VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 2: 112–121
10.5603/IMH.2023.0017
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Linkage of job ranks and personality traits with augmented stress: a study on Indian marine engineers in the context of the COVID-19 pandemic

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ABSTRACT

Background: *Marine engineering is a profession that affects a high level of physical and psychological stress. Such a high level of stress was further aggravated during the coronavirus disease 2019 (COVID-19) pandemic. On the other hand, personality traits and perceived stress are linked with each other, while job ranks also influence stress levels among employees. However, very few clinical studies are available on this mechanism in seafarers. This study explores the hidden area through the collection of cross-sectional data.*

Materials and methods: *Big Five personality traits instrument, along with a stress augmentation questionnaire, were administered among 280 Indian marine engineers across job ranks who have sailed prior to and during the COVID-19 pandemic. The collected data were analysed using Kruskal-Wallis test and structural equation modelling.*

Results and Conclusions: *The analysis reveals significant differences among Indian marine engineers across their job ranks towards their perception of augmented stress levels. It also indicates that, except for extraversion, personality traits have linkages with levels of augmented stress among Indian marine engineers during the pandemic.*

(Int Marit Health 2023; 74, 2: 112–121)

Key words: allostasis load, Big Five personality traits, structural equation modelling, Cronbach's alpha, heterotrait-monotrait ratio of correlations

INTRODUCTION

Psychological stress is part and parcel of human life. Development in different aspects of human society has made human lives easier and more comfortable while impacting mental health. In today's world, stress is an inevitable aspect of human life. While too little stress may not result in the desired outcome, too high stress may lead towards various complications, including a negative impact on the physical and mental health of the human being and may interact with one another [1]. Stressful life events often lead to depression [2, 3].

The 'human function curve', as shown in Figure 1, can reveal stress's impact on a human's physical and mental health. The arousal of stress to the desired level improves the performance of the individual. The performance would keep improving while an individual experiences 'Good stress' or 'Eustress,' i.e. till the stress reaches such a level that the individual would face an inability to cope and thereby feel fatigued. Further increase in stress would result in 'Distress' and would only worsen the performance and lead towards exertion, health implications and many adverse impacts to the individual.

JOB STRESS AS A MATTER OF CONCERN

Human beings are engaged in different professions to earn livelihoods, which often become sources of stressful

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Received: 15.04.2023 Accepted: 4.05.2023

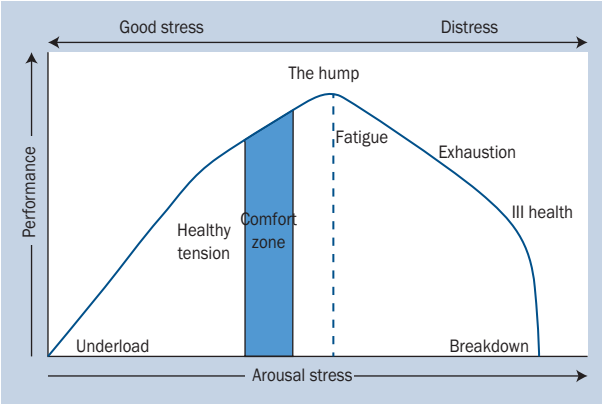

Figure 1. Human function curve. Source: Adapted from Nixon (1982)

situations. A good number of individuals suffer stressful conditions at workplaces where they spend a major portion of their lives. Job stress is generally an outcome due to a mismatch between job demand and available resources, skills, knowledge, etc. Technological advancements, competitive business environments, etc. lead to changing working patterns among employees, giving rise to higher levels of job demands, job insecurity, layoff, lower control, etc. [4].

McEwen (2005) [5] propounded the Allostasis Load Model of Stress and introduced a new terminology called allostasis refers to the adaptive bodily responses to stress. He propounded that an adaptive response to demands would occur if the allostasis load is within limits. However, allostasis "overload" may lead to negative effects on human health physically as well as psychologically.

