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"Voices from the Deck": Evacuation Effectiveness on Cruise and Passenger Ships through Seafarers' Perspectives and Literature Analysis

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ABSTRACT: The effectiveness of cruise/passenger ship evacuation is influenced by multiple factors. This paper investigates the limitations of current evacuation protocols by examining crew training practices, human behavioral and psychological patterns during emergencies, ship design innovations and constraints, as well as factors not under human control such as weather, sea state, and specific type of emergency. Furthermore, it provides a comparative analysis between available literature around various factors that can determine the outcome of a cruise/ passenger ship evacuation, and empirical data obtained from responses of approximately 100 seafarers employed in the cruise and passenger ship industry. Related data revolves around key areas such as drills, ashore training, psychological impact, decision making, evacuation practices and preparedness, and evacuation equipment. Seafarers (along with passengers) are directly and most affected during a ship emergency, therefore uncovering existing regulatory gaps, boosting the safety culture onboard ships, and providing solutions that will enhance the safe evacuation practices (and ultimately save more lives) are clearly actions of priority.

1 INTRODUCTION

Evacuation of cruise/passenger ships is a crucial element of maritime safety; this procedure can be activated in case profound danger threatens the livelihood of all individuals onboard a vessel, including both crew and passengers. It requires the fast, structured, and coordinated movement of individuals from their current locations to designated muster stations, and finally embarkation to lifeboats or other survival crafts. Despite the seemingly structured nature of this process, real-world incidents have showcased multiple challenges-both predictable and emergent- that can affect the efficiency and effectiveness of an evacuation. Delays in decision-making, difficulties in communication, and human behavioral unpredictability are indicative factors that can contribute in escalating a manageable emergency into a large-scale disaster. In such perilous situations, where every minute counts, an inability to complete the abandonment promptly and within the timeframes as established by SOLAS Reg. Ch. III/ Reg. 21.1.3 – 30 minutes [1] for cruise and passenger ships- may result in numerous life-losses.

On paper, modern cruise/passenger ships are conforming to strict safety regulations that aim to ensure the adequacy of evacuation procedures under diverse emergency scenarios. The International Maritime Organization (IMO), over the years recognizing the growing size, capacity, and complexity of passenger and cruise ships, has established detailed design and safety requirements aimed to enhance evacuation outcomes. Among these are evacuation simulation models used during the ship design phase, which test theoretical performance by evaluating factors such as available escape routes, congestion patterns, and total evacuation time [2]. Naval architects

employ these simulations to verify compliance or detect contradictions with the regulatory standards, thus determining whether vessel layouts permit for safe egress for all onboard occupants within the established limits. Nonetheless, despite the advances and developments in naval architecture, technology, and simulation-based planning, high profile maritime disasters such as the Costa Concordia (2012) and the Norman Atlantic (2014) have highlighted the persistence of crucial shortcomings in actual evacuation scenarios. These deficiencies cannot be solely attributed to design limitations or equipment failure, but in many cases are connected to human factors, such as inadequate crew training (ashore and onboard), poor passenger preparedness, panic behavior, and communication breaches. Maritime regulatory bodies have broadened their scope beyond technical considerations, aiming to investigate and address the influence of the "human element" in safety management. STCW in conjunction with SOLAS [2,3], over the years have mandated training protocols and regulations for seafarers involved in the cruise/passenger ship industry, aiming to boost crew competence during emergencies. Indicative examples are crowd management, crisis communication, and passenger assistance.

Nevertheless, the practical effectiveness of these developments remains a topic of concern. Questions persist around the ability of the existing training regimes, drills, and procedural briefings to adequately prepare the crew and passengers for stressful, uncommon events such as a real-life ship evacuation. Additionally, the safety culture onboard ships and shipping organizations, the consistency in the conduct of drills, the uniformity in ashore training and preparedness between flag states, remain largely a debate with researchers often claiming considerable deficiencies. Furthermore, the psychological and behavioral reactions of individuals during emergencies, particularly in an environment of large and diverse passenger groups, exacerbate even further the complexity around evacuation planning and preparedness. Certain research efforts suggest that panic, confusion, and deviation from instructions are a common phenomenon during emergency conditions, particularly when instructions are unclear or oppose instinctive responses. These dynamics in combination with unregulated variables in the aftermath of the accident such as list, visibility, time of day, type of accident, intensify the problem and raise further the question around the effectiveness of the current evacuation practices.

