

Self-evaluation of Health State in Chinese Navy of Different Fleets

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Research

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Abstract

Objective: To clarify physical and psychological health state and potential medical need of Chinese navy.

Methods: A cross-sectional study was performed in the total of 438 personnel of two fleets in different latitudes in China by self-reported questionnaire. The physical and psychological states were investigated and the potential medical needs were explored.

Results: The top was muscle and skeletal system disease, affecting to 59% of the population, followed by respiratory disease, skin disease, oral disease, et al. The frequency of oral disease increased gradually, with the first peak at 26-30 years old. Ophthalmic and Ear-nose-throat diseases increased rapidly over 40 years old. The frequencies of above diseases were higher in submarine of Fleet B than that of Fleet A ($P<0.05$). In Fleet A, the frequencies of influenza and diarrhea in submarine were higher than those in surface fleet ($P<0.001$). The corps with low psychological self-evaluation suffered more diseases than those with high evaluation ($P=0.04$).

Conclusions: Fleets in different latitudes exhibited different disease frequencies. **Submarine force was more susceptible to infectious disease** than surface fleet possibly due to the closed environment. High effective medical care should be given according to the age threshold of **25** and **40**.

Introduction

Navy corps is supposed to be the major defensive support for costal countries. Many missions of Navy corps are implemented either offshore or far sea. The health states of the corps, working and living in such an environment different from inland, should be given the special concern. Neuromusculoskeletal injuries were considered as one of the largest detractors from military readiness and causes of disability in the military, and early physical therapists intervention can prevent and rehabilitate injuries and promote human performance optimization by a ten-year review¹⁻². Numerous evidence suggested the link between deployment and development of chronic lung disease³. An Acceptance and Commitment Therapy (ACT)-based program called Mindfulness for Pain and Performance Enhancement (MPPE)⁴, was proved to help recruits effectively handle pain and improve their physical performance. The impact of psychological stressors should also be addressed within naval service populations⁵. Tele-critical care (TCC) has recently been taken as a effective means to extend intensivist expertise and to improve outcomes of critically ill patients⁶. Several evaluation systems including NPS(U.S. National Park Service)⁷ and high-fidelity medical simulation scenario⁸ were successfully applied to assess the medical demand of Navy and the of medical training.

In recent years, Chinese Navy has developed and undertaken multiple international ocean navigations, including Somalia escort, Gulf of Aden escort, multi country joint naval training, including RIM of the pacific (RIMPAC), and many kinds of military visits. The navy corps routinely takes a long journey, exposes to the complex climates and environments, and therefore may be stressed a lot from physical

and psychological problems. In addition, spectrum of disease and life style in China especially for young people has been changed a lot⁹⁻¹⁰. Thus the health states of Chinese Navy and the health demand remains unclear and should be urgently updated.

Methods

Participants

A cross-sectional study was performed in two fleets of Chinese Navy (termed as Fleet A and Fleet B) which are located in different latitudes and climates. The total of 438 personnel was enrolled in this study, including 159 of Fleet A and 279 of Fleet B. Fleet A involved 79 personnel served for the surface fleet and 80 served for the submarine force. All Fleet B members were served for the submarine force. All the recruits were male with the average age of 25.82 ± 5.08 years (Age group of 16-25: 22.29 ± 2.00 years; Age group of 26-35: 29.29 ± 2.67 years; Age group of 36-45: 39.16 ± 3.08 years). The average employment time in the Navy was 7.15 ± 5.02 years.

Questionnaire and epidemiological investigation

A self-reported questionnaire was designed by three investigators (XT, YD, HZ). After two rounds of pre-survey, final version of the questionnaire was determined and included the following three main parts (Appendix A). The demographic characteristics such as age, gender, service years in the Navy was recorded in Part one. Part two was composed of two multi-choice questions(Q1, Q3), eight single-choice questions (Q16-Q23) and one essay question (Q24), in which basic physical and psychological problems were acquired. Part three was composed of seven multi-choice (Q2,Q4,Q5,Q8,Q10,Q12,Q13), five single-choice (Q6,Q7,Q11,Q14,Q15) and one essay questions (Q9), in which the potential risk factors related to the health, hygiene consciousness, medical needs were investigated. Because the questionnaire was self-administered, all the questions were listed according to the logical order so that those pulled were easy to follow. Except for the questionnaire, 20 Navy medic in Fleet A were personally interviewed on the current measures of healthy and epidemic prevention, future demand of Navy hygiene and health care workers. All procedures performed in our studies involving human participants were in accordance with the ethical standards of the Institutional Ethical Review Board of Naval Medical University (reference number: TMEC2014-002) and with the 1964 Helsinki declaration. And verbal consent of the respondents was obtained before the interviews were conducted.

The surveyors were trained according to the standardized protocol. The investigation began in Sep 2016 and last five days. The primary data was double checked by the two different entry personnel. The missing items were completed or deleted as appropriate. The response rate of each question was calculated.

Statistical analysis

Comparative analysis was performed between submarine force and surface fleet, or between Fleet A and Fleet B. The comparison of categorical data was performed using Chi-square test. The quantitative data was analyzed using Student t test. All statistical tests were two-sided and conducted using Statistical Program for Social Sciences (SPSS 21.0, Chicago, IL, USA). A P-value of <0.05 was considered as statistically significