the root of the reasons why fishermen experience opioid-related overdose deaths disproportionately to other occupations requires a comprehensive strategy that includes both primary and tertiary prevention measures. Primary interventions, such as reducing injuries and increasing access to healthcare, are important for mitigating the underlying risk factors that contribute to opioid and substance use. However, tertiary prevention strategies, including the availability of naloxone (NARCAN®) and overdose response, must also be included and are equally essential. In remote and high-risk work environments like fishing vessels, immediate access to life-saving measures can mean the difference between life and death during an overdose.

To operationalize this focus, we integrated an opioid overdose response training module into an existing fishermen safety training program to build knowledge and hands-on skills for naloxone (NARCAN®) administration among Washington's commercial fishing workforce.

Methods

This project utilized the Knowledge to Action (KTA) framework, which aims to bridge the gap between knowledge and practical application to a clinical scenario.[36,37] The framework's structured approach includes two key components: the Knowledge Creation and the Action Cycle, which guided the synthesis, creation, and application of an evidence-based training module that was tailored to the specific needs of fishermen.[36,37] Adaptation of knowledge to the specific context of the fishing community ensured the application is relevant, practical, and sensitive to the unique needs and challenges of this population. A technical advisory group, including safety trainers, occupational health professionals, and the United States Coast Guard, reviewed the module and provided feedback to the primary author on usability and content.

The intervention was delivered through the Southbend Tides to Table FFAST training, held at the Willapa Chamber of Commerce in February 2025, in collaboration with Washington SeaGrant and Oregon SeaGrant. Participants were fish-related workers enrolled in the event, including adults over the age of 18, all gender identities, and who were interested in fishermen first aid and safety. All participants were invited to complete the anonymous post-training evaluation. Participants were informed completion of the evaluation form was voluntary and their participation indicated consent. Language accommodations included real-time translation by a bilingual course coordinator from Oregon SeaGrant and closed captioning for participants who preferred Spanish. Participants were not compensated in any form for completing the training evaluation form. Post-training evaluations were collected using a paper survey tool, with 21 multiple-choice, select all that apply, Likert, and short-answer questions. This project was reviewed through the University of Washington Human Subjects

Division (IRB ID STUDY00021771) and determined to be exempt from IRB oversight.

Results

There were 25 participants who attended the training, and most worked in commercial shell fishing for mussels and clams as their main occupation. The majority of participants (80%) reported English as their primary language, while 20% reported their primary language as Spanish. Live translation and closed captioning were used to support participants preferring Spanish. The training module and manikin demonstration were presented twice in two 30-minute sessions, allowing the participants to engage in hands-on practice, including the administration of naloxone (NARCAN®) using training doses. Printed handouts from the UW Addictions, Drug & Alcohol Institute, along with fentanyl and xylazine test strips, drug deactivation kits, and naloxone (NARCAN®), were provided free of charge to all participants.

A total of 22 responses (88%) were collected from 25 participants in the training. As shown in Table 1, when participants were asked if they currently had a first aid kit on their fishing vessel, dock, or other workplace, 95% ($n = 21$) responded "yes". However, 91% ($n = 22$) indicated they do not currently carry naloxone (NARCAN®) on their fishing vessel, dock, or other workplace. The most common response ($n = 22$) for not carrying naloxone (NARCAN®) was "not knowing how to use/administer naloxone" (Table 1). Prior to the training, 55% ($n = 22$) of participants knew how to administer naloxone (NARCAN®), but 100% stated the training increased their knowledge. Nearly 70% ($n = 21$) of participants reported knowing how to get naloxone (NARCAN®) for their fishing vessel, workplace, or port. When asked if they would change anything about their first aid kit or naloxone (NARCAN®) plans after taking the training, 70% ($n = 20$) responded yes, they would make changes by adding naloxone (NARCAN®) to first aid kits and vessels, making it more available, and they would "handle with more care".

Participants were asked what they found to be most impactful about the training in the form of free-text questions. Themes arising from answers included identifying a knowledge gap about understanding naloxone (NARCAN®) and its purpose, mechanism, and administration. Participants found engagement with the manikin demonstration was a critical aspect of the training, emphasizing the importance of hands-on learning. Statements such as "A lot, because that way I'll be ready if someone needs it" and "Learning how to use Narcan and how many doses" indicate attendees felt more equipped to respond to an overdose event.

