

Psychological Aspects of Seasickness: The Role of Sailors' Stress Appraisal and Self-Efficacy

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Abstract

Background and Objective. Extending the biomedical model, increasing attention has been directed toward the psychological determinants of seasickness. The present study examined whether, among sailors, threat appraisal is associated with an increased frequency of seasickness symptoms and lower self-efficacy. Furthermore, the study investigated whether self-efficacy mediates the relationship between threat appraisal and symptom frequency.

Materials and Methods. A total of 312 sailors (55.8% female; M age = 39.46 years, SD = 11.57; age range: 18–74) completed self-report measures of stress appraisal, domain-specific self-efficacy, and seasickness symptoms.

Results. Threat appraisal, lower self-efficacy, female gender, and younger age were all significantly associated with a higher frequency of seasickness symptoms. Mediation analyses indicated that the relationship between threat appraisal and symptom frequency was partially accounted for by reduced self-efficacy.

Conclusions. These findings underscore the importance of psychological factors in the experience of seasickness. Interventions targeting maladaptive stress appraisal and enhancing self-efficacy may represent promising avenues for reducing symptom burden.

seasickness, motion sickness, cognitive appraisal, self-efficacy, sailors, mediation

INTRODUCTION

Seasickness is one of the most frequently observed reasons why people decide not to go on a cruise. Observations show that the fear of seasickness is enough to discourage them from this form of activity. What if they could be assured

that the discomfort associated with seasickness would be minimal or would not occur? From a medical point of view, this is not possible because seasickness is recognized as a type of motion sickness (kinetosis). It is an intense response to the kinetic movement that occurs during travel. During travel, our brain receives signals from the visual organs (our eyes) and interprets them as movement. On the other hand, the vestibular system reacts to kinetic changes (braking or acceleration) but does not register changes in body position—movement. The cause of this condition is therefore a sensory conflict between the

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visual stimuli received by the brain and the stimuli received by the vestibular system (the sense of balance). This discrepancy results in symptoms such as dizziness, nausea, vomiting, increased sweating, and even salivation or heart rhythm disturbances [1]. Nevertheless, sailors' experiences clearly indicate that seasickness is influenced by more factors than its definition would suggest.

It is widely acknowledged that many people experience symptoms of seasickness when they go sailing, but individuals vary in their resistance to the aforementioned sensory imbalance. These individuals differ in their personality traits and other psychological aspects, which affect the intensity of seasickness symptoms. The subject has not been widely described yet, but there are a few studies that confirm this relationship. It has been shown that a high sense of control reduced the symptoms of seasickness in a group of people who suffered from this condition. A significant positive correlation was observed between a low sense of control and the severity of symptoms [2].

Another study showed that among women, the frequency of seasickness symptoms was positively correlated with neuroticism, while among men, this correlation was not significant [3]. More recent studies show that the general level of anxiety of the respondents has a significant impact on the intensity of motion sickness symptoms. This is confirmed by the results of an experiment involving 167 healthy people and 94 people with balance disorders. The study clearly shows that people with balance disorders are more likely to suffer from motion sickness. However, an interesting aspect is the finding in the group of healthy individuals, where a positive correlation was observed between anxiety traits (including general anxiety levels) and symptom severity. The higher the level of anxiety a person exhibited, the more often they experienced symptoms of motion sickness [4]. These studies clearly indicate that there is a connection between motion sickness, including seasickness, and psychological factors. Among these psychological factors, the cognitive assessment of stress and the sense of self-efficacy play a particularly important role.

Numerous studies confirm that sailing can be not only a source of positive experiences but

also a contributor to the experience of stress [5]. There are several reasons for the stress experienced by sailors. Firstly, sailors must manage the processing of diverse information and make complex decisions based on that data. This is accompanied by a sense of responsibility and, at times, an awareness of risk. Such circumstances can lead to cognitive overload. Research involving sailors confirms that after sailing competitions, there is an increase in both physical and mental fatigue, as well as higher levels of subjectively perceived stress and task load [6].