Taking into consideration the interplay between technical design, regulatory compliance, human psychology and interaction in regards to the topic of evacuation practices and efficiency, an in-depth analysis of the issue requires a multifaceted approach. This paper is conducting a comparative study that utilizes findings from existing academic literature with empirical data acquired from seafarers employed in the cruise/passenger ship sector. Since seafarers and passengers are the people most and directly affected during a ship emergency, the survey captures first-hand insights from the experiences, perceptions, and difficulties faced by maritime professionals before and during real or simulated evacuation scenarios. By validating the established literature with the acquired data, this study aims to locate existing gaps in knowledge around the topic, discrepancies between theoretical planning and practical execution, possible disparities and inefficiencies in training protocols, and understanding of human nature. Finally, drawing on the survey responses of seafarers working within the cruise/ passenger ship sector, this study presents a recommendation aimed at improving the effectiveness and efficiency of evacuation procedures.

2 METHODOLOGY

The current paper constitutes part of the wider PhD effort of the leading author, designed to present the current state of passenger and cruise ship evacuation efficiency, to locate the factors and elements that contribute to ineffective evacuation, and to propose measures that could potentially enhance the evacuation efficiency and preparedness; thus, boosting the cruise/ passenger ship evacuation safety standards and ultimately saving more lives. The methodology utilized is a comparison between literature findings and results of a mixed-method survey questionnaire disseminated between seafarers of different ranks employed on passenger and cruise ships. The main literature findings are strongly based on three different review papers, aiming to examine holistically the various aspects of the evacuation inefficiencies topic. The research areas that the literature explored/presented are the topics of seafarer evacuation training in forms of ashore and onboard preparedness (drills), the behavioral patterns exhibited by people during evacuation, the unregulated factors experienced during an abandonment and their effect on the evacuation outcome (e.g., weather conditions). Furthermore, the influence and impact of the human element, human psychology, group behavior, and ship design during an emergency evacuation were approached through the literature review. Additionally, a literature investigation was conducted around possible existing innovative solutions (from the maritime and other industries) aimed to enhance the safety and efficiency of an emergency ship evacuation.

The literature findings are compared with the questionnaire results to evaluate or contradict the available literature and to provide an upgraded understanding of the current state of affairs around the reviewed topic, while providing recommendations from the seafarers' perspective aimed to enhance the evacuation efficiency on cruise/passenger ships. Moreover, the adoption of a mixed-method survey was considered as the optimal research tool for the current study as it allowed for a comprehensive exploration of seafarers' opinions and experiences of the aforementioned topics, without tiring the respondents with long-open ended questions that could possibly have high dropout rates. By having a seafaring background, researchers were aware that seafarers are often tired of their demanding working schedule and hours and in many cases tend to provide short or untrue answers when faced with open-ended surveys; consequently, a mixed-method questionnaire seemed as useful means to encourage wider participation, while at the same time achieving the required thoroughness.

The mixed-method design that was selected to be utilized in the questionnaire was the "Embedded Design" with 47 quantitative questions guiding the questionnaire, that are complemented with 8 open-ended qualitative questions used as an explanatory opportunity for the participant to discuss and elaborate more on the previous short-ended questions (overall 55 questions). Additionally, the survey adopted an electronic format ("Question Pro" survey program) to facilitate easier dissemination between seafarers of different ranks employed in the cruise/passenger ship industry. The questionnaire was strictly anonymous and followed the research ethical standards, as established by the Research Ethics Committee of the World Maritime University. This approach was intended not only to safeguard the privacy of the participants, but also to encourage candid and honest responses from them, without the fear of personal identification or potential repercussions from their employers. The completion rate of the survey was 61,9% and the total answers received varied between 90-100 depending on the question.