When asked about barriers to opioid overdose prevention, participants identified challenges that are also noted in the literature. One participant noted the isolated nature of work on fishing vessels makes overdose response more challenging stating, "all alone out on the ocean." Another participant noted the limited access to medical care, stating fishermen needed "better access to medical care, more affordable options to prevent self-medication." Still another participant noted, "I think that every boat should have naloxone (NARCAN®) just in case of an overdose." Others connected stigma and judgment, lack of communication, and the need for more training and recovery programs as barriers to preventing overdose.

Discussion

There is an overall gap in training for commercial fishermen regarding opioid use and a specific gap in knowing how to respond to an overdose. Due to the remote nature of fishing work, having a crew trained in emergency medical response such as the administration of overdose rescue medications like naloxone (NARCAN®) can be lifesaving.[21] However, there are currently no Occupational Safety and Health Administration (OSHA) standards for providing naloxone (NARCAN®) in the workplace or teaching employees how to identify and respond to an overdose.[38] There are limited USCG regulatory standards for first aid equipment and training, including guidance related to cardiopulmonary resuscitation (CPR).[35] Consistent with this are low reported rates of overdose response training: one study revealed only 10.4% of participants reported being trained to administer naloxone (NARCAN®).[12] Preparedness efforts have largely emerged from within the fishing community

Table 1. Post-evaluation participant responses from live training on opioid use and naloxone (NARCAN®).

Survey question (n)	Response category	n (%)†
First aid kit present on fishing vessel, dock, or other worksite ($n = 21$)	Yes	20 (95%)
	No	1 (5%)
Currently carrying naloxone (NARCAN®) on fishing vessel, dock, or other worksite ($n = 22$)	Yes	2 (9%)
	No	20 (91%)
Reasons for not carrying naloxone (NARCAN®) ($n = 22$)	Not knowing how to use/administer naloxone	10 (46%)
	Other††	4 (18%)
	Access/difficulty obtaining naloxone	2 (9%)
	Negative attitudes about carrying or using naloxone	1 (5%)
	Space limitations on vessel/workplace	1 (5%)
Knowledge of naloxone (NARCAN®) administration prior to training ($n = 22$)	Yes	12 (55%)
	No	10 (45%)
Training increased knowledge of naloxone (NARCAN®) administration ($n = 21$)	Yes	21 (100%)
	No	0 (0%)
Knowledge of how to obtain naloxone (NARCAN®) for fishing vessel, workplace, or port ($n = 21$)	Yes	14 (67%)
	No	7 (33%)
Desire to change first aid kit or naloxone (NARCAN®) plans post training ($n = 20$)	Yes	12 (70%)
	No	5 (25%)
	Unsure	1 (5%)
Discussed health promotion topics with crew or workers ($n = 20$)	Yes	9 (45%)
	No	10 (50%)
	Unsure	1 (5%)
Health promotion topics discussed with crew or workers (select all that apply) ($n = 20$)	Substance use and overdose prevention	4 (20%)
	Injury prevention and safety	5 (25%)
	Mental health and wellbeing	3 (15%)
	Nutrition and physical health	3 (15%)
	Other†††	1 (5%)
Comfort administering naloxone (NARCAN®) in an emergency ($n = 22$)	Very Comfortable	13 (59%)
	Somewhat Comfortable	7 (32%)
	Neutral	1 (4.5%)
	Somewhat Uncomfortable	1 (4.5%)
	Very Uncomfortable	0 (0%)
Comfort teaching naloxone (NARCAN®) administration ($n = 22$)	Very Comfortable	13 (59%)
	Somewhat Comfortable	7 (32%)
	Neutral	2 (9%)
	Somewhat Uncomfortable	0
	Very Uncomfortable	0
Perceived effectiveness of PowerPoint presentation ($n = 22$)	Very Effective	18 (82%)
	Somewhat Effective	3 (14%)
	Neutral	0 (0%)
	Not Very Effective	0 (0%)
	Not Effective at All	0 (0%)
Perceived effectiveness of manikin demonstration ($n = 22$)	Very Effective	18 (82%)
	Somewhat Effective	3 (14%)
	Neutral	0 (0%)
	Not Very Effective	0 (0%)
	Not Effective at All	0 (0%)
Knows someone in the fishing industry who has experienced an opioid overdose ($n = 21$)	Yes	6 (29%)
	No	12 (57%)
	Unsure	3 (14%)
Knows someone in the fishing industry who has died from an opioid overdose ($n = 21$)	Yes	5 (24%)
	No	14 (67%)
	Unsure	2 (9%)

†Values are presented as a number (percentage). Percentages are calculated using the total number of respondents for each item. Some survey items allowed multiple responses ("select all that apply"); percentages may exceed 100%.