Secondly, sailing involves operating in a natural environment that is not entirely predictable. Research results indicate that offshore sailing is associated with prolonged psychophysiological stress, increased cortisol levels, and physical exhaustion [7-9]. Additionally, the limited space in which sailors operate and the lack of privacy can also be a source of stress, which is particularly challenging during long cruises [10]. Although the available evidence is largely based on military and professional sailing populations, the review by Podstawka et al. [11] synthesizes research on the determinants of seasickness across both professional and amateur sailing populations, demonstrating how experience levels and psychological factors modulate symptom severity. The review highlights that extensive maritime experience facilitates habituation, thereby reducing overall susceptibility to seasickness. Conversely, psychological factors, such as anxiety and negative anticipation, can significantly exacerbate symptom severity, acting as catalysts that intensify physiological manifestations. Crucially, this psychological modulation affects both professional mariners and amateur sailors alike; acute psychological stressors can override the protective effects of maritime experience, rendering even seasoned crew members vulnerable to severe symptomatology [11]. Based on the presented research findings, it can be assumed that recreational sailing may also be a stressful experience—especially since such sailors often have less experience, and therefore, the challenges associated with sailing may exceed their coping resources. In other words, leisure in the form of participation in a sea cruise can be considered a type of stressful situation.

There are many approaches that define the concept of stress, but for the purposes of this

study, stress was approached according to the Transactional Model of Stress by Lazarus and Folkman [12]. According to this model, stress is defined as the interaction between an individual and their environment, which is appraised by the person as exceeding their capabilities and coping mechanisms [12,13]. This assessment is made on the basis of a primary appraisal, which consists of cognitively assigning meaning to a given situation. The primary appraisal can be described as: irrelevant, benign-positive, or stressful. Classifying a situation into the stressful category results in a secondary appraisal, in which the situation is evaluated as harm/loss, threat, or challenge [13]. On this basis, Wrześniewski [14,15] proposed an interactive model in which he distinguished two assessments of stress: dispositional—a permanent tendency of an individual, manifested in various situations, and situational—relating to a specific situation [16].

One of the important resources that enables individuals to cope with stress is self-efficacy [17-19]. Self-efficacy is defined as a personal belief that one has the competence and capabilities necessary to achieve a set goal, and a belief that one can also overcome obstacles that may stand in the way of the intended result [19-25]. Some researchers distinguish between global and specific self-efficacy, but Bandura considers that the global nature is difficult to predict because it does not take into account the fact that people's reactions are different in different situations [24].

The relationship between stress and self-efficacy is bidirectional. On the one hand, self-efficacy plays a crucial role in effective coping with stress. On the other hand, stress itself may negatively affect an individual's sense of self-efficacy and lead to its reduction [22,23]. When a situation is evaluated as threatening and one's personal resources are perceived as insufficient, perceived self-efficacy in that particular situation tends to decrease [22]. As a consequence, individuals may begin to doubt their ability to cope effectively. This reduced confidence often leads to lower engagement in problem-solving efforts, which in turn intensifies stress and reinforces the belief in one's own incompetence [22-25]. Diotaiuti et al. found that cognitive appraisal influenced distress both directly and indirectly through perceived self-efficacy. Threat-

based appraisal was associated with greater distress, whereas adaptive and supportive appraisals strengthened self-efficacy, which was subsequently associated with lower distress [26].

These results are consistent with the finding that a decrease in perceived self-efficacy increases an individual's susceptibility to the biological effects of stress, thereby intensifying somatic symptoms. Empirical studies indicate that individuals with lower self-efficacy report illness symptoms more frequently and cope less effectively with pain, as they tend to perceive stress as overwhelming rather than mobilizing [22,23]. One study found a link between enhancing self-efficacy and symptoms of seasickness. The study used verbal manipulation—some people were told that they would not get sick, while others were told that they would get sick. The results showed that this manipulation led to a different perception of self-efficacy. Those who were told that they would not experience symptoms showed a higher sense of self-efficacy than the group who were told that they would experience symptoms [27].