Past studies indicate that crises adversely affect individuals' psychological well-being [6–8]. Epidemiological evidence indicates that job stress is rapidly emerging as the single greatest cause of work-related disease and injury [9]. Stressful working condition is more likely to lead to workplace accidents [10]. According to Bartlett [11], it's not only stress which is an important element of health psychology but knowledge of stress, health, work and well-being are closely linked.

Apart from day-to-day job-related stress, the coronavirus disease 2019 (COVID-19) pandemic creates a sense of panic and fear among people, including a high level of stress resulting in disturbances in mental well-being [12]. A recent study shows that the pandemic has increased mental health problems and chronic fatigue among seafarers [13].

PERSONALITY AND STRESS

The impact of personality on stress has been an area of interest for researchers for a long time. According to Carroll [14], people differ a lot depending on how differently their bodies react to certain challenging situations. These individual differences also have implications on their health and behaviour [15, 16]. A low score in the general factor of personality exhibits less engagement with socially adaptive stress coping strategies, leading to maladaptive behaviour [17]. The Big Five factor model of personality, developed by Goldberg in 1993, is the widely used personality test in recent years which indicates five personality traits, viz. Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness. According to Hengartner et al. [18], fear, panic, distress, etc., are specifically related to neuroticism. A person higher on neuroticism frequently feels negative emotions and, therefore, is more prone to experience role stress in the workplace [19]. The five-factor model is also widely used to assess stress vulnerability [20]. Personality has also been linked with the likelihood of experiencing stressful situations [21]. On the other hand, evaluating stressful situations is also linked to personality [22]. These five factors are also used to assess how people cope with stress [23]. Similarly, adequate pieces of evidence are available, which indicates that there is a close link between 'personality' and 'stress'. Some population-based studies indicate that people's personality and temperament predict their perception of job strain and effort-reward imbalance [24–26]. Another study by Sutin and Costa [27] shows that the direction of association runs from personality to stress but not the other way.

SEAFARING AND STRESS

The shipping industry bears a huge toll due to the consequences of stress [28]. According to Parker et al. [29], seafarers reported a higher level of stress in comparison to the reference group. Compared to galley staff, the officers on board are more stressed due to their higher level of responsibility and changing nature of job demands [30, 31].

Though the concept and levels of psychological stress differ from person to person, some commonly identified stressors at sea include excessive or insufficient work responsibilities, shift work, and extended family separation [28]. Separation from home and family is being identified as a dominant stressor among seafarers [30, 32–37]. Factors like job content and inadequate organizational communication may lead to distress among seafarers [1]. Seafarers' physical efforts in accomplishing tasks and factors associated with such accomplishments are responsible for a high level of stress [38]. According to Leszczyńska et al. [39], stress among seafarers is associated with the physical and psychological conditions of working onboard. He also identified specific stressors like monotony, loss of attention, biorhythmic disorders, excessive or inadequate job responsibility, being away from the family, continuous change of environment, conflict and responsibility towards the safety of personnel and decisions making.

SEAFARERS PLIGHT DURING COVID-19 PANDEMIC

Throughout the pandemic, the world's 1.9 million seafarers have played a vital role in keeping ships moving and ensuring critical goods such as food, medical equipment and vaccines are delivered [40]. Studies conducted in recent times have identified that in the work and life onboard, there have been several changes in recent years due to the COVID-19 pandemic [41–44]. These include maintenance of cleaner surroundings, disinfecting surfaces, more paper works concerning port calls and at the same time, necessary arrangements for maintenance of physical distance. On the other hand, due to restrictions on shore-based services supply of necessary items, medical facilities, as well as the supply of contractors onboard for maintenance and repair jobs, got adversely affected [13].

During the COVID-19 pandemic, due to lockdown, travel restrictions, etc., the changing of ship crew members was delayed for a reasonable time, resulting in the extension of contracts even for several months. Four United Nations organizations issued a joint statement on 28.02.2022 that at times during the COVID-19 pandemic has left more than 4,00,000 seafarers stranded at sea [40]. Even due to the pandemic, the seafarers were not allowed shore leave. Ana Sliskovic [43] mentioned that physical, mental, and social well-being are seriously threatened due to the restrictions imposed to prevent the spread of COVID-19. According to International Labour Organization, COVID-19 is responsible for adverse impacts on seafarers' and their family member's mental and physical health [45]. As per Erdem and Tutar [46], the COVID-19 pandemic increases stress levels among seafarers. In brief, the pandemic has augmented seafarers' stress levels.