3 RESULTS & DISCUSSION

3.1 *Training*

Based on the Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Convention, people aiming to pursue employment as crew members onboard ships are obligated to complete Basic Safety Training and familiarization, as mandated in Regulation VI/1. During the course of this training, essential knowledge and principals are provided around survival strategies, procedures, and individuals' duties during emergency situations, such as evacuation. Nevertheless, although this training incorporates theoretical knowledge ashore and some basic practical experience, it is understandable that such classes are often insufficient in preparing seafarers for real-life emergency evacuation scenarios which involve high-stress and life-threatening situations at sea [4]. Consequently, practical onboard training in the form of drills is required across all vessel types, to enhance these competencies and place into practice the acquired knowledge under more realistic conditions. As per SOLAS Chapter III, Regulation 19.3 [1] passenger vessels are required to conduct abandon-ship drills at least once per week to ensure continuous readiness among the crew. Furthermore, a drill must be conducted within 24 hours of departure from port if more than 25% of the crew is newly assigned or has not participated in a drill within the previous month. Additionally, passenger or cruise ships involved in voyages lasting more than 24 hours, hold Muster drills where passengers are required to participate as well (these drills aim to prepare the passengers for safe evacuation, in the event of an emergency onboard the ship; at the same time, they familiarize the crew and passengers with the escape routes of the vessel). The related regulations highlight the critical importance of practical preparedness, particularly while taking into consideration the special characteristics of each vessel, differences in life-saving appliances, and the unique responsibilities given to each crew member. The significance of early and thorough familiarization with onboard emergency procedures is vital for ensuring readiness during emergencies.

Despite the existence of a wide regulatory framework aiming to safeguard human life at sea, serious concerns around the sufficiency and implementation of these measures still persist. Literature suggests that in practice, emergency drills are often treated with minimal seriousness, frequently perceived by seafarers as a mandatory monotonous task, rather than a vital safety exercise [5]. This data is furtherly supported by the survey findings that showcase that 34% of the respondents claim that fellow crew members have stated that drills are a waste of time, and shall be performed in less frequent intervals. This finding is rather alarming while considering that further survey answers indicate that only around 40% percent of the participants feel fully confident in understanding and performing their duties during evacuation drills. Moreover, literature findings support that in many cases crew members- particularly those with larger experience and of older age- feel overconfident in their abilities to perform their evacuation duties, which may lead in downplaying the importance of alarms and limit their responses [5]. The literature evidence is furtherly highlighted by the survey results that claim that around 32% percent of the participants have experienced colleagues abstaining from drills, usually attributing this to lack of professionalism, interest, high work demands and refusal to disrupt their rest-time. Further survey results indicate that around 30% of the respondents report instances in which drills were falsely reported as performed, while another 9% were unsure about the legitimate conduct of drills. Mostly, false drill reporting as per the findings is attributed to high work demands leading to lack of time to perform the required onboard training. Additionally, another concerning finding is the fact that around half of the survey participants claim that their workload negatively impacts their ability to fully achieve the objectives of an evacuation drill (Fig. 1), drawing therefore a direct connection between high work demands and drill inefficiency; a scenario that not only undermines the procedural integrity of evacuation preparedness, but also might poses a lethal danger to the lives of crew and passenger in a potential real-life emergency.

In regards to the ashore training Pospolicki [6] based on interview findings highlights inconsistencies in pre-boarding training within large passenger and cruise vessels. Indicatively lower-ranking personnel are reported to undergo considerably less training than higher ranking officers, resulting in uneven levels of preparedness among the crew; thus, prompting questions around ineffective responses in real life emergencies. This finding is complemented by the questionnaire findings since 40% percent of the respondents consider the provided training ashore inefficient for preparing the crewmembers for real-life emergencies or they are unsure of its effectiveness. Some seafarers elaborate furtherly claiming that some flags allow seafarers to have their training onboard without any previous ashore training, others claim that the ashore training standards in some countries are very low or non-existent, resulting in considerable gaps of understanding and preparedness among crewmembers.

Consequently, it can be understood that gaps in ashore training could lead to inconsistencies in the understanding, effectiveness and responses of crewmembers during drills, a phenomenon that could be fatal during a real need of abandonment. Another common element noticed both in the literature [6,7] and the survey is the inability of the ashore training and drills to replicate in an optimal manner emergencies requiring evacuations and the analogous surrounding conditions (e.g. inclination, water intake), as it would be extremely capital intensive. Moreover, these types of training cannot depict the real image of an evacuation, since the participants are usually in good mental and physical health and they are focused on the well-being of passengers and not their own; a fact that does not correspond to the reality of an abandonment. Survey respondents strongly agree with that finding with only 22% percent of them opposing the perception that people's responses and reactions differ between real-life evacuations and drills.

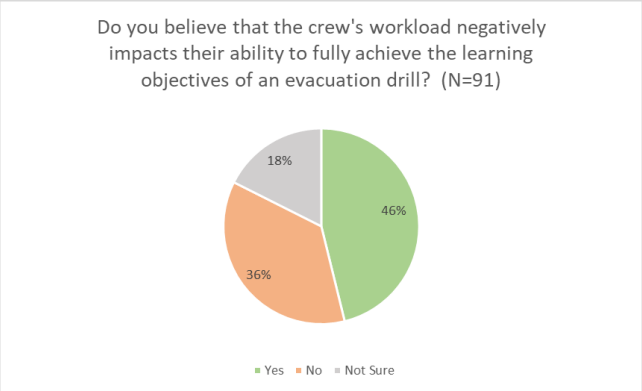

Figure 1. Effect on crew's workload on evacuation drills.

3.2 *Human Element*

During emergencies at sea, individuals may showcase a wide variety of behavioral and psychological responses, often including but not limited to indecisiveness, leadership issues, hesitation, panic, confusion, and even inaction. These reactions are not incidental but are largely influenced by a complex spectrum of factors, such as age, health, cognitive impairment, familiarity with the vessel, nature of emergency, and the presence (or absence) of companions. In high-density environments like passenger and cruise ships, personal behavior is largely affected by the actions of others, a phenomenon known as social influence, which plays a crucial role when reliable information is scarce or contradictory [8]. Consequently, it can be understood that the unpredictable elements of human nature can play a determining role in the outcome of an evacuation. The decisive effects of human element were showcased in the maritime disasters of M/S Estonia and Costa Concordia, where it was clearly demonstrated that human behavior and reactions can shape the success or failure of evacuation procedures and protocols; especially under stressful and time-sensitive conditions [9, 10].

As per Casareale et al. [11] an evacuation process can be divided in three primary phases: pre-movement phase, motion process, and achievement of the safe place. During these phases the effects of human element are extensively prevalent through different actions and responses and can largely influence the outcome of the ship evacuation. The pre-movement phase commences after the alarm activation. During this period individuals try to raise situational awareness regarding the situation, by observing actions and behaviors exhibited by their co-passengers. Interestingly, it is common this period to be long-lasting, since individuals tend to disregard early emergency and alarm signs and continue with their routine activities – a behavior that can be linked to psychological denial. Throughout this psychological state, which constitutes a psychological defense mechanism, people fail to acknowledge the severity of an unfolding situation; as they do not want to accept that their life and safety might be in danger. Therefore, they subconsciously attempt to connect the ongoing warnings with previously experienced false emergency warnings and alarms.

Furthermore, [12, 13] underlines the direct link of denial with "freezing" behavior, which is a psychological and mental state in which people find themselves psychologically paralyzed and unable to act. The roots of this behavioral pattern can be traced in the disruption of habitual behavioral scripts , where individuals confronted with unprecedented danger might be unable to formulate new action patterns quickly, resulting in inaction or confusion. The aforementioned literature findings are in total agreement with the survey results that indicate that 65% of the respondents believe that their capabilities to perform their duties can be affected at a large extend by panic, fear, "freezing behavior" or despair in a real-life abandonment event, while 20% of the participants claim a moderate effect in their capabilities (Fig. 2). It is worth noting that these results are coming from professional seafarers that have had formal ashore training and drill participations throughout their career. It is therefore conceivable to assume that the passengers who are largely inexperienced and untrained around any evacuation scenario, are prone to showcase more prevalent and long-lasting signs of denial, "freezing behavior", and other similar patterns that provoke evacuation delays.

Harbst and Madsen [14] attempt to provide further insights on the occurring delays by suggesting that delays might occur due to the fact that the passengers do not pay the necessary attention to the briefings and Muster drills at the beginning of the voyage. Generally, passengers are prone to underestimate the possible risks and consequently they are unprepared for responding effectively during an emergency. The seafarers participating in the conducted survey report that around half of the passengers are truly engaged during the execution of Muster drills, while the rest of the ship passengers are moderately or less interested in them. Furthermore, only 58% of the respondents believe that the Muster drills, in the currently performed way, are sufficient to prepare the passengers for a real-life evacuation, with the remaining 22% supporting that they are insufficient and the remaining 20% is unsure about their effectiveness.