Health psychology literature further suggests that the cognitive appraisal of a situation as threatening initiates a process of depletion of personal coping resources. According to the model proposed by Benight and Bandura [22], a reduction in self-efficacy serves as a key mediator: individuals lose confidence in their ability to control the stressor, which results in an intensified physiological stress response. This mechanism is supported by research conducted by Wiedenfeld and colleagues [28], which demonstrated a relationship between low self-efficacy and elevated cortisol levels. In the long term, this process may contribute to somatization or to the exacerbation of symptoms associated with existing illnesses. Recent research continues to support the importance of self-efficacy and cognitive appraisal in explaining psychological and somatic responses to stress. Higher self-efficacy has consistently been associated with lower perceived stress and better adaptation across occupational and health-related contexts, whereas threat appraisal predicts greater psychological distress and somatic complaints. Furthermore, contemporary mediation studies indicate that self-efficacy may partly explain how stress-

ful appraisals translate into adverse psychological and physical outcomes [29-31].

These findings provide a useful theoretical basis for examining whether recreational sailors' appraisal of sailing-related stressors affects their self-efficacy and, consequently, their psychological experience of seasickness. Recreational sailors constitute a particularly relevant population for studying these mechanisms because they typically differ in sailing experience, exposure to sea conditions, and confidence in their sailing abilities. Such variability is likely to increase the role of cognitive appraisal and perceived self-efficacy in shaping psychological responses to sailing-related stressors and, consequently, the subjective experience of seasickness.

Based on the theoretical framework and previous empirical findings, three hypotheses were formulated and tested in the present study. It was hypothesized that, among sailors participating in the study, threat appraisal would be negatively associated with self-efficacy and positively associated with the frequency of seasickness symptoms (H1). Furthermore, sailors' self-efficacy was expected to be negatively associated with the frequency of seasickness symptoms (H2). Finally, it was hypothesized that sailors' self-efficacy would mediate the relationship between threat appraisal and the frequency of seasickness symptoms (H3).

MATERIALS AND METHODS

Participants

The participants of the online study were a group of 312 Polish sailors (including 136 men and 2 individuals of other genders), aged 18 to 74 ($M = 39.46$; $SD = 11.57$). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The study was based on an anonymous questionnaire survey involving adult participants and did not include any medical intervention or procedures that could pose risks to participants. All participants were informed about the purpose of the study, the voluntary nature of participation, their right to withdraw at any time without consequences, and the anonymity and confidentiality of the

collected data. Informed consent was obtained from all participants prior to enrolment. Most of the respondents declared that they spend an average of 7–14 days per year (37.2%) or 15–30 days (29.2%) on sea cruises, while significantly fewer people indicated 1–6 days per year (17%) or more than 30 days (16.7%). Most respondents had sailing qualifications—an Offshore Skipper licence (54.5%), significantly fewer had only an Inland Skipper licence (22.8%), while few had a Yachtmaster Ocean licence (9.6%). A few did not have any sailing qualifications (13.1%). Most of the respondents (70.5%) stated that they had not received psychological care in the last two years, while only some of the respondents (29.5%) declared that they had received such care. The respondents were also asked how often they took medication for seasickness. Most said they did not take medication (69.2%), some said they took it only occasionally (24%), while a few said they always took medication for seasickness during a cruise (6.7%).

Stress Appraisal

Stress appraisal was measured with the Stress Appraisal Questionnaire (SAQ), version B [15]. This test examines how a person usually perceives a stressful situation. In the confirmatory factor analysis, four factors were identified: threat, challenge-activity, challenge-passivity, and harm/loss [15]. The questionnaire consists of 35 adjectives describing the perception of a stressful situation, preceded by the statement: "Usually, a stressful situation is for me..." Respondents rated each adjective on a four-point scale: 0 (definitely not), 1 (rather not), 2 (rather yes), 3 (definitely yes). The reliability of the questionnaire was determined using two methods: Cronbach's alpha internal consistency and Guttman's split-half method [14,19,20]. The reliability indices obtained by both methods range from 0.71 to 0.90, which indicates acceptable and good reliability of the analysed SAQ subscales [15]. In the current study, the individual scales also achieved satisfactory reliability, which ranged from 0.82 for the harm/loss subscale, 0.83 for the challenge-passivity subscale, 0.88 for the challenge-activity subscale, to 0.90 for the threat subscale.