On 22.02.2021, the International Seafarers' Welfare and Assistance Network (ISWAN) reported that the number of suicide and seafarers calling ISWAN about suicidal thoughts had "roughly doubled" from about 12 in a normal year to 25 since March 2020 [47]. The Seafarers Happiness Index shows that the happiness level for a year (2021––2022) is lowest during the first quarter of 2022 (Fig. 2).

A high level of stress among seafarers is an already established fact through various studies. Coupled with the COVID-19 pandemic, its restrictions, etc., the stress level among seafarers increases further, resulting in an augmented stress level among them.

RESEARCH GAPS AND INTERVENTION

On review of relevant literature, the research gaps are identified, i.e. the existing research studies on seafarers' stress during the COVID-19 pandemic are based on seafarers as a whole and not specific to particular job, rank or nationality. At this juncture, this study is an intervention which addresses the Indian marine engineers across ranks from chief engineers to fourth engineers who sailed during the pandemic. The existing studies do not focus on the personality of seafarers and its linkage with augmented stress levels during the pandemic, which is being addressed in the present study.

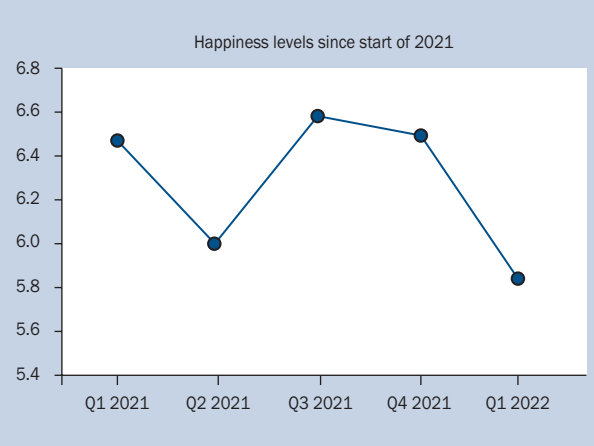

Figure 2. Seafarers happiness index. Source: Seafarers Happiness Index, Quarter 1 2022

RESEARCH QUESTIONS

The following research questions are formed with reference to the period of the COVID-19 pandemic:

— RQ_1: During the COVID-19 pandemic, do Indian marine engineers differ significantly with reference to augmented stress levels?

— RQ_2: Based on different personality traits, do Indian marine engineers' perceptions of augmented stress levels differ significantly during the COVID-19 pandemic?

MATERIALS AND METHODS

SAMPLING AND DATA COLLECTION

As the profession, marine engineering is highly specialised, and the professionals are scattered throughout the world, the researcher used the snowball sampling technique. An online survey was conducted from January–April, 2022 and data were collected from 280 Indian marine engineers who served different types of vessels and sailed for a considerable period before as well as during the COVID-19 pandemic. Seventy responses were collected from each rank, i.e. 'Chief engineer', 'Second engineer', 'Third engineer' and 'Fourth engineer'. The respondents completed the survey voluntarily.

TOOLS USED FOR ASSESSMENT

Data was collected through a battery consisting of the following instruments:

— socio-demographic variables: a structured questionnaire on socio-demographic aspects to collect data on age,

sex, marital status, job experience, etc., was used; such collected data were analysed using descriptive statistics;

— Big Five Inventory (44 items) is a five-point Likert scale (1 = "strongly disagree" to 5 = "strongly agree"). The theory holds that the ways people think, feel, and interact with others are attributable to individual differences in five personality dimensions. Accordingly, the instrument was developed by Goldberg (1992), which captures an individual's personality using five dimensions, viz. (i) Extraversion, i.e. qualities like assertiveness, sociability, etc. On the contrary, people who lack extraversion tend to be reserved; (ii) Agreeableness, i.e. friendly behaviour, flexibility in dealing, etc. People with less agreeableness tend to be rigid while dealing with others; (iii) Conscientiousness, i.e. people with high conscientiousness show qualities like orderliness, responsible, dependability, etc.; (iv) Neuroticism refers to emotional stability, i.e. the degree to which people experience stress, anxiety, anger, depression, etc.; (v) Openness, i.e. people with high openness acceptance new ideas, curious, imaginative, etc. The Big Five factors are also increasingly being used to help researchers understand the dimensions of psychological disorders such as anxiety and depression [48];

