Health-related Quality of Life in Medical Personnel on the Peace Ark Hospital Ship During a Long Voyage: A Cohort Study

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Abstract

Background The Chinese hospital ship “Peace Ark” has conducted nine overseas humanitarian missions.

Methods Research indicated long-distance voyages significantly impact seafarers’ physical and mental health. This study investigated changes in and influencing factors for medical professionals’ health-related quality of life (HRQoL) during a 2017 humanitarian mission (8 countries, 155 days). Using a cohort study design, 90 medical professionals’ HRQoL was assessed (via the SF-12) pre-voyage and after 5 months at sea.

Results Pre-voyage, mean physical component scale (PCS) and mental component scale (MCS) scores were 52.34 (SD 5.07) and 53.03 (SD 6.40), respectively—significantly higher than in the general Chinese population ($p < 0.0001$). Afterwards, PCS and MCS scores declined by 3.9867 (SD 6.03) and 5.70 (SD 7.03), respectively. PCS scores were negatively associated with female gender ($p = 0.004$). Compared to administrative staff, doctors ($p < 0.001$) and nurses ($p < 0.001$) showed less deviation in PCS scores. Lower MSC scores were associated with older age ($p = 0.011$) and less family support ($p = 0.0165$).

Conclusions Long-term voyages negatively impacted HRQoL in medical personnel. Thus, prior to similar future humanitarian missions, selection criteria and training procedures for medical personnel should be optimized, thereby increasing their confidence and social support.

1. Background

The Peace Ark is a hospital ship of the Chinese Navy specifically designed to provide maritime health care support, and can be considered a “mobile hospital at sea.” In wartime, it can provide early stage treatment and partial specialized treatment for wounded and sick combat troops. During peacetime, it can be used for health care training tasks and provide medical services for ship formations and rebel units in remote areas. In recent years, public perception of the Peace Ark has been that it is an important force for international humanitarian relief. Almost every year since August 2010, the Peace Ark has conducted international service voyages and medical assistance missions, called “Harmonious Missions.” To date, over nine missions, the Peace Ark has provided humanitarian medical services to more than 230,000 people in 43 countries and regions worldwide^[1]. For example, in November 2013, the Peace Ark participated in the Philippine tsunami rescue, receiving over 2,000 patients and submitting 12 disease reports to the World Health Organization within 16 days.

The Peace Ark’s role in providing humanitarian relief is commendable; however, the ship’s medical staff is not fixed, but temporarily drawn from Chinese naval hospitals before each voyage. The members of the medical staff usually work in hospitals on land, and only some of them have sailing experience. During these missions, they need to live in the hospital ship’s confined environment, which may cause various physical changes in medical personnel onboard the ship for an extended period. Even for professional seafarers, living and working at sea for a prolonged time is often stressful and risky. Diverse and rapid changes in the natural environment make it difficult for seafarers to maintain physical homeostasis^[2];

thus, they endure a highly stressful work environment and a significant degree of fatigue, relative to other employment locales. Furthermore, accumulated stress and fatigue have a direct negative effect on seafarers' health. Many studies^[3–5] have reported hearing and visual impairment, obesity, and diseases of the circulatory, digestive, and musculoskeletal systems among seafarers. Research on Lithuanian and Latvian sailors^[6] indicated that about one-half of all those studied stated they had experienced psycho-emotional stress after 2.7–2.8 months at sea, on average. Studies in Australia^[7] showed that periods of duty over 3 months at sea were associated with increased stress.

Seafaring also leads to a number of unique issues in the work environment that may cause health problems. Noise and vibration, as well as the continual rolling and pitching of the ship, are constant issues, in addition to thermal stress and pollutants. A survey of Chinese seafarers^[8–9] using the System Checklist-90 (SCL-90) found that their mental health was below the Chinese norm, and that positive coping style and social support were related to better mental health.