Self-efficacy

A behavior-specific self-efficacy measure was developed following Schwarzer’s recommendations within the Health Action Process Approach (HAPA) framework [24,25]. According to this approach, item content should be tailored to the specific behaviour under investigation while preserving the theoretical construct of self-efficacy. Therefore, the statements referred to confidence in performing duties during a sea voyage. The initial pool of items was developed based on the theoretical assumptions of the HAPA model and the characteristics of typical tasks performed during sea voyages. The final version consisted of seven items. Respondents rated each statement on a four-point Likert scale (“completely untrue” to “completely true”). Example items included: “I am confident that on every cruise I can undertake the tasks assigned to me, even if it is not always easy for me”; “I am confident that I am able to perform the tasks assigned to me during a cruise, even if others are unable to do it.” The scale demonstrated satisfactory internal consistency (Cronbach’s $\alpha = 0.90$). Because the scale was intentionally designed to measure a single theoretical construct derived from HAPA, only internal consistency was assessed.

Seasickness symptoms

Seasickness symptoms were assessed using an author-developed symptom checklist based

on the most commonly reported manifestations of seasickness described in the literature and maritime medicine. Five symptoms (e.g., dizziness, weakness, sleepiness, nausea, and vomiting) were included. Participants indicated how frequently they experienced each symptom using a five-point response scale ranging from “never” to “very often”. Higher scores indicated greater intensity of seasickness symptoms. The checklist showed satisfactory internal consistency (Cronbach’s $\alpha = 0.81$).

RESULTS

Data were analyzed using the Statistical Package for Social Sciences (SPSS 29.0). Table 1 contains the means, standard deviations, internal consistency coefficients (Cronbach’s α), and intercorrelations of all the variables measured. The pattern of correlations between appraisal of a stressful situation, self-efficacy, and frequency of seasickness symptoms was in line with expectations. Higher threat appraisal was associated with a greater frequency of seasickness symptoms and lower self-efficacy. Similarly, higher harm/loss appraisal was associated with lower self-efficacy. In contrast, higher challenge appraisal – both activity and passivity – was associated with higher self-efficacy. Additionally, higher challenge-passivity appraisal was associated with a lower frequency of seasickness symptoms. Finally, higher self-efficacy was associated with a lower frequency of seasickness symptoms.

Table 1. Internal consistency reliability (Cronbach’s α), means, standard deviations, and intercorrelations among all study variables.

	M	SD	Stress Appraisal: Threat	Stress Appraisal: Challenge-activity	Stress Appraisal: Challenge-Passivity	Stress Appraisal: Harm/loss	Self-efficacy	Symptoms of seasickness
Stress Appraisal: Threat	17.58	4.97	(0.90)	-0.33**	-0.18**	0.58**	-0.27**	0.25**
Stress Appraisal: Challenge-activity	15.29	2.82		(0.88)	0.54**	-0.37**	0.23**	-0.08
Stress Appraisal: Challenge-Passivity	11.98	3.21			(0.83)	-0.23**	0.20**	-0.11*

	M	SD	Stress Appraisal: Threat	Stress Appraisal: Challenge-activity	Stress Appraisal: Challenge-Passivity	Stress Appraisal: Harm/los	Self-efficacy	Symptoms of seasickness
Stress Appraisal:Harm/los	8.08	2.45				(0.82)	-0.19**	0.11
Self-efficacy	23.22	3.45					(0.90)	-0.26**
Symptoms of seasickness	12.33	4.21						(0.81)

Note: Diagonal values are the internal consistency estimates for each scale. *p<0.05; **p<0.01 (all two-tailed significance tests).

Table 2 provides information on the results of regression analyses for the frequency of seasickness symptoms. Hierarchical multiple regression analysis was performed to assess the impact of gender, age, stress appraisal, and self-efficacy. Standard demographic characteristics (age and

sex) were included as control variables rather than variables of substantive theoretical interest. In the first step, the demographic variables gender (coded – 1 = female, 1 = male) and age were entered, followed in the second step by stress appraisal. In the third step, self-efficacy was added.