— A stress augmentation scale was developed to collect data on augmented stress levels during the pandemic. The instrument consists of 24 items that address stress factors like (i) the job itself; (ii) planning activities; (iii) company rules, policies, etc.; (iv) situations like being away from family, friends, etc.; (v) lack of socialisation opportunities due to the pandemic.

QUESTIONNAIRE: INTERNAL CONSISTENCY AND VALIDITY

The reliability and validity of the instruments were also tested and items that failed to be valid were excluded from the final questionnaire. The final questionnaire includes questions/statements on (i) Socio-demographic variables (5 questions); (ii) the Big Five Inventory (35 items) and (iv) the Stress augmentation scale (24 items). The confirmatory factor analysis was carried out, and the factor loadings are shown in Table 1. Items with a factor loading of 0.50 and above are considered and included in this instrument, except item 6 in the Big Five personality traits instrument and item 7 in the stress augmentation scale, as the factor loadings were very near to 0.50. The reliability and validity scores of validated instruments are shown in the following Tables 2A and 2B.

The Cronbach's alpha of all variables are above 0.70, ensuring both instruments' internal consistency. According to Fornell and Larcker [49], the convergent validity is still adequate even if the average variance explained (AVE) is

Table 1. Factor loads of two instruments

Big Five personality factors		Stress augmentation scale	
Item no.	Factor load	Item no.	Factor load
1	0.213	1	0.469
2	0.535	2	0.617
3	0.504	3	0.642
4	0.670	4	0.444
5	0.709	5	0.719
6	0.493	6	0.627
7	0.565	7	0.492
8	0.627	8	0.612
9	0.673	9	0.524
10	0.305	10	0.442
11	0.777	11	0.522
12	0.535	12	0.745
13	0.636	13	0.742
14	0.621	14	0.710
15	0.333	15	0.437
16	0.703	16	0.457
17	0.506	17	0.686
18	0.718	18	0.801
19	0.577	19	0.895
20	0.662	20	0.932
21	0.302	21	0.840
22	0.558	22	0.865
23	0.554	23	–0.164
24	0.647	24	0.785
25	0.828	25	0.773
26	0.587	26	0.927
27	0.308	27	0.919
28	0.511	28	0.576
29	0.630	29	0.713
30	0.668	30	0.847
31	0.425		
32	0.603		
33	0.728		
34	0.648		
35	–0.431		
36	0.881		
37	0.728		
38	0.549		
39	0.698		
40	0.591		
41	–0.258		
42	0.648		
43	0.671		
44	0.316		

Table 2A. Test of reliability and validity of Big Five personality questionnaire

Variables	Cronbach's alpha	AVE	CR	HTMT				
				Extrovert	Agreeableness	Conscientiousness	Neuroticism	Openness
Extrovert	0.741	0.41	0.82					
Agreeableness	0.806	0.35	0.81	0.64				
Conscientiousness	0.833	0.38	0.84	0.77	0.69			
Neuroticism	0.849	0.48	0.85	–0.60	–0.59	–0.62		
Openness	0.776	0.48	0.82	0.69	0.51	0.50	–0.50	

AVE — average variance explained; CR — composite reliability; HTMT — heterotrait-monotrait ratio of correlations

Table 2B. Test of reliability and validity of stress augmentation scale

Variables	Cronbach's alpha	AVE	CR	HTMT				
				Job content and environment	Company policy	Planning	Away from family	Lack of socialisation
Job content and environment	0.781	0.39	0.79					
Company policy	0.934	0.71	0.93	0.29				
Planning	0.780	0.43	0.79	0.62	0.23			
Away from family	0.910	0.73	0.91	0.51	0.15	0.62		
Lack of socialisation	0.730	0.52	0.76	0.48	0.14	0.53	0.50	