††Responses in the "other" category include, "Didn't realize we need it," "wasn't sure of need for it," "never considered it," and "just haven't gotten it.".

†††Response in the "other" category includes "Company policy on drugs and alcohol.".

itself, public health practice, or adjacent partnerships with academic research and outreach organizations.

This project demonstrated the feasibility of integrating opioid overdose response training into an existing commercial fishing safety program. Practicing naloxone (NARCAN®) administration in a controlled environment contributed to participant confidence in emergency response situations. Many participants also reported feeling capable of training others, creating a potential multiplier effect by spreading skills across additional fishermen and increasing community-wide capacity. In this way, skill transfer could extend the intervention beyond the initial cohort of 25 participants.

Key themes discovered through this work include high baseline readiness for basic first aid but that overdose preparedness lags. Barriers are mostly related to limited awareness and low perceived need. Pre-training knowledge gaps exist as many participants did not know how to administer naloxone (NARCAN®) prior to the training. Although 55% of participants reported knowing how to administer naloxone (NARCAN®) prior to the training, "not knowing how to use/administer naloxone" was also the most common reason given for not including it in workplace first aid kits. Taken together, these responses suggest a disconnect between participants' stated ability and their confidence or willingness to act on that ability in a workplace setting. After training, participants overwhelmingly reported increased knowledge of accessing and using naloxone (NARCAN®). Table 1 suggests that fishing crews engage in active but variable dialogue about health; that participants reported high self-efficacy for overdose response; that hands-on training methods resonated; and that many participants know someone in the industry who has overdosed or died from an overdose. Another recurring theme was that participants did not realize naloxone (NARCAN®) should be included in a first aid kit, pointing to an opportunity to further normalize naloxone (NARCAN®) as a standard first aid supply, paired with the training.

This research was limited by the small sample size of 25 participants, most of whom were involved in harvesting mussels and clams. This sample may not accurately represent perspectives of workers engaged in other types of commercial fishing. There is a wide variation in work practices, injury risks, occupational exposures, and social contexts across commercial fishing, so a small sample size limits the generalizability of the findings. Another unanticipated challenge was not having prior knowledge of languages other than English, as Spanish was the preferred language among five participants. This language barrier may have influenced participant engagement and discussion about the topic. This was addressed by obtaining one of the handouts in Spanish and utilizing real-time translation through PowerPoint, which included closed captioning. Iterative piloting of the training module with additional participant groups is essential to gain further insights into community needs, refine the training module, and adapt it to other languages.

Conclusion

Fishing crews are ready to discuss health, feel capable of responding to first aid incidents that include overdose after training, and see value in practical, hands-on training. This project has highlighted the importance of targeted, industry-specific interventions for addressing substance use and overdose prevention in high-risk occupations such as commercial fishing. Recommendations include continued integration of overdose response training into FFAST and other existing maritime safety courses, which is a sustainable method to improve accessibility and reach, reduce stigma, and normalize lifesaving interventions. Broader adoption of training and adoption for first responders, including the United States Coast Guard, would be a significant win in terms of increasing knowledge and emergency preparedness in addressing overdoses at sea. Continued naloxone (NARCAN®) distribution, adaptation of training materials into multiple languages to improve accessibility, and incorporation of overdose response and injury prevention into other industries can enhance the overall reach and equity of these interventions. Scalability and further adaptations of the training module could expand the overall reach through alternative delivery formats, including online e-learning.