Table 2. Results of hierarchical multiple regression of symptoms of seasickness on demographic variables, stress appraisal and self-efficacy.

	Symptoms of seasickness		
	Step 1	Step 2	Step3
	β	β	β
Age	-0.17***	-0.13*	-0.15**
Gender	-0.13*	-0.11	-0.08
Stress Appraisal: Threat		0.24***	0.19**
Stress Appraisal: Challenge-activity		0.03	0.05
Stress Appraisal: Challenge-Passivity		-0.10	– 0.08
Stress Appraisal:Harm/los		-0.06	-0.06
Self-efficacy			-0.20***
Adjusted R²	0.04***	0.08**	0.12***
R ² change	0.05***	0.05**	0.04***

Note. All beta weights are standardized; Gender is coded – 1=female,1=male; *p<0.05; **p<0.01; ***p<0.001

Since the reduction of the threat appraisal effect upon adding self-efficacy to the model suggested possible mediation, a bootstrapping procedure [32] was employed. The bootstrapping procedure based on 5000 bootstrapped resamples to estimate BC95% CI for the indirect effect was used in order to examine the indirect effect of threat appraisal of a stressful situation on the frequency of seasickness symptoms through the mediation of self-efficacy. The PROCESS macro for SPSS Version 3.1 (Model 4) by Hayes [32,33] was used. The results indicated that threat appraisal significantly and negatively predicted

the mediator, self-efficacy (B = – 0.19, SE = 0.04, p < 0.001). Self-efficacy was also found to be a significant negative predictor of the frequency of seasickness symptoms (B = – 0.25, SE = 0.07, p < 0.001). The total effect of threat appraisal on the frequency of seasickness symptoms was significant (B = 0.21, p < 0.001). After accounting for the mediator (self-efficacy), the direct effect remained significant (B = 0.16, p < 0.001). Finally, the bootstrap analysis revealed a significant indirect effect of threat appraisal on seasickness symptoms through self-efficacy (B = 0.047, 95% CI [0.017, 0.084]). Since the confidence inter-

val did not include zero, these results indicate that self-efficacy partially mediates the relationship between threat appraisal and the frequency of seasickness symptoms. Specifically, higher threat appraisal was associated with lower self-efficacy, which in turn was associated with more frequent seasickness symptoms (Figure 1).

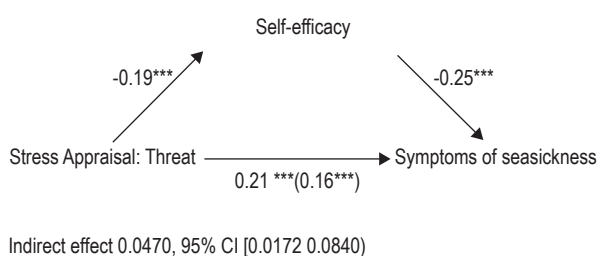


Fig. 1. The mediating effect of the Self-efficacy on the relationship between Stress Appraisal: Threat and symptoms of seasickness. Note: path values represent unstandardized regression coefficients. *** $p < 0.001$.

Taken together, the results demonstrated that self-efficacy serves as a significant psychological mechanism that partially explains how threat appraisal contributes to an increased frequency of seasickness symptoms.

DISCUSSION

The present study confirmed the significant role of psychological factors—specifically, threat appraisal and self-efficacy—in sailors' experience of seasickness symptoms. These findings suggest that seasickness is influenced not only by physiological mechanisms but also by psychological processes, supporting the need to move beyond a purely biomedical model of kinetosis.

Most importantly, the results indicate that self-efficacy partly explains how threat appraisal translates into seasickness symptoms, identifying a psychological pathway that has received little attention in previous research.

Consistent with previous findings, sailors who appraised sailing situations as more threatening reported more frequent seasickness symptoms. This observation is in agreement with studies demonstrating associations between anxiety and seasickness severity [4]. Since threat appraisal represents one of the primary cognitive responses to stress [29-31], individuals who perceive en-

vironmental demands as overwhelming may experience stronger physiological and emotional reactions, thereby increasing their susceptibility to seasickness.