AVE — average variance explained; CR — composite reliability; HTMT — heterotrait-monotrait ratio of correlations

Table 3. Demographic profile of the respondents

Age [years]									Job experience [years]					
21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	60+	01–05	06–10	11–15	16–20	21–25	26+
1	55	110	67	18	19	6	2	2	33	88	88	43	18	10
Job rank									**Marital status**					
Chief engineer		**2nd engineer**		**3rd engineer**		**4th engineer**			**Married**	**Unmarried**		**Divorced**		**Live-in relation**
70		70		70		70			231	47		1		1

less than 0.50 but the composite reliability (CR) is more than 0.60. The scores of CR, AVE and heterotrait-monotrait ratio of correlations (HTMT) indicate adequate discriminant and convergent validity.

ANALYSIS OF DATA USING 'R'

R' is a programming language used in the present study. As the data is not normally distributed, to answer the research question RQ_1, the Kruskal-Wallis test was performed through 'R'. On the other hand, for RQ_2, structural equation modelling (SEM) is used through 'R' to identify the impact of different personality traits on augmented stress levels among Indian marine engineers. As the data is ordinal in nature, the method of estimation followed was unweighted least squares. According to Bentler and Chou [50], SEM is a statistical method which takes a hypothesis-testing approach to analyse a structural theory bearing on some phenomenon. SEM conveys two aspects, viz. (i) that a series of regression equations represent the causal processes under study and (ii) these structural equations can be modelled pictorially to enable a clearer conceptualisation of the theory under study. The developed model is tested, and if the goodness of fit is found adequate, the model indicates reasonable relations among the variables [51].

RESULTS

DEMOGRAPHIC PROFILE OF THE RESPONDENTS

The demographic profile of the participants is in Table 3. All 280 respondents were male only.

Table 4. Mean scores of augmented stress

Chief engineer	Second engineer	Third engineer	Fourth engineer
84.17	83.21	79.31	80.14

Table 5. Kruskal-Wallis test output of augmented stress based on job rank

Kruskal-Wallis rank sum test
Data: Augmented_Stress by Job_Rank
Kruskal-Wallis chi-squared = 10.704, df = 3, p-value = 0.01344

The COVID-19 pandemic brought a number of challenges to seafarers. The present study aimed to examine if factors responsible for increased stress levels are perceived similarly by Indian marine engineers across their job ranks.

COMPARISON OF STRESS LEVELS ACROSS JOB RANKS

RQ_1: During the COVID-19 pandemic, do Indian marine engineers differ significantly with reference to augmented stress levels?

The answer to the above question can be obtained by job rank wise mean augmented stress levels and using the Kruskal-Wallis test, carried out using 'R'; the output is shown in Tables 4 and 5.

Table 4 above shows average scores of augmented stress across job ranks. The Kruskal-Wallis test with a p-value of 0.01 indicates that across job ranks, there is a significant difference in perceived augmented stress levels among Indian marine engineers.

While answering RQ_2, the present study considers five different personality traits and studies how respondents perceived augmented stress levels.

RQ_2: Based on different personality traits, do Indian marine engineers' perceptions of augmented stress levels differ significantly during the COVID-19 pandemic?

Structural equation modelling was carried out using the 'R' language, and the outputs are shown in Figure 3 and Table 6.

The Figure 3 and Table 6 above indicate that, except for extraversion, marine engineers of all other traits are significantly impacted by augmented stress levels during the pandemic. While for agreeableness, the effect is negative; for openness, conscientiousness and neuroticism, significant positive impacts are seen. It resembles higher levels of openness, conscientiousness and neuroticism are responsible for a higher stress level during the pandemic; in contrast, higher agreeableness lowers stress levels.

DISCUSSION

The present study is probably the first of its kind, revealing a linkage between personality traits and perceived stress levels during the pandemic among Indian marine engineers. This outcome is in line with past studies on populations other than seafarers. Several past studies have revealed that personality and stress are linked with each other, and higher levels of certain personality traits result in higher stress levels.

Though apart from extraversion, all other personality traits have shown significant linkages; conscientiousness has been found to have a very high positive impact on augmented stress levels with a standardised regression coefficient of 0.538. Such a finding contradicts some of the previous studies, viz. Murphy et al. [52], which state that a higher level of conscientiousness may protect from exposure to certain stress factors. According to Schlatter et al. [53], higher conscientiousness has been found to be associated with lower psychological stress levels. Conscientiousness has been considered a type of personal resource that may help individuals protect themselves from the harmful effects of stress [54, 55]. According to Ikizer et al. [56], lower levels of conscientiousness perceived higher levels of stress during the pandemic. Consciousness has been found to be negatively associated with COVID-19 anxiety [57]. However, the present study's finding aligns with Getzmann et al. [58], which found conscientiousness to have a significant positive correlation with stress among individuals during the COVID-19 pandemic.

The present study found a significant positive impact of the openness trait on augmented stress levels among Indian marine engineers during the pandemic, which contradicts existing literature. According to Roesch et al. [59], highly open individuals can cope with stressful situations more effectively than others. However, the finding of this study complements a cross-sectional study by Xu et al. [60], carried out among nursing students during the COVID-19 pandemic. Another study reveals a positive link between openness and the COVID-19 anxiety syndrome [57]. A similar finding is that individuals with a higher level of openness perceived a higher stress level during the COVID-19 pandemic [56].

Agreeableness is seen to have a significant negative linkage with augmented stress levels among Indian marine engineers during the pandemic. Such finding is at par with some of the earlier studies. Agreeable-

