Protocol for Evaluating the Impact of Capacity Building on Seafarers' Occupational Health and Safety in Three Gulf of Guinea Seaports Using a COM-B Framework Approach

Claudine Mulih Shei[1]*, Tendongfor Nicholas[1], Lawrencia Osae-Nyarko[2], Chrisantus Eweh Ukah[1], Ismaila Karimu[1], Bongkiynuy Nancy[3], Randolf Fuanghene Wefuan[1], Nsagha Dickson Shey[1]

[1]Department of Public Health, Faculty of Health Sciences, University of Buea, Buea, Cameroon

[2]Biomedical and Public Health Research Unit, CSIR – Water Research Institute, Accra, Ghana

[3]Department of Public Health, University of Antwerp, Belgium

***Corresponding Author**

DOI: https://dx.doi.org/10.51244/IJRSI.2026.1315PH00006

Received: 28 December 2025; Accepted: 03 January 2026; Published: 14 January 2026

ABSTRACT

Background: Occupational risks remain prevalent among seafarers along the Gulf of Guinea. However, structured evaluations of safety education and capacity-building initiatives targeting these risks remain scarce.

Objective: This protocol outlines a mixed-methods study to assess the impact of a tailored occupational health and safety (OHS) training program on the knowledge, attitudes, and behaviours of West -African seafarers using the COM-B behavioral model.

Methods: A quasi-experimental design will be used to conduct the study in the ports of Douala (Cameroon), Warri (Nigeria), and Tema (Ghana). Following recruitment, participants will be randomly allocated to intervention and control groups. A pre-assessment will be conducted with both intervention and control groups to establish baseline information. A six-module OHS training will focus on safety practices, hazard identification, and behavioral reinforcement. Data will be collected through surveys, focus group discussions (FGDs), in-depth interview (IDIs), and structured observation at both pre- and post-intervention stages. Quantitative data will be analyzed using SPSS, while qualitative data will be coded and analyzed using ATLAS.ti.. The COM-B framework will guide the intervention logic and inform outcome assessment.

Expected Outcomes: This protocol is designed to generate replicable, policy-relevant evidence on improving seafarers' safety behavior through contextualized health education and capacity building intervention.

Keywords: Seafarers, COM-B, Occupational Health and Safety, Capacity Building, Gulf of Guinea, Protocol

1.0 INTRODUCTION

Maritime workers face disproportionate health and safety challenges compared to land-based labor forces. Life at sea is demanding, unpredictable, and often dangerous. For the millions of seafarers who keep global trade moving, each voyage brings not only the challenge of isolation and long hours, but also serious risks to their health and safety. While the Gulf of Guinea has its own unique challenges, seafarers across other international seaways face a similarly complex set of occupational hazards.

Globally, injury and fatality rates among seafarers are alarmingly high. UK seafarers are over 20 times more likely to suffer fatal accidents than land-based workers [1], and Danish seafarers face an 11-fold increase in risk [2]. Despite these statistics, underreporting remains widespread—often driven by fear of blame or disciplinary action [3].

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV January 2026 | Special Issue on Public Health

Mental health issues such as depression, anxiety, and suicidal ideation are prevalent, exacerbated by long voyages and limited access to support [4, 5]. Physical risks include exposure to toxic substances like benzene and asbestos, communicable diseases such as tuberculosis and norovirus, and non-communicable conditions like obesity and cardiovascular disease [6, 7].

Fatigue from irregular shifts, inconsistent use of personal protective equipment (PPE), and language barriers among multinational crews further complicate safety enforcement [8, 9]. Access to medical care is often limited to telemedicine or understocked onboard kits [10].

In the Gulf of Guinea, seafarers are frequently exposed to occupational hazards in the absence of adequate systems for OHS training, documentation, or emergency response. Despite the existence of occupational safety frameworks for maritime work, such as the Maritime Labour Convention (MLC 2006) and the International Convention on Standards of Training, Certification and Watchkeeping (STCW), enforcement across African ports remains uneven [8].

This research will seek to address these gaps by developing and testing a replicable training intervention rooted in behavior change science, designed to improve seafarer safety culture and practices.

2.0 CONCEPTUAL FRAMEWORK

This study will adopt the capability, opportunities and motivation behaviours (COM-B) model as its foundational behavioral framework. The COM-B postulates that for any behavior to occur (e.g., consistent PPE use), three essential conditions must be satisfied:

Capability (C): Physical and psychological ability to perform the behavior.

Opportunity (O): Environmental and social support for the behavior.

Motivation (M): Reflective and automatic drivers that stimulate behavior.

The design of the intervention - including its content, delivery methods, and evaluation tools—will be aligned with these three components to maximize adherence and promote sustained safety behaviours among seafarers.

3.0 MATERIALS AND METHODS

The main aim of this study will be to determine the impact of capacity building on occupational health and safety among seafarers in three seaports in the Gulf of Guinea.

The study will specifically aim to:

1. Identify the public health aspects of occupational health and safety among African seafarers in the Gulf of Guinea.
2. Assess the level of awareness of occupational health and safety among seafarers in the Gulf of Guinea.
3. Determine the extent of adherence to occupational safety and health (OSH) protocols among African seafarers in the Gulf of Guinea.
4. Examine the association between port state control, ship management, and the occurrence of occupational health and safety hazards among seafarers in the Gulf of Guinea.
5. Evaluate the impact of a targeted health education intervention delivered through OSH training on occupational health and safety outcomes among seafarers in the Gulf of Guinea.

This study will explore how targeted occupational health and safety (OHS) training can improve the lives of seafarers working in the Gulf of Guinea. It will focus on two key locations: Douala Seaport in Cameroon and Tema Seaport in Ghana for intervention while Warri will be added for the cross-sectional study. Seafarers in Douala will form the intervention group and will receive structured training on hazard identification, proper use of personal protective equipment (PPE), mental health awareness, and emergency response. Those in Tema will serve as the control group, continuing their routine operations without added safety instruction.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV January 2026 | Special Issue on Public Health

This study will employ a mixed-methods approach combining qualitative and quantitative techniques to evaluate the impact of capacity building on seafarers' occupational health and safety in three Gulf of Guinea ports, guided by the COM-B framework.

Seafarers will be purposefully recruited from ships to constitute focus group discussion (FGD) groups. These discussions will provide a platform for participants to share knowledge, practices, perceptions, experiences, and attitudes toward occupational health and safety. FGDs will be designed to assess levels of awareness of occupational hazards, and participants will be encouraged to express their views on safety practices, drills, artificial intelligence (AI) technology, and training in seafaring. From these groups, resourceful individuals will be identified for in-depth interviews (IDI).

In-depth interviews will be conducted with selected FGD participants, lower-ranking seafarers, managers, and port authorities. These interviews will explore factors associated with occupational health incidents, risky behaviours, and the use of training and technology, as well as management and control of accidents, injuries, and diseases. They will capture nuanced insights and expert opinions regarding occupational health and safety practices and interventions.

An observational study will complement these discussions by systematically assessing actual safety and health practices among seafarers onboard ships in the three ports. Observations will be guided by a checklist adapted from the *Guidelines for Implementing the Occupational Safety and Health Provisions of the Maritime Labour Convention, 2006*.

Alongside these qualitative components, quantitative methods will be applied. A cross-sectional survey will identify risky health behaviours and adherence to OHS protocols, evaluate the impact of targeted health education interventions, and determine correlations between port state control and the occurrence of marine accidents.

3.1 Study Design

The research will unfold in three phases. Phase one will assess the baseline knowledge, attitudes, and practices of all participants. Phase two will deliver the intervention in Douala and control in Ghana using interactive workshops, role-play, visual materials, and mobile messaging. Phase three will evaluate post-intervention outcomes, comparing both groups to identify changes in behavior, safety compliance, and overall well-being.

Through surveys, interviews, and direct observation, the study will examine common challenges such as fatigue, injury, exposure to harmful substances, and limited access to medical care. Ultimately, the goal is to empower seafarers with the tools to protect themselves and to encourage port authorities and ship operators to prioritize crew safety across the region.

A before-and-after intervention design will further assess effectiveness: seafarers will be divided into intervention and control groups through random allocation at the ship level to minimize bias. The intervention group will receive health education through occupational safety and health training, reminder messages, and OHS posters/flyers, while the control group will receive non-OHS health messages and materials.

Study Duration

The overall study duration will span from January 2025 to December 2025**.** The months allocated for each phase of the study are outlined in Table 1 below:

Table 1: Study Duration and Timeline

Phase	Period
Baseline	Months 1–2
Intervention implementation	Months 3–6
Post intervention	Months 7–12

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV January 2026 | Special Issue on Public Health

3.2 Study Settings

The study will be conducted across three major seaports in the Gulf of Guinea: Douala Seaport in Cameroon, Warri Seaport in Nigeria, and Tema Seaport in Ghana. These ports are vital hubs for trade and maritime operations, employing a diverse workforce that includes dockworkers, ship crew members, and port-based personnel. Douala Seaport, located on the Wouri River, is Cameroon's largest and busiest port, handling millions of tonnes of cargo annually. It is operated by the Port Autonome de Douala and serves as a gateway for exports like cocoa and coffee. Warri Seaport, situated in Nigeria's Delta State, plays a key role in the country's oil and gas sector. Managed by the Nigerian Ports Authority, it supports general cargo, petroleum products, and inland waterway transport. Tema Seaport, Ghana's largest and most modern port, is located near Accra and handles over 85% of the country's trade. Operated by the Ghana Ports and Harbours Authority, it accommodates container ships, tankers, and Ro-Ro vessels. These ports provide a rich operational environment for the study, which will assess how capacity-building interventions can improve occupational health and safety among seafarers. The research will target real-world challenges and promote safer, more supportive working conditions across the region.

3.3 Study Population and Eligibility Criteria

The study will take place in three major seaports in the Gulf of Guinea: Douala Seaport in Cameroon, Warri Seaport in Nigeria, and Tema Seaport in Ghana. These ports are central to regional trade and maritime operations, employing a wide range of personnel, including dockworkers, ship crew members, and port-based staff. Douala, located on the Wouri River, is Cameroon's busiest port and a key export hub for cocoa, timber, and coffee [8]. Warri Seaport plays a strategic role in Nigeria's oil and gas logistics [9], while Tema Seaport near Accra handles over 85% of Ghana's trade and is the country's most modern port [11].

Participants will include active seafarers aged 18 and above who have served on African-flagged vessels for at least six months, as well as ship owners, managers, and Port State Control inspectors. Eligible individuals must be literate in English or French and available for the full six-month study period.

Exclusion criteria will apply to individuals under 18, those with less than six months of sea service, and maritime personnel not affiliated with the selected ports. Also excluded are those unable to communicate in English or French, administrative or non-operational staff with no direct involvement in OHS-related tasks, seafarers on temporary leave or reassigned elsewhere during the intervention period, and individuals with cognitive impairments or unwillingness to provide informed consent.

3.4 Sampling Strategy and Sample Size

The study will adopt a multi-stage sampling strategy to ensure broad representation across key maritime roles. First, three seaports—Douala in Cameroon, Warri in Nigeria, and Tema in Ghana—will be purposively selected based on their strategic relevance, operational diversity, and volume of seafarer activity. Within each port, participants will be stratified into distinct groups: active seafarers, ship owners, vessel managers, and Port State Control (PSC) inspectors. This stratification will allow the study to capture a wide range of perspectives on occupational health and safety (OHS).

From each stratum, simple random sampling will be used to select individuals who meet the inclusion criteria. This approach will help minimize selection bias and ensure that the sample reflects the diversity of roles and experiences within the port environments.

Sample Size: The sample size for the cross-sectional study will be determined using Cochran's formula, with the researchers assuming a 95% confidence level, a 5% margin of error, and an estimated prevalence of OHS awareness based on prior studies in similar contexts. After adjusting for potential nonresponse and attrition during the six-month study period, the final sample size will be approximately 384 participants. This number will be proportionally distributed across the three ports and stakeholder categories to ensure balanced representation and meaningful analysis. The number of individuals involved in the different activities of the study is described in table 2 below.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV January 2026 | Special Issue on Public Health

Table 2: Study Participants by Activity

Component	Method	Sample Size
Cross-sectional survey	PPS, randomized ship selection	384
Intervention/Control	Random allocation, cluster design	119
FGDs	Stratified by department/port	9 groups (12 per group)
IDIs	Ship owners, managers, PSC officials	27

3.5 Intervention Structure

A 4-month intervention will be delivered via workshops, flyers, WhatsApp messages, and video materials.

The intervention will be carried out over a four-month period at Douala Seaport, Cameroon, targeting active seafarers and maritime personnel. It will consist of a structured occupational health and safety (OHS) training program designed to improve awareness, attitudes, and practices. The training will be delivered through multiple mediums to ensure accessibility and engagement.

Workshops will serve as the core component, held twice monthly, each lasting about three hours—totaling 24 hours of in-person training. These sessions will include expert-led presentations, group discussions, and roleplay exercises to simulate real-life safety scenarios. Video materials will be used during workshops to visually demonstrate safe and unsafe practices and will also be shared via WhatsApp for reinforcement between sessions. This mobile access allows participants to revisit content at their convenience.

Posters and flyers will be displayed in high-traffic areas such as crew lounges, administrative offices, and docking zones, serving as daily visual reminders of key safety messages. These materials will be bilingual (English and French) to accommodate language diversity. For those unable to attend in person, digital sessions will be offered through mobile-friendly modules, ensuring continuity of learning. This multi-channel approach will help embed safety culture across the port environment.

Table 3: Intervention Focus Areas by Port Setting

Workshop	Focus Area	COM-B Domain
W1	OHS Regulations & Compliance (MLC, STCW)	Capability, Motivation, and Behaviour
W2	Identifying Hazards	Capability/Opportunity
W3	Risk Management Methods	Motivation
W4	Accident Response Procedures	Opportunity
W5	COVID-19 & Emerging Diseases	Motivation
W6	Review & Simulation	Compatibility and Motivation

All sessions will incorporate participatory learning and skills practice.

3.6 Data Collection Tools

A combination of quantitative and qualitative data collection tools will be employed, aligned with the COM-B behavioral framework will be used to assess the impact of the OHS training intervention on seafarers' knowledge, attitudes, and behaviours. These tools include:

Data Collection Tools (Corrected)

- Pre/post training questionnaires
- Focus Group Discussion (FGD) guides
- In-Depth Interview (IDI) guides
- OHS observation checklist
- Training logs
- WhatsApp engagement records

3.7 Data Management and Analysis

Data analysis for the study will involve both quantitative and qualitative approaches. Quantitative data will be processed using SPSS version 26, applying descriptive statistics to summarize participant characteristics and key variables. Inferential tests such as t-tests and logistic regression will be used to examine relationships and measure changes in outcome variables—including knowledge, attitudes, practices, personal protective equipment (PPE) usage, and safety communication—between baseline and end line. Statistical significance will be determined at a threshold of $p < 0.05$. For qualitative data, thematic coding will be conducted using ATLAS.ti, guided by the COM-B model (Capability, Opportunity, Motivation–Behaviour) to explore underlying behavioural drivers and contextual factors influencing occupational health and safety practices. This mixed-methods approach will provide a comprehensive understanding of the intervention's impact.

3.8 Ethical Considerations

Ethical clearance will be obtained from the University of Buea IRB, the CSIR (Council for Scientific and Industrial Research) Institutional Ethical Review Board, and the Nigerian Zankli Institute. All participants will provide written informed consent. To ensure confidentiality and anonymity, participants will be assigned unique codes, and no personal identifiers will be recorded. All data will be securely stored in password-protected files, accessible only to the research team. Responses will be presented in aggregate form, and direct quotes will be anonymized. Written informed consent will be obtained, and participants will be informed of their right to withdraw at any time. Additionally, formal permission will be sought from the leadership of Douala, Warri, and Tema ports before commencing data collection. This will include submitting the study protocol and securing administrative clearance to access port facilities and personnel.

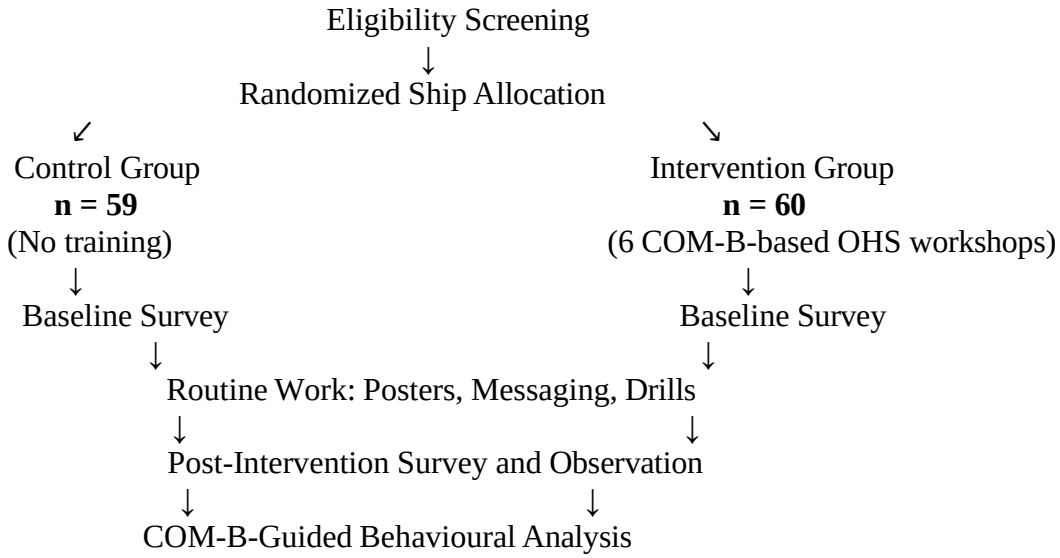

Figure 1. Study Methodology Flowchart

3.9 Expected Outcomes

1. Behavioural Intelligence in Maritime Safety

The intervention will apply the COM-B model (Capability, Opportunity, Motivation) to assess and influence safety behaviours among seafarers and port workers. By mapping behavioural determinants to specific roles, the study will enable targeted, evidence-based changes in safety practices.

This will mark the first known application of COM-B in African maritime occupational health, offering a replicable model for other high-risk sectors.

2. Bilingual, Role-Specific Assessment Tools

The study will feature a bilingual (English/French) questionnaire and training manual tailored to the linguistic and operational diversity of seaport workers. This will ensure accessibility, comprehension, and engagement across roles—especially among populations often excluded from standardized safety programs.

The bilingual design will enhance inclusivity and set a precedent for culturally sensitive occupational health research.

3. Structured Behavioral Profiling for Intervention Design

Rather than applying generic safety training, the study will develop behavioural profiles for distinct maritime roles (e.g., crane operators, deck crew, safety officers). These profiles will guide the design of role-specific interventions, maximizing relevance and impact.

This precision approach will allow for scalable, adaptive training programs that reflect realworld operational diversity.

4. Integration Of Public Health and Logistics Operations

By embedding public health principles into maritime logistics, the study will bridge two traditionally siloed domains. It will position occupational safety not just as a technical concern but as a public health priority—linking injury prevention, behavioral change, and systemic resilience.

REFERENCES

1. Roberts SE, Jaremin B, Lloyd K. Fatal accident rates among UK merchant seafarers compared with other workers. Occup Med (Lond). 2014;64(4):259–65.
2. Lefkowitz RY. Fatalities among Danish seafarers: A population-based study. Occup Med (Lond). 2013;63(3):193–7.
3. Bhattacharya S. The impact of the ISM Code on the management of occupational health and safety in the maritime industry. Health Policy Plan. 2009;24(3):221–8.
4. Iversen RTB. The mental health of seafarers. Int Marit Health. 2012;63(2):78–89.
5. Lefkowitz RY, Slade MD. Seafarer mental health: A review of recent literature. J Occup Health Psychol. 2019;24(3):282–93.
6. Boschetto P, et al. Occupational exposure to benzene and risk of hematologic malignancies. Am J Ind Med. 2006;49(9):709–17.
7. Drylli E, et al. Health risks and safety challenges among seafarers: A review of occupational exposures. Int Marit Health. 2020;71(2):123–30.
8. International Maritime Organization (IMO). Maritime Labour Convention and STCW enforcement. IMO Report. 2019.
9. Runyan CW, et al. International perspectives on seafarer safety: Challenges and solutions. Safety Sci. 2008;46(6):933–8.
10. Sagaro GG, et al. Access to medical care among seafarers: A global review. Glob Health Action. 2021;14(1):1927321.
11. Campbell SJ, Osei-Atweneboana MY, Stothard R, et al. The COUNTDOWN study protocol for expansion of mass drug administration strategies against schistosomiasis and soil-transmitted helminthiasis in Ghana. Trop Med Infect Dis. 2018;3(1):10.
12. World Health Organization. Helminth control in school-age children: A guide for managers of control programs. 2nd ed. Geneva: WHO Press; 2011.
13. World Health Organization. Preventive chemotherapy to control soil-transmitted helminth infections in at-risk population groups. Geneva: WHO Press; 2019.
14. MacPherson E, Theobald S, Gyapong M, et al. COUNTDOWN: Building evidence for equitable access to neglected tropical disease interventions. Int Health. 2018;10(5):317–24.