Importantly, threat appraisal was also associated with lower self-efficacy. Individuals who focus primarily on potential danger tend to perceive themselves as having fewer personal resources to cope with stressful situations. This finding supports previous theoretical and empirical work indicating a reciprocal relationship between stress appraisal and self-efficacy. Rather than viewing themselves as capable of influencing the situation, individuals with low self-efficacy are more likely to experience a sense of helplessness, which may further intensify stress-related physiological responses.

The protective role of self-efficacy observed in the present study is consistent with previous research demonstrating that greater perceived control is associated with reduced susceptibility to seasickness [2]. Although perceived control and self-efficacy are distinct constructs, both reflect confidence in one's ability to manage environmental demands effectively [18-26]. Additional support for this interpretation comes from experimental studies showing that verbal persuasion—one of the principal sources of self-efficacy [23]—reduces motion sickness symptoms by strengthening individuals' expectations that they are able to cope successfully [27].

The principal contribution of the present study lies in demonstrating that self-efficacy partially mediates the relationship between threat appraisal and seasickness symptoms. This finding suggests that cognitive appraisal alone does not fully explain symptom severity. Rather, perceiving a situation as threatening appears to undermine individuals' confidence in their coping abilities, which in turn contributes to more frequent motion sickness symptoms. This interpretation is consistent with the seminal work of Wiedenfeld et al. [28], who showed that stress affects physiological functioning through changes in self-efficacy. The present findings therefore suggest that one mechanism through which psychological stress influences seasickness is a reduction in perceived competence and self-efficacy.

In addition to the psychological variables, age and gender also emerged as significant predic-

tors, although they were not included in the original theoretical model. Younger participants and women reported more frequent motion sickness symptoms. The observed sex difference is consistent with previous studies indicating greater susceptibility to motion sickness among women [3,34], potentially reflecting hormonal influences, sex-related differences in vestibular function, and the higher prevalence of migraine [34]. The association with younger age may, however, reflect differences in sailing experience, which was not controlled in the present study. Future research should therefore examine whether sailing experience accounts for this relationship after controlling for age.

From a practical perspective, the findings suggest that psychological interventions may complement traditional biomedical approaches to motion sickness prevention. Strategies aimed at reducing threat appraisal and strengthening self-efficacy—such as cognitive-behavioral techniques, stress management training, or interventions enhancing perceived coping ability—may help reduce the frequency and severity of seasickness symptoms in sailors.

The findings of the present study should be interpreted in light of several limitations. First, the study relied on a retrospective assessment, which may be subject to recall bias and inaccuracies in participants' recollections. Second, all data were collected through self-report measures, increasing the possibility of response bias, including social desirability and subjective interpretation of the questionnaire items.

Furthermore, several potentially important contextual variables were not controlled. These include weather conditions during the voyage, the duration of the voyage, and the type of vessel, all of which may have influenced participants' experiences and responses. In addition, the study did not fully control for participants' level of maritime experience, which may have acted as a confounding factor.

Finally, the correlational nature of the study calls for some caution in interpreting the direction of the relationships. A longitudinal design could help address this issue. Future studies should also consider including variables such as sailing experience, vessel type, duration of cruises, and weather conditions during the cruise. However, this would require a larg-

er sample size to allow for meaningful subgroup analyses. Finally, it would be beneficial to incorporate objective measures of seasickness symptoms alongside self-reports.

CONCLUSIONS

The present study demonstrates that psychological factors constitute an important component of seasickness. Specifically, the findings indicate that appraising sailing situations as threatening contributes to more frequent seasickness symptoms both directly and indirectly through reduced self-efficacy. These results provide evidence for a psychological mechanism linking stress appraisal with seasickness and support the integration of cognitive and psychological processes into existing models of kinetosis. They also suggest that interventions targeting self-efficacy and threat appraisal may complement conventional biomedical methods of seasickness prevention and management.

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