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BRIEF REPORT

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ABSTRACT

Commercial fishing is a dangerous occupation where injuries, stress, and traumatic events are common. This study determined probable Post-Traumatic Stress Disorder (PTSD) rates in a cohort of 142 commercial fishermen in the United States and assessed factors that influence PTSD outcomes and severity. Fishermen representing four fisheries were sampled: salmon gillnetters (Alaska), Dungeness crab (Oregon), scallopers and lobstermen (Massachusetts). Participants self-reported information on health, sleep, activity, and substance use through surveys, and responded to a brief PTSD screener (PC-PTSD-5) that assesses probable PTSD under the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Positive PTSD screening rates in male fishermen were 12% (as compared to 10% for female fishermen), roughly three times the national average for US men (4%). Fishermen with self-reported depression, financial struggles, inability to control important things in their lives, difficulty going to ($p = .0278$) or staying ($p = .038$) asleep were significantly more likely to screen positive for PTSD. Factors influencing the severity of PTSD symptoms in those that have experienced a traumatic event included: financial insecurity, interpersonal concerns (family, crew), stress, and concern for safety on the vessel. Interestingly, sleep variables did not impact the severity of PTSD symptoms, only the outcome of probable PTSD. These results suggest the need to better understand the nature of traumatic events in fishing communities and to validate existing PTSD screening tools with fishermen to determine their accuracy in diagnosing PTSD in this population. Additionally, tailored behavioral health care for fishermen is essential to effective treatment and recovery from trauma.

Introduction

Commercial fishermen are 13 times more likely to die on the job than the average worker.[1] Drowning is the leading cause of death, with vessel sinkings and falls overboard responsible for most fatality cases.[2] On and off shore injuries involving gear or equipment are not uncommon.[3] Work stressors include variable working hours, social isolation, economic pressures (e.g., dependence on fish stock, fluctuating prices), changing weather patterns, competition for coastal resources and regulations.[4] Additionally, work days can be long and dictated by harvest or tides, which can result in sleep deprivation and fatigue.[5] These stressors can contribute to higher levels of anxiety, depression and/or other mental health outcomes, however,

little research has been conducted on mental health in commercial fisheries.[6] Individuals with depression and/or Post-Traumatic Stress Disorder (PTSD) have been known to experience increased illness, poorer prognoses, and delayed response to the treatment of depression.[7]

As a population with higher exposure to severe workplace injuries, fatalities (including high suicide rates), and vessel incidents, fishermen witness traumatic events, which can have lasting effects, such as PTSD.[8] Criteria for PTSD can include persistent thoughts or flashbacks to the event, negative emotions, difficulty sleeping, avoiding trauma related stimuli, or self-destructive behavior. Limited access to healthcare services, combined with mental health stigma and cultural/

masculine norms, can mean that fishermen are less likely to seek care for conditions like PTSD.[9]

All the described stressors combine in ways that may considerably impact work performance, the risk of future injury, and mental well-being.[10,11] In response to these concerns, this study that collected self-reported information on health, sleep, activity, substance use, and PTSD through surveys determined probable PTSD rates in US commercial fishermen and assessed factors that influence PTSD outcomes and symptom severity.

Methods

Study region, sampling, and survey instruments

This study included four fisheries in Alaska (salmon gillnet), Oregon (Dungeness crab), and Massachusetts (scallop and lobster). Participating fishermen signed a consent form, under Mary Imogene Bassett Hospital Institutional Review Board protocol #1481898. Fishermen in the salmon, crab, and lobster industries were randomly selected from permit lists in specific geographic locations to the travel distance for in-person health assessments. Scallopers were recruited through settlement houses, as pre-existing permit lists were not available. Further recruitment efforts were conducted dockside, via social media outlets, through partner promotions, and local radio.

Survey instruments captured demographics, fishery/boat information, sleep, caffeine/substance use, diet, physical, emotional and financial health. Health assessments captured data on height, weight, vision, respiratory health, blood pressure, diabetes risk (A1C and glucose), cholesterol, and risk for heart disease (Framingham scores[12]). A screener for probable PTSD, the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5)[13] was self-administered. This five-question screener assesses whether an individual has experienced a traumatic event (i.e. has trauma history), and, if so, whether and how much that event impacted them over the past month. Scores of 3 or higher denote probable but not diagnosed PTSD. A clinical interview/assessment (not available for this study) is required for a definitive diagnosis. Henceforth, "PTSD rates/diagnoses" in this study is referring to probable rates/diagnoses obtained from the screening tool.

Statistical analyses

All data were recorded on paper, cleaned, and entered into the project REDCap database system.[14] Two general sets of analyses were performed. The first involved a dichotomous variable denoting whether the subject screened positive for PTSD (*Probable PTSD Outcome*). The second set of analyses was a sub-analysis of the frequency of self-reported PTSD symptoms among those who experienced a traumatic event (*Symptom Severity*).

Probable PTSD outcomes for all subjects

To identify probable PTSD, subjects were given the Primary Care PTSD Screen for DSM-5, where they were asked a series of questions (see Table 1).

Subjects who answered "yes" to three or more of these questions were classified as probable PTSD positive,[13] resulting in 17 subjects being identified as PTSD positive and 125 as PTSD negative (negative subjects included 85 responding "no" to the original question, plus 40 who responded "yes" but had less than three positive responses to the five follow-up questions). Responses to categorical questions were compared between PTSD positive and negative subjects using chi-square, or Fisher's Exact Test in cases where the assumptions for chi-square were not satisfied. Continuous variables were compared using the Wilcoxon Rank Sum Test.

Prior studies indicate the PC-PTSD-5 screener has high levels of diagnostic accuracy.[15,16] However, it is important to note that several studies suggest that a cut-point of four "yes" answers versus three would maximize sensitivity (few false negatives) while maintaining acceptable specificity (few false positives),[15] and maximize efficiency (overall accuracy of test).[16] For this study, researchers used three as the cut point to be compliant with current screener instructions, but note that validation of the screener tool is an important focus for future research.

Symptom severity for those experiencing trauma

For all 57 subjects who reported a trauma history, the sum of the "yes" responses to the five follow-up questions was calculated, resulting in a score of 0 to 5. The relationship of this variable to other

Table 1. Probable post traumatic stress disorder screening questions and descriptions. Participants answering yes to 3 or more of the 5 questions were classified as PTSD positive (*n* = 17).

Probable Post-Traumatic Stress Disorder Screening Questions
All participants were asked: *"Sometimes things happen to people that are unusually or especially frightening, horrible, or traumatic. Have you ever experienced this kind of event?"*
Participants that answered no to this question (*n* = 85) did not continue. Participants that answered yes to this question (*n* = 57) were asked the following 5 questions.
In the past month, have you …
(1) … Had nightmares about the event(s) or thought about the event(s) when you did not want to?
(1) … Tried hard not to think about the event(s) or went out of your way to avoid situations that reminded you of the event(s)?
(1) … Been constantly on guard, watchful, or easily startled?
(1) … Felt numb or detached from people, activities, or your surroundings?
(1) … Felt guilty or unable to stop blaming yourself or others for the event(s) or any problems the event(s) may have caused?

demographic and sleep quality variables, was measured using Spearman's Rank-Order Correlation Coefficient.

Results

Probable PTSD outcomes for all subjects

Male fishermen reported higher screening rates of PTSD (12.1%) than female fishermen (10.0%); however, there were few females in our sample (*n* = 10). On average, those screening positive for PTSD had been in the industry longer than those without PTSD. PTSD outcomes did not appear to affect sleep patterns while fishing, with all subjects getting consistently less than five hours per night (see Table 2).

Initial analyses identified factors associated with PTSD outcomes. Roughly, one-fifth (17.7%) of fishermen screening positive for PTSD also reported having depression, while 1.6% of fishermen

screening negative for PTSD reported having depression (self-reported diagnosis) (*p* = .0118). Fishermen reporting financial struggles (*p* = .0157), or that they were unable to control important things in their lives over the last month (*p* = .0023), were significantly more likely to screen positive for PTSD.

Several sleep related variables were also significantly correlated with PTSD outcomes. Fishermen reporting difficulty falling asleep (*p* = .0278), staying asleep (*p* = .038), and having poor sleep quality (*p* = .0635, marginally significant) were more likely to screen positive for PTSD. Additionally, fishermen were asked how different factors impacted their sleep while they were on the boat. Negative working relationships on the boat (*p* = .0126), pain (*p* = .0104), concerns with family/relationships (*p* < .001), and unreliability of crew/captain (*p* = .0201) were all significantly correlated with positive PTSD screenings.

Using the cut-point of three for probable PTSD, 12.0% of fishermen (male and female) in the study

Table 2. Sample characteristics of subjects, noting average years in commercial fishing, sex, and average hours of sleep per night while fishing, by probable PTSD screening outcome.

Sample Characteristics		
Variable	PTSD Positive (n = 17)	PTSD Negative (n = 125)
Average years in commercial fishing	29	26
Males (n)	16 (12.1%)	116 (87.9%)
Females (n)	1 (10.0%)	9 (90.0%)
Males & Females (n)	17 (12.0%)	125 (88.0%)
Average hours of sleep per night while fishing	4.6	4.7
Average hours of sleep per night while at home	6.5	6.1

screened positive. Referring back to the prior discussion on cut-point, if a cut-point of four is utilized, 6.3% screen positive, above the national average of 5% in any given year.[17]

Symptom severity for those experiencing trauma

Higher levels of financial insecurity were positively correlated with higher scores (i.e., the sum of "yes" responses) ($p = .0067$). Fishermen who reported that their sleep was impacted by: working relationships on the boat ($p = .0065$), pain ($p = .0014$), stress (0.0088), concerns with family/relationships ($p < .0001$), unreliability of crew/captain ($p = .0273$), or safety concerns on the boat ($p = .0088$), were more likely to have a higher score. Reporting current depression ($p = .0207$) or feeling unable to control the important things in life ($p = .0153$) were also positively correlated with higher scores.