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References

1. National Institute for Occupational Safety and Health (NIOSH). Regions: National Overview. 2024. https://www.cdc.gov/niosh/fishing/data-research/regional-summaries/index.html#:~:text=A%20review%20of%20the%20data%20from%202000-2019%20found,fatalities%20occurred%20while%20diving%20or%20from%20onshore%20injuries. Accessed November 3, 2024.
2. National Institute for Occupational Safety and Health (NIOSH). About commercial fishing safety. 2023. https://www.cdc.gov/niosh/fishing/about/index.html. Accessed November 3, 2024.
3. U.S. Bureau of Labor Statistics. U.S. Bureau of Labor Statistics. TABLE A-5. Fatal occupational injuries by occupation and event or exposure, all United States, 2019. 2020. https://www.bls.gov/iif/fatal-injuries-tables/fatal-occupational-injuries-table-a-5-2019.htm.
4. Horn P, The Pew Charitable Trusts. More than 100,000 people die annually across global fishing sector, new research shows. 2022. https://www.pewtrusts.org/en/about/news-room/press-releases-and-statements/2022/11/03/more-than-100000-people-die-annually-across-global-fishing-sector-new-research-shows. Accessed November 3, 2024.
5. Seafood Source DE. New study estimates 100,000 fishing-related deaths occur annually. 2022. https://www.seafoodsource.com/news/environment-sustainability/fish-and-pew-charitable-trusts-find-more-then-100-000-annual-deaths-in-the-global-fishing-sector.
6. Fulmer S, Jain S, Kriebel D. Commercial fishing as an occupational determinant of opioid overdoses and deaths of despair in two Massachusetts fishing ports, 2000-2014. *New Solut*. 2021;31(3):252–258. doi: 10.1177/10482911211023476.
7. National Institute for Occupational Safety and Health (NIOSH). Safety Guidelines: Onboard Hazards. 2024. https://www.cdc.gov/niosh/fishing/onboard-hazards/index.html. Accessed May 15, 2024.
8. Lundstrom EW, Macmadu A, Steege AL, Groenewold M. Synthetic opioid and stimulant co-involved overdose deaths by occupation and industry - United States, 2022. *MMWR Morb Mortal Wkly Rep*. 2025;74(10):173–178. doi: 10.15585/mmwr.mm7410a3.
9. Walter AW, Morocho C, King L, et al. Preventing opioid use disorders among fishing industry workers. *Int J Environ Res Public Health*. 2018;15(4):648. doi: 10.3390/ijerph15040648.
10. Prinz K, Alaska Marine Safety Education Association. Amsea and Project Gabe join forces. 2024. https://www.amsea.org/post/amsea-and-project-gabe-join-forces.
11. Alaska Marine Safety Education Association. Alaska Marine Safety Education Association. Opioid overdose response kits. 2020. https://www.amsea.org/opioids.
12. Bellantoni JM, Bulzacchelli MT, Orchard D, Sulman HB, Bartlett JJ, Dzugan J. Naloxone training and availability in the US commercial fishing industry. *Am J Ind Med*. 2023;66(8):687–691. doi: 10.1002/ajim.23491.
13. Billock RM, Steege AL, Miniño A. Drug overdose mortality by usual occupation and industry: 46 U.S. states and New York City, 2020. *Natl Vital Stat Rep*. 2023;72(7):1–34.
14. Hawkins D, Roelofs C, Laing J, Davis L. Opioid-related overdose deaths by industry and occupation-Massachusetts, 2011–2015. *Am J Ind Med*. 2019;62(10):815–825. doi: 10.1002/ajim.23029.
15. Kaki S, Hawkins D. Drug poisoning deaths by occupation and drug type, Massachusetts 2010–2019. *Ann Work Expo Health*. 2024;68(3):243–255. doi: 10.1093/annweh/wxae001.
16. National Institute for Occupational Safety and Health, Devin L, Teske T, Kloczko D Commercial fishing fatality summary — West Coast Region 2015–2019. *Report No.: 2015-113*. National Institute for Occupational Safety and Health; 2025. https://www.cdc.gov/niosh/docs/2025-113/.
17. National Institute for Occupational Safety and Health, Devin L, Teske T, Kloczko D Commercial fishing fatality summary — East Coast Region 2015–2019. *Report No.: 015-114*. National Institute for Occupational