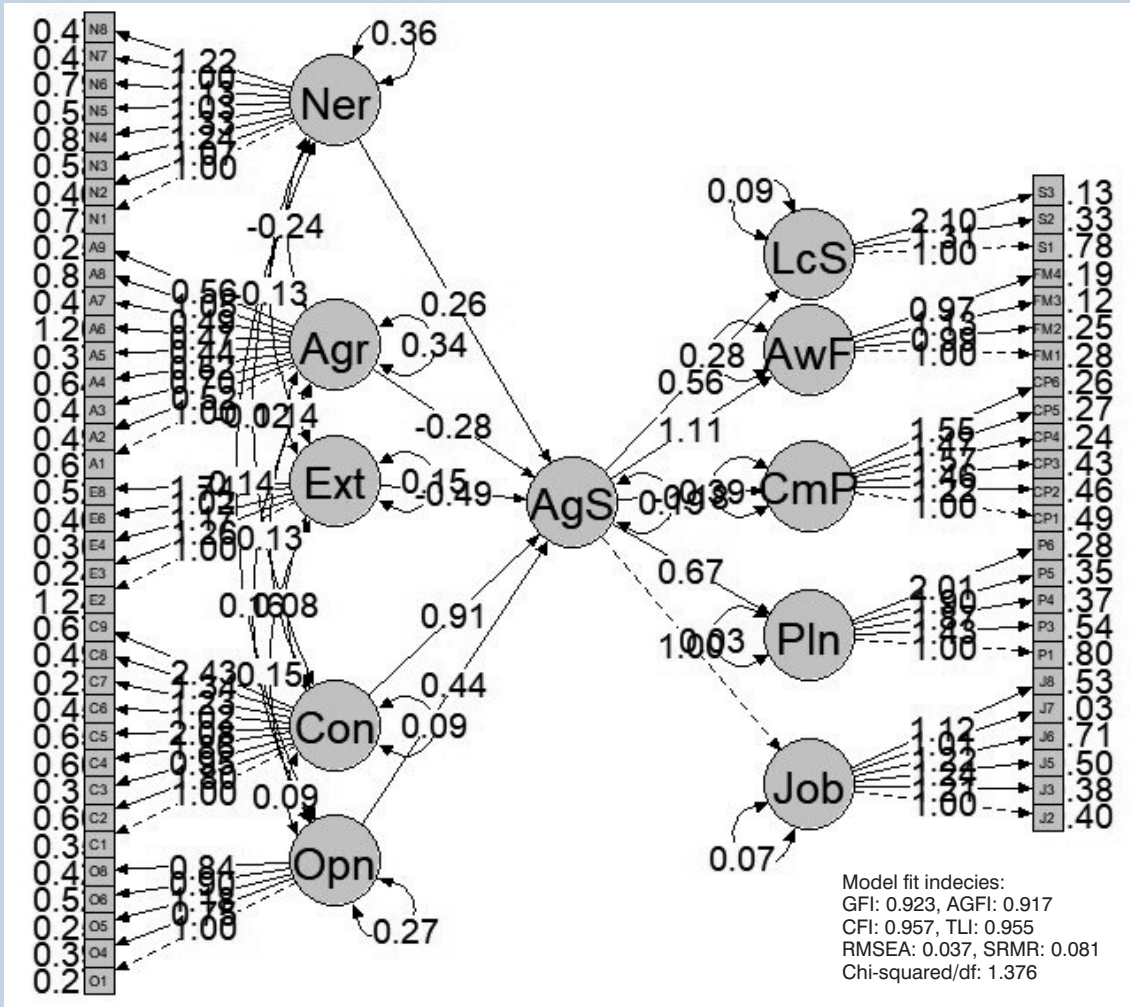

Figure 3. Impact of personality traits on augmented stress among Indian marine engineers; Opn — openness; Con — conscientiousness; Ext — extraversion; Agr — agreeableness; Ner — neuroticism; AgS — augmented stress level; Job — job; Pln — planning activities; CmP — company policies; AwF — away from family; LcS — lack of socialisation

Table 6. Regression coefficients of personality traits (independent variables) and augmented stress (dependent variable)

Augmented Stress ~	Estimate	SE	z-value	P(>|z|)	SLV	SOLV
Openness	0.440	0.144	3.056	0.002	0.459	0.459
Conscientiousness	0.908	0.320	2.837	0.005	0.538	0.538
Extraversion	–0.491	0.256	–1.918	0.055	–0.380	–0.380
Agreeableness	–0.278	0.135	–2.055	0.040	–0.323	–0.323
Neuroticism	0.263	0.065	4.059	0.000	0.314	0.314

SE — standard error; SLV — standardised latent variables; SOLV — standardised observed and latent variables

ness has been found to have a significant negative relationship with stress [58]. According to Ebstrup et al. [24], agreeableness significantly negatively affects perceived stress. Agreeableness has been identified to have negatively and directly associated with anxiety during the pandemic [57]. According to another study [60], agreeableness negatively impacts anxiety during the COVID-19 pandemic among nursing students.

The finding of this present study on the linkage between neuroticism and augmented stress complements existing

pieces of literature, i.e. a higher level of neuroticism reflects an augmented stress level. Some recent studies have encompassed the COVID-19 pandemic, and the findings are similar, i.e. a higher level of neuroticism reflects a higher level of stress [56–58, 60].

LIMITATIONS OF THE PRESENT STUDY

Though this study on marine engineers, especially during the COVID-19 pandemic, provides valuable insights; it is also important to acknowledge the limitations. Firstly, the study may have limited generalisability due to the small sample size, and the sample size may not represent the larger population of Indian marine engineers. Further, the study uses primary data from the respondents, which may be subject to biases such as social desirability or memory bias. This could potentially affect the accuracy of the results obtained. Also, the study collects data for a very limited period and not over time, limiting the ability to examine changes in stress levels and personality traits over time.

CONCLUSIONS

This study captures data from Indian marine engineers concerning their sailing experience during the COVID-19 pandemic, which is uniquely stressful. The study aims to understand if, during the pandemic, the level of augmented stress differs among Indian marine engineers across job ranks. It also attempts to shed some light on the impact of personality traits on augmented stress levels among Indian marine engineers during the COVID-19 pandemic. Thereby, this study enlightens on developing cross-sectional strategies to assist Indian marine engineers in coping with stress levels. The same is expected to benefit marine engineers, shipping companies, and policymakers in formulating policies and rules regarding stress mitigation strategies for seafarers, especially during periods of uncertainty.

Conflict of interest: None declared

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