Average hours of sleep per night while fishing ($p = .5998$), and least hours of sleep in a 24-hour period during the fishing season ($p = .7264$) were not significantly correlated with higher scores. Sleep quality questions, including getting enough sleep ($p = .3857$), having trouble falling asleep ($p = .3964$), having trouble staying asleep ($p = .4004$), and having great sleep quality ($p = .3285$) were also not correlated with the sum of "yes" responses.

Discussion & conclusion

Probable PTSD screening rates among fishermen in this sample (12.0%), were more than double the national average in any given year (5.0%).[17] Male fishermen had positive PTSD screening rates (12.1%) three times higher than the national average for men over the course of their lifetime (4.0%).[17] The positive screening rate in female fishermen (10.0%) was higher than the national average for females over the course of their lifetime (8.0%), though not as pronounced as those for males.[17] Veterans and military personnel have some of the highest rates of PTSD in the United States.[18] Comparatively, our study found that fishermen have PTSD screening rates similar to that of veterans who served in the Persian Gulf War (Desert Storm) (14.0%).[19] However, it is

worth noting that this study's PTSD screener determined rates for the last month, while PTSD rates among Desert Storm veterans were assessed for the last year. Fishermen's elevated PTSD screening rate, coupled with their low likelihood of help-seeking behaviors,[9] increases the risk of poor health outcomes associated with PTSD, including higher rates and severity of pain, arthritis, asthma, cardiovascular disease, gastrointestinal symptoms, and overall mortality.[20]

Though the probable PTSD rate fell from 12.0% to 6.3% in fishermen if the cut-point was set to four rather than three, the authors chose to complete analyses using the cut-point of 3, as it is the recommended cut-point for that instrument. Using a cut-point of three or four indicates an increased rate of probable PTSD, which has been supported by other studies.[20,21]

Trauma exposures appear higher for commercial fishermen, which is troubling given the importance of sleep during the acute post-trauma period. Studies show that adequate quality and quantity of sleep during this time (also known as "the window of opportunity"[22] for the potential impact of treating sleep disturbances) can adversely affect mental health outcomes.[22,23] Fishermen in our study averaged less than five hours per night while fishing, far below the recommended seven to nine hours of sleep.[24] As noted, these abbreviated sleep periods may have implications for adequately processing and recovering from trauma, which negatively impacts long-term health outcomes.

This study has a few limitations. Random recruitment was used, as well as promotional materials and dockside recruiting, making it impossible to say whether these survey results are representative of the general fishing population. Additionally, as stated above, the screening tool used in this study determines probable PTSD, rather than a definitive diagnosis. Subsequent clinical interviews are recommended to make a definitive diagnosis, but that was not available in this study.

Understanding contributing factors of probable PTSD among fishermen is crucial for supporting fishermen's mental and physical health. Additionally, the variability in operating characteristics of the PTSD screener from population to

population suggests the need for a targeted study within the commercial fishing population to determine of the optimal cut-point for diagnosing PTSD.

Developing guidance for how to adequately treat fishermen after they experience a traumatic event is imperative. Typical trauma recovery guidelines such as avoiding drugs or alcohol; spending time with one's social support system; maintaining routine meals, sleep and exercise; and reducing stress, may be more difficult for fishermen.[25] Providing specialized options such as professional counselling or peer-based supports, re-skilling if alternate jobs need to be sought outside of the industry, and financial recovery resources may be essential to better support fishermen experiencing trauma.

Acknowledgments

Author contributions

Dr. Amanda Roome led efforts on data collection, calibrated equipment, provided feedback to fishermen on their health assessment results and drafted the manuscript. Ms. Gertz participated in preparing the manuscript with Dr. Roome. Dr. Roome, Dr. Jenkins, Dr. Sorensen & Ms. Gertz led the data analysis, interpretation, and drafting of the manuscript. Ms. Pain led efforts to organize and analyze the data, and participated in database management. Ms. Sulman critically reviewed the manuscript as a mental health expert. Ms. Graham and Dr. Quinn developed protocols, surveys and information sheets for the health assessments, worked to coordinate the clinical team, organized the gathering of health assessment data, calibrated equipment and provided feedback to fishermen on their health assessment results. Ms. Weil coordinated all aspects of the research and led efforts to increase stakeholder engagement. Dr. Kincl provided input on research and survey design and assisted with data collection and the recruitment of fishermen in Oregon. Mr. Dzugan provided input on concept development, research and survey design and assisted with data collection and the recruitment of fishermen in Alaska. Dr. McCue-Weil participated in the research design, the development of data collection instruments, data analysis and interpretation and led data collection efforts to collect data on sleep schedules at sea. Dr. Jenkins and Dr. Sorensen led the development of the research design, survey development, and critical review of the manuscript.

Disclosure statement

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