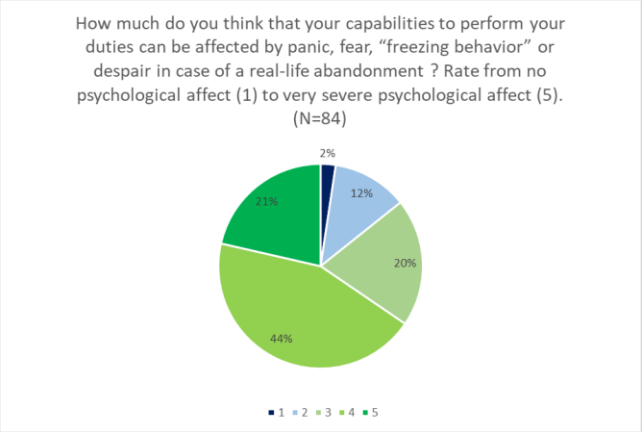

Figure 2. Effects of psychological and mental impact in real-life abandonment.

The motion process -which constitutes the second stage of an emergency evacuation- is commencing after the individuals onboard have acknowledged the pressing danger to their lives. This phase involves active wayfinding and movement towards designated safe zones, such as muster stations, lifeboats, and/ or life rafts within a limited time window. It also requires the passengers to adhere to the crew instructions around following the most efficient and accessible evacuation route, in order to avoid congestion and facilitate orderly movement [16]. This stage is arguably the most demanding, crucial, and decisive element of the entire evacuation process, since its success is dependent on a variety of interrelated factors such as: passengers' familiarity with the vessel layout and emergency protocols, the crew's ability to provide appropriate guidance (people's management) and effective leadership, the quality of crew's training and the ability of personnel to respond effectively in high stress emergency conditions [17].

The effects of miscommunication, lack of leadership or misdirection during this evacuation stage can lead to vital delays with catastrophic effects, as individuals tend to place trust and confidence on figures with authority during emergencies [11]. The importance of effective communication (and the catastrophic effects in its absence) during emergency evacuation is also highlighted by the survey findings; which indicate that the most significant impediment during an evacuation is the ineffective communication between crew and passengers, together with the ability or inability of the crew to make timely and informed decisions. Furthermore, the questionnaire results demonstrate that based on the participants opinions the most common mistakes occurring during the course of an evacuation are associated with the failure to properly communicate instructions to the passengers. While the second most commonly identified shortcoming is connected with the inadequacy of the crew to coordinate and to lead the crew effectively to a safe place.

The third and final stage of an evacuation process (achievement of the safe place) entails the accounting and physical embarkation of crew and passengers onto the lifesaving vessels and the following launch of them. Although this process is seemingly straightforward, this phase still requires effective coordination and self-control under pressure. The findings from the survey are consistent with those reported in the existing literature, supporting as the third most common mistake contributing to the overall delays during ship evacuation the delayed deployment of evacuation means.

3.3 *Ship Design*

Ship design is a further factor that affects the outcome of an evacuation as suggested by the findings of the existing literature. The sinking of M/V Estonia in 1994, which resulted in 851 life-losses, served as the catalyst in the evolution of maritime safety regulations. The IMO in response to the disastrous incident initiated various regulatory enhancements aimed at elevating onboard safety from the preliminary stages of vessel design [18]. These measures incorporate a wide range of key structural elements, including damage stability following water ingress, structural fire protection, reliability of essential onboard systems, and, ultimately, arrangements for safe evacuation should all other systems fail [19]. More specifically, regulatory frameworks have been developed and incorporated into SOLAS, particularly regarding the optimization of passenger ship design for evacuation readiness.

Chapter II-1/2 of SOLAS outlines the mandatory structural and stability requirements aimed at enhancing ship safety levels and survivability in adverse scenarios. Furthermore, the IMO's Maritime Safety Committee (MSC) over the years have issued circulars [2, 20] which provide detailed guidelines for performing evacuation analyses during both the initial design and possible modification phases of passenger vessels. The aim of these guidelines is to ensure that a ship abandonment can be completed in the prescribed 30-minute timeframe, as clearly established in SOLAS Reg. Ch. III/ Reg. 21.1.3 [1]. These guidelines utilize certain calculative formulas and methodologies to estimate the duration of ship evacuation, always taking into consideration factors such as crew, passengers, ship's inclination, water intake. In case that the evacuation time exceeds the 30-minute limit, the evacuation plan must be revised. If compliance cannot be attained despite revisions, the vessel's internal layout, particularly the arrangement of escape routes, must be modified accordingly [21, 22].