Safety and Health; 2025. https://www.cdc.gov/niosh/docs/2025-114/.
18. National Institute for Occupational Safety and Health, Devin L, Teske T, Kloczko D Commercial fishing fatality summary — Alaska region 2015–2019. *Report No.: 2015-112*. National Institute for Occupational Safety and Health; 2025. https://www.cdc.gov/niosh/docs/2025-112/.
19. Nahorniak J, Bovbjerg V, Case S, Kincl L. Application of data linkage techniques to Pacific Northwest commercial fishing injury and fatality data. *Inj Epidemiol*. 2021;8(1):26. doi: 10.1186/s40621-021-00323-z. Accessed July 5, 2021.
20. National Institute for Occupational Safety and Health (NIOSH) [Internet]. Commercial fishing. 2024. https://www.cdc.gov/niosh/maritime/about/commercial-fishing.html.
21. Miner T, Kincl LD, Bovbjerg VE, Vaughan A, Jacobson K. Emergency medical training for the commercial fishing industry: an expanded role for wilderness medicine. *Wildern Environ Med*. 2019;30(3):281–286. doi: 10.1016/j.wem.2019.05.008.
22. Eckert C, Baker T, Cherry D. Chronic health risks in commercial fishermen: a cross-sectional analysis from a small rural fishing village in Alaska. *J Agromed*. 2018;23(2):176–185. doi: 10.1080/1059924X.2018.1425172.
23. Bovbjerg VE, Vaughan AM, Syron LN, Jacobson KR, Pillai S, Kincl LD. Non-fatal injuries and injury treatment in the West Coast Dungeness crab fishery. *J Agromed*. 2019;24(4):316–323. doi: 10.1080/1059924X.2019.1638860.
24. Kucera KL, Loomis D, Lipscomb HJ, Marshall SW, Mirka GA, Daniels JL. Ergonomic risk factors for low back pain in North Carolina crab pot and gill net commercial fishermen. *Am J Ind Med*. 2009;52(4):311–321. doi: 10.1002/ajim.20676.
25. Kim JH, Vaughan A, Kincl L. Characterization of musculoskeletal injury risk in Dungeness crab fishing. *J Agromed*. 2023;28(2):309–320. doi: 10.1080/1059924X.2022.2068715.
26. Doza S, Bovbjerg VE, Vaughan A, Nahorniak JS, Case S, Kincl LD. Health-related exposures and conditions among US fishermen. *J Agromed*. 2022;27(3):284–291. doi: 10.1080/1059924X.2021.1944416.
27. Kia K, Kincl L, Chan A, Kim JH. A fishermen-developed intervention reduced musculoskeletal load associated with commercial Dungeness crab harvesting. *Appl Ergon*. 2023;110:104016. doi: 10.1016/j.apergo.2023.104016.
28. Guillot-Wright S, Wang LK, Figueira BT, Jones MO, Maredia R, Kichili N. Social determinants of occupational injuries among US-based commercial fishermen: a systematic review. *Int J Equity Health*. 2025;24(1):25. doi: 10.1186/s12939-024-02363-5.
29. Case S, Bovbjerg V, Lucas D, Syron L, Kincl L. Reported traumatic injuries among West Coast Dungeness crab fishermen, 2002–2014. *Int Marit Health*. 2015;66(4):207–210. doi: 10.5603/IMH.2015.0041.
30. Kincl L, Doza S, Nahorniak J, Case S, Vaughan A, Bovbjerg V. Commercial fishing fatalities and injuries described by linked vessel incidents. *J Agromed*. 2023;28(4):881–889. doi: 10.1080/1059924X.2023.2229827.
31. Kincl L, Syron L, Lucas D, Vaughan A, Bovbjerg V. Relationship of personal, situational, and environmental factors to injury experience in commercial fishing. *J Saf Res*. 2023;87:375–381. doi: 10.1016/j.jsr.2023.08.009.
32. Johnson T, Weatherford Darling K, Kantor D, et al. Understanding occupational injury and substance use issues among workers in the shellfish and lobster industries. *Maine Policy Rev* [Internet]. 2023;32(2):155–164. doi: 10.53558/HMLG6818.
33. Brown T, Paul G. Perceptions of opioid misuse and chronic pain: a qualitative assessment of Rhode Island commercial fishing captains. *J Opioid Manag*. 2019;15(2):129–135. doi: 10.5055/jom.2019.0494.
34. Doonan SM, Wheeler-Martin K, Davis C, et al. How do restrictions on opioid prescribing, harm reduction, and treatment coverage policies relate to opioid overdose deaths in the United States in 2013–2020? An application of a new state opioid policy scale. *Int J Drug Policy*. 2025;137:104713. doi: 10.1016/j.drugpo.2025.104713.
35. US Coast Guard. Code of Federal Regulations. 46 CFR 28.210. 2019. https://www.ecfr.gov/current/title-46/section-28.210.
36. Crockett L. The knowledge-to-action framework. 2017. https://medium.com/knowledgenudge/kt-101-the-knowledge-to-action-framework-7fbe399723e8. Accessed November 3, 2024.
37. Graham ID, Logan J, Harrison MB, et al. Lost in knowledge translation: time for a map? *J Contin Educ Health Prof*. 2006;26(1):13–24. doi: 10.1002/chp.47.
38. Clarkson M, Kamelhair C, Ridenour C, Selvaggio S. Stocking naloxone in the workplace: What employers need to consider. *The National Law Review*. https://natlawreview.com/article/stocking-naloxone-workplace-what-employers-need-consider#:~:text=Currently%2C%20there%20are%20no%20specific%20OSHA%20standards%20addressing,employers%20from%20liability%20with%20regard%20to%20naloxone%20administration. 2023. Accessed May 15, 2024.