The authors participated in a recent overseas humanitarian medical assistance mission onboard the Peace Ark—the “Harmonious Mission – 2017”—which began in Zhoushan, China, and provided medical service to people in Djibouti, Sierra Leone, Gabon, the Congo, Angola, Mozambique, Tanzania, and Timor-Leste. The mission began on July 26, 2017, and was completed on December 28, 2017, for a total duration of 155 days. We conducted a cohort study of medical personnel during this mission, assessed their health status at the beginning and end of the voyage (5 months later), and analyzed factors influencing their health-related quality of life (HRQoL). Although many unique aspects of seafaring are unchangeable, it is possible to make better preparations in order to reduce the impact these factors have on the health of non-professional seafarers who work and live onboard a ship for an extended period of time. We anticipate that our findings will provide useful guidance for personnel selection and preparation prior to voyages.

2. Methods

2.1. Study Design

The health status of medical personnel onboard the hospital ship Peace Ark who participated in “Harmonious Mission – 2017” were examined using a self-administered questionnaire 2 days before boarding (July 24, 2017) and 2 days before the voyage ending (December 26, 2017). Consent forms were obtained before the investigation, which clarified that participating in the study was entirely voluntary. Participant anonymity was assured by enclosing each questionnaire in a booklet, which had no identifying information whatsoever.

The SF-12 was used to evaluate the participants' HRQoL and health status. This scale comprises 12 items, which participants were asked to complete by recalling their personal experiences over the previous 4 weeks. The SF-12 has been used in numerous studies worldwide, and includes one item each for bodily pain, general health, vitality, and social functioning and two items each on physical functioning, role

physical, role-emotional, from the physical and mental health scales of the SF-36 ^[10]. Participants' overall physical and mental health were evaluated using the scale's physical component summary (PCS) and mental component summary (MCS) scores. MCS and PCS scores were calculated using the methods proposed by Ware et al ^[11]. The questionnaire also included basic information such as age, gender, education level, personal confidence, social support, and family support. Among them, personal confidence refers to whether the respondents have confidence in their competency in the hospital ship.

2.2. Data Analysis

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) Version 21.0 (IBM Corp., Armonk, NY). First, descriptive statistics (frequencies, percentages, means, and standard deviations [SD]) were calculated. Subsequently, t-tests (for two-group comparisons) and analyses of variance (ANOVAs; for multigroup comparisons) were used to evaluate differences in continuous variables when the data were normally distributed and in accordance with assumptions regarding the homogeneity of variance; otherwise, non-parametric methods were used (Wilcoxon rank sum tests for two-group comparisons and Kruskal – Wallis H tests for multigroup comparisons). A stepwise linear regression analysis was performed to identify predictors of PCS and MCS scores, and the beta coefficients (β), standardized error of the coefficient (SE), and t-values are reported. The PCS and MCS scores of the medical staff onboard the Peace Ark were compared to those of the general population in China using a one-sample t-test. $P < 0.05$ was considered statistically significant.

3. Results

There were 115 members in the medical staff—aged between 25 and 55 years—in the offshore hospital, all of whom participated in our investigation. After all questionnaires were collected, our investigators carefully reviewed them and obtained 90 valid questionnaires, for a response rate of 78.26% (90/115). The remaining 25 were discarded due to poor response quality, such as missing information.

3.1. Sociodemographic Characteristics

Sociodemographic characteristics are presented in Table 1. Of the 90 participants, 43 (47.78%) were men, and 55 (61.11%) were under 40 years old. Nearly half of the medical personnel (44, 48.89%) were undergraduate and the vast majority (81, 90%) were married. In terms of occupation, 54 (60%) were doctors and 20 (22.22%) were nurses. Over half had confidence (70, 77.78%) and had positive family support (56, 62.22%). A total of 53 (58.89%) personnel had prior voyage experience.

Two days prior to boarding, mean PCS and MCS scores in the present sample were 52.34 (SD = 5.07) and 53.03 (SD = 6.40), respectively, which were significantly higher than the general population in China ^[12] (PCS = 50, MCS = 50, $p < 0.0001$). None of the factors assessed in the present study showed any association with PCS or MSC scores ($p > 0.05$).