Nevertheless, real-life evacuations often deviate significantly from simulation-based expectations due to a variety of factors. For instance, vessel's heel and trim as a result of asymmetric flooding can obstruct movement and block escape routes, thus hindering the evacuation process and causing delays. Research indicates that during evacuation simulation studies conducted by Fang et al. [23] that heeling angles directly influence the evacuation times. Interestingly it was observed that at a 10° heeling angle, evacuation times rose by 15.2%, at 20°, evacuation durations escalated markedly by 42.5%, while at the extreme angle of 30°, evacuation times surged by 142.9%. Hence, it is evident that passengers' movement is utterly affected by the rolling angles. Furthermore, the ship's trim appears to affect the pedestrian flow in a similar manner. In an evacuation simulation study conducted by Wang et al. [24], it was observed that a 20° bow trim can increase the evacuation times up to 46.4% and a 20° stern trim increases evacuation time by 29.3%.

Additionally, the availability and configuration of staircases and exits can impact the evacuation process and outcome by causing congestion and delays. In greater detail literature supports that centralized staircases can create bottlenecks that overall slow evacuation time and can lead to passenger confusion and erratic behavior [25]. In contrast the utilization of side staircases, that in practice implies multiple exit pathways (even if narrower) expedite evacuation by dispersing the crowd and significantly reducing bottlenecks. Moreover, the placement of exits opposite to the staircases enhances even further the evacuation efficiency by reducing turns and possible obstacles. Also, by positioning the exits directly in front of people's field of view, a reduction of confusion and hesitation is achieved making the movement towards the Muster Stations more immediate and intuitive [26].

Furthermore, the location of Muster Station is another factor that can significantly influence the evacuation outcome during an emergency. Research supports that placing Muster Stations in proximity to high-occupancy zones, such as cabins, commonplaces and operational workspaces, minimizes the distance passengers and crew must travel during an emergency. Consequently, by reducing these distances, the probability of confusion, congestion, waiting times proportionally decreases, thus expediting the evacuation performance and lowering the probability of casualties [27]. The questionnaire results indicate that around 40% of the survey participants strongly or moderately support that the structure and interior design of a ship (e.g. placement of stairs and exits, width of doors and corridors) can have a significant impact at an abandonment outcome. Nevertheless, it is noteworthy, unexpected, and largely contradictory to the literature findings that the remaining 60% did not recognize the ship design as a significant contributing factor in an evacuation outcome; thus, raising questions around the crew's comprehension around crucial factors during shipboard emergencies (Fig. 3).

The technological advancement of the last decades has contributed significantly to the facilitation of advanced simulation models aimed to facilitate evacuation prediction and simulation from the design phase taking into consideration many factors. This software tools are built based on the SOLAS mandates and specifications and can furtherly replicate factors such as surrounding environment, individuals' behaviors, crowd dynamics, ship motion, and environmental conditions in order to produce a highly accurate prediction of an evacuation outcome; aiming to improve the ship design quality and promote further crew and passenger safety [28, 29, 30].

Moreover, as mentioned above, communicating evacuation orders and controlling large numbers of crowds are the main challenges in large passenger ship and cruise ship evacuations. Studies support that wayfinding systems can be very beneficial in leading passengers to safety and maintaining orderliness. These systems utilize algorithms to dynamically adjust evacuation routes based on real-time crowd behavior and environmental conditions and aim to disseminate people to directions and exits that accelerate the evacuation and prevent bottlenecks [29, 31]. The survey findings indicate that seafarers are generally very supportive towards the integration of modern technologies in ship evacuation with 40% of the participants strongly believing that the incorporation of innovative technologies can enhance the effectiveness of evacuation practices and 27% of them being unsure around the extent that the contemporary technological solutions can assist during an evacuation emergency.

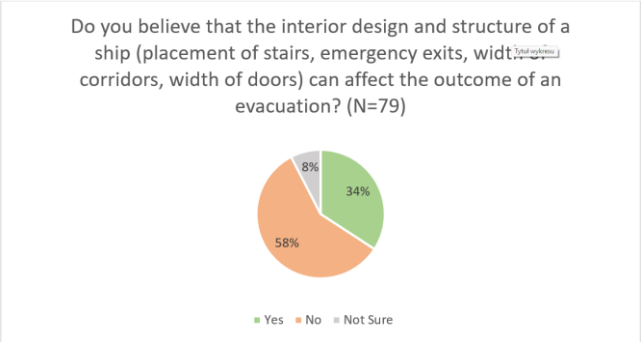

Figure 3. Influence of Ship' design in evacuation outcome.

4 CONCLUSIONS & SEAFARERS' SUGGESTIONS

This paper briefly examined the complex factors that influence the effectiveness of evacuation procedures on cruise/passenger ships, by utilizing a dual approach that incorporated extensive literature analysis with empirical data collected through a mixed-method questionnaire with the participation of professional seafarers. This approach uncovered a persistent (and rather alarming) inconsistency between the formal regulatory framework and the practical application of evacuation protocols on board vessels. Although international maritime conventions such as SOLAS and STCW (with a strong safety focus) have placed commendable effort in effectively approaching technical standards, design considerations, human element issues and training protocols, the data collected from seafarers clearly underline that a certain number of important weaknesses remain in the real-life application of these measures.

More precisely, among the most urgent challenges identified are the irregularities in the quality and frequency of onboard drills, the limited and inconsistent value of ashore training activities, and the inclination among crew members to downplay the seriousness and value of evacuation drills and training. Moreover, the phenomena of "drill fatigue" and false drill reporting further undermine procedural integrity and introduce incalculable risks and dangers during emergencies. Similarly, the comparative study underlines the unevenness in the training received by different ranks of personnel (often mandated by flag states or regulated by companies), that could introduce disparities in the preparedness of crew which may critically affect coordinated action during a crisis. Another major area of implications surrounds the psychological and behavioral aspects of human response during emergencies.

In the same direction, the survey results verify that even seasoned seafarers are susceptible to fear, confusion, and hesitation under stress – responses that are even more common and profound between untrained passengers. Additionally, during the pre-movement phase of an evacuation, it is notably likely for psychological phenomena such as denial and

freezing to occur, which can significantly delay the commencement of evacuation actions. Furthermore, ineffective communication, lack of leadership, and decision-making delays were identified by the survey participants as key contributors to evacuation delays during the motion phase. In regards to ship design, it was also validated (and confirmed the existing literature findings) that structural configurations involving staircases, exits, and the placement of muster stations, play a crucial role in promoting or impeding safe evacuation. Nevertheless, the survey also captured a surprisingly limited understanding among crew members around the contribution and importance of design factors in emergency outcomes, showcasing a possible gap in onboard and ashore safety education and familiarization.

The identification of numerous technical, procedural, and psychological shortcomings is strongly indicating the need to reevaluate the current evacuation strategies and to examine the possible adoption of a more holistic safety paradigm. The survey responses of the participants regarding suggestions that could potentially improve the overall evacuation processes are mostly focused on the need of enhancing the level training the seafarers receive both ashore (before joining the vessel), but also onboard (in the form of drills). More specifically, the respondents emphasized on the need of higher level, stricter, and more homogenous ashore training through all crew ranks. Furthermore, they underlined that all flag states should mandate ashore training as compulsory – without the alternative of conducting that training onboard. In that way the level of competency of seafarers around evacuation procedures can be increasingly uniform between individuals of different nationalities and ranks, thus achieving a higher overall procedural understanding, competency, and a fertile ground for drills to be performed more effectively.

In regards to the conduct of drills, a large number of participants stressed the importance of conducting drills in more frequent intervals that will be able to cover a wide variety of emergencies and evacuation scenarios, aiming to familiarize the crew members with all possible emergencies and necessary responses. In that way the reaction time and freezing behavior could be possibly shortened and therefore the evacuation delays could be reduced, resulting in higher efficacy and efficiency of the process. Additionally, the survey participants underlined the need of adopting more in-depth Muster Drills, during which the passengers can be more engaged and informed about emergency evacuations and understanding the complete severity of an emergency situation requiring abandonment. Also, it is suggested that crew members should receive more knowledge and training around leadership and management of psychologically distressed people, in an effort to be more reliable and successful in their duties of guiding and managing individuals in the stressful and life-threatening event of an evacuation. These proposals provided by the seafarers offer promising avenues for overcoming the human limitations identified in this research effort. Ultimately, the findings of this paper are a strong reminder that any sustainable safety advancement in the cruise/passenger ship sector must be "seafarer-centric", since they are the individuals directly involved and handle those emergency scenarios. Their experiences and insights constitute invaluable feedback that regulatory authorities, flag states, and training institutions must integrate into future safety planning.

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