3.2. Factors Associated with Changes in Physical and Mental Component Summary Scores

When we compared participants' MCS and PCS scores from 2 days prior to boarding and 2 days before the voyage ended, the deviation calculation results were 3.9867 (SD 6.03) for PCS and 5.70 (SD 7.03) for MCS. These results indicated that both physical and mental health declined among medical personnel during the voyage.

In bivariate analyses, PCS scores were significantly associated with confidence ($p = 0.0058$), occupation ($p < 0.001$), age ($p = 0.0334$), and gender ($p = 0.0071$). MCS scores were significantly associated with family support ($p = 0.0215$) and age ($p = 0.0136$). Multiple stepwise regression analyses (Table 2) indicated that deviations in PCS scores between timepoints were negatively associated with the female gender ($p = 0.004$). Compared with other occupations (medical administrative staff), doctors ($p < 0.001$), and nurses ($p < 0.001$) showed less deviation in PCS scores. Lower MSC scores were associated with older age ($p = 0.011$) and receiving less family support ($p = 0.0165$).

4. Discussion

Spending an extended period of time at sea can negatively impact individual physical and mental health to differing degrees, especially for medical personnel who live and work onboard a ship. The medical profession has been associated with more stressful work, higher physical load, and a higher probability of depression and anxiety than other professional fields. Our research aimed to observe the impact of long-distance sea travel on the HRQoL of medical personnel, and the results indicated some important influencing factors. Thus, our findings could provide useful guidance for medical personnel selection and preparation prior to long-range voyages that will require medical assistance tasks to be performed onboard a ship.

In the present study, participants' pre-voyage PCS and MCS scores were significantly higher than in the general Chinese population and previous research on the physical and mental health of Chinese medical personnel. A questionnaire survey was conducted among 3665 medical staff from 80 hospitals in 10 provinces and cities in China^[13]. It was found that a large proportion of the medical staff often felt uncomfortable physically and more than one third of the medical staff were in a constant state of depression, mental compression, and anxiety. Meanwhile, symptom checklist 90 (SCL-90) was used to investigate 328 doctors in general hospitals^[14]. Among them, 27.74% of subjects had at least one item scoring over 3 (which means that the index reached medium severity), and doctors' mental health was found to be significantly worse than that of the general adult population. In studies conducted outside of China^[15–18], researchers have also found the incidence of depression in medical staff to be higher than in the general population. The participants of this study were medical personnel temporarily selected to perform tasks onboard a hospital ship. They were military medical personnel, drawn from the Chinese Navy Hospital. Some common features of military personnel, such as physical fitness, regular physical exercise, good peer interactions, and social support may lead to higher HRQoL in this population. This could give them a competitive advantage over non-military medical personnel in performing long-term maritime medical assistance missions with far-reaching significance, great responsibility, and environmental difficulties.

After a five-month voyage, participants' PCS and MCS scores decreased significantly. This is consistent with the results of previous studies which found relatively poorer physical and mental health among seafarers. This also supports previous findings that long-distance sea travel decreases individual HRQoL. Shipping accidents, confined work environments, high alcohol and tobacco consumption, unhealthy diet, and inadequate physical activity have all been identified as major contributing factors to these health problems^[19–22]. Medical personnel in our study did not consume alcohol during the study period, because the Chinese Navy currently implements alcohol prohibition during missions. However, health risks can be exacerbated by the stress related to working conditions that are demanding both physically and mentally, including long-term separation from family, isolation, long working hours, high temperatures, hard physical work, and lack of sleep^[23]. Thus, how seafarers can better maintain their physical and mental health is still a topic worthy of study.

After more than five months at sea, the decline in PCS scores was more pronounced in female participants than male participants. For a long time, men have been the main force at sea. Due to the harshness of the maritime living environment, the inconvenience of living in close quarters in the minimal space on board, the severe homesickness, and the strong sense of family responsibility of traditional Chinese women, fewer Chinese women choose to become sailors. A study conducted with female medical workers on hospital ships from 2002 to 2006 found that female seafarers were more likely to suffer from seasickness than men, especially before and during menstruation, which affected their physical comfort. The International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers has clearly stated that it is highly desirable for women and men to have equal opportunities in maritime education and employment onboard ships. Some researchers have also suggested that female seafarers have some advantages over male seafarers in navigation, such as high participation in public affairs, keen intuition, innate spirit of cooperation, and self-control necessary for being disciplined^[24]. However, the physical health of female seafarers still deserves further attention.

Compared with doctors and nurses, PCS scores for medical administrative staff showed a more significant decline. In response to this finding, we interviewed some medical administrators among our participants. Based on these interviews, hypothesized that this might be related to the large difference between the work they perform onboard and on land, and that cumbersome planning and writing work leads to frequent overtime and increased smoking caused by stress. This hypothesis also suggests that we should pay attention to the daily working hours and smoking habits of medical staff in a follow-up study.

PCS scores decreased more for medical personnel who had no confidence in their ability to perform humanitarian mission-related tasks—such as coordination with the local government and military, medical needs communication, epidemiological investigations, personalized medical outpatient arrangements, and ward setting—before sailing, which are quite obviously more challenging and pressurizing than their previous work in domestic hospitals. The lack of confidence indicates these participants did not sufficiently prepare for the mission physically or psychologically, or that they did not have a very positive attitude toward conducting long-term medical assistance tasks at sea. This is

important to consider when selecting medical personnel to carry out such missions. Those who participate in the long-range medical assistance missions should be proactive, mentally prepared, and have strong confidence. In terms of mental health, MCS scores decreased significantly more in older medical staff than in younger staff. A study in the UK^[25] showed that suicide rates were higher for older seafarers, compared to those who were younger. In a study on Lithuanian and Latvian seafarers^[26], age was found to be a main predictive factor for psycho-empirical stress 2.7–2.8 into a voyage.

In our study, lack of family support was a mental health risk factor for medical personnel. Meanwhile, a survey conducted by Li Jing^[27] found that for 22% of seafarers, family problems were the most significant factor in terms of their psychological stress. Some studies have discussed the association between social support and seafarers' HRQoL. Jing Xiao et al. found that social support has a significant positive effect on HRQoL in Chinese seafarers^[28]. Research on Polish seafarers^[29] also indicated that social relationships have a large impact on their QoL. Social support is defined in terms of social network characteristics, such as assistance from family, friends, neighbors, and other community members, that help individuals cope with everyday life, particularly in response to difficult situations^[30–31]. In the research design stage, after preliminary investigation, we found that for these medical personnel who would perform long-term missions at sea, the hospital at which they worked on land and their colleagues all expressed strong support and willingness to help them resolve their problems during their leave period. However, their family members, especially parents, spouses, and children, may have shown unsupportive attitudes, because they were worried about their health and could not afford for them to take such a long leave period. Therefore, we focused on the domain of family support for medical personnel, and our findings indicated the importance of this type of social support for their mental health.

4.1. Limitations

First, it should be noted that HRQoL in the present study was based on the subjective assessment using the SF-12 of medical personnel onboard a hospital ship; no objective measurements were applied. Thus, the analysis was based strictly on subjective indicators of HRQoL. In future research, we may consider including some objective physiological indicators, such as blood pressure, vital capacity, hematologic tests, and other laboratory diagnostic indicators. Second, lifestyle factors, such as smoking habits, frequency of physical exercise, and working hours per day, were not analyzed as influencing factors in this study. Thus, we will make modifications to the study design in future research.

5. Conclusions

Using a cohort study design, this study investigated changes in and influencing factors for medical personnel's HRQoL during a 2017 humanitarian mission on a Chinese hospital ship, the "Peace Ark". Results indicated long-term voyages negatively impact HRQoL in medical personnel. PCS scores were negatively associated with female gender and occupation type (administrative staff). Lower MSC scores were associated with older age and less family support. These findings provide evidence that supports

optimized selection criteria, training procedures, and social support, and also provide a reference for similar humanitarian missions in the future.

6. List Of Abbreviations

HRQoL: health-related quality of life

PCS: physical component scale

MCS: mental component scale

7. Declarations

Ethics approval and consent to participate:

The study complied with all principles of voluntary participation and was conducted in accordance with the Declaration of Helsinki. Ethical approval was granted by the ethics committee of the Second Military Medical University. the ethical approval code is 2014LL015. The consent procedure for the study was also approved by the ethics committee.

Consent for publication:

All participants gave informed consent.

Availability of data and materials:

No additional data are available.

Competing interests:

The authors declare that they have no competing interests.

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Author Contributions:

Xu Liu, Bihan Tang, and Hailing Zhang contributed equally to this work. Xu Liu and Lulu Zhang conceived the idea and the designed the study. Yingnan Han and Fangjie Zhao collected the data. Bihan Tang, Hailing Zhang and Chaoqun Hu accomplished data curation and analysis. Xu Liu, Bihan Tang and

Hailing Zhang drafted the manuscript. All of the authors critically revised the manuscript for important intellectual content. All of the authors read and approved the final version of the manuscript.

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Tables

Table 1
Demographics and other influencing factors among medical personnel

Variable	N	Percentage (%)	PCS	MCS	
			Mean (SD)	p-value	Mean (SD) p-value
Total	90		52.34(5.07)		53.03(6.40)
Gender				0.0830	0.5689
Male	43	47.78	51.36(5.27)		52.91(6.06)
Female	47	52.22	53.23(4.77)		53.15(6.77)
AGE				0.4637	0.4007
< 40	55	61.11	52.62(5.15)		52.4(7.07)
≥ 40	35	38.89	51.9(4.99)		54.03(5.11)
Education Level				0.0816	0.6664
Undergraduate	44	48.89	53.18(5.14)		52.38(7.07)
Master	19	21.11	52.55(3.72)		53.31(5.51)
Doctor	27	30.00	50.82(5.58)		53.91(5.92)
Marriage Status				0.7982	0.0803
Married	81	90.00	52.37(5.08)		52.69(6.45)
Single	9	10.00	52.05(5.29)		56.15(5.22)
Occupation				0.5342	0.9681
Nurse	20	22.22	53.63(4.09)		52.91(5.74)
Doctor	54	60.00	52.24(5.08)		52.83(7.09)
Other	16	17.78	51.09(6.01)		53.88(4.79)
Confidence				0.3691	0.7895
Yes	70	77.78	52.57(5.02)		53.06(6.65)
No	20	22.22	51.53(5.28)		52.96(5.6)
Family Support				0.9303	0.5970
Yes	56	62.22	52.15(5.4)		53.38(6.29)
No	34	37.78	52.66(4.53)		52.47(6.64)
Voyage Experience				0.6937	0.5547

Variable	N	Percentage (%)	PCS		MCS	
			Mean (SD)	p-value	Mean (SD)	p-value
Yes	53	58.89	52.66(4.75)		52.95(5.78)	
No	37	41.11	51.88(5.54)		53.16(7.28)	

Table 2
Multiple stepwise regression analysis of factors independently associated with PCS and MCS scores

Category	β	SE	t-value	p-value
Dependent variable: PCS				
Gender (female)	4.22684	1.414737	2.9877	0.0037
Confidence (no)	4.384129	1.46062	3.0015	0.0035
Occupation (nurse)	-8.23507	2.056843	-4.0037	0.0001
Occupation (doctor)	-8.25848	1.616136	-5.1100	< 0.0001
Dependent variable: MCS				
Age (older)	3.7529	1.4363	2.6128	0.0106
Family support (no)	3.5303	1.4442	2.4444	0.0165

β , regression coefficient; SE, standard error. The inclusion criterion of the stepwise regression was $p = 0.05$; exclusion criterion was $p = 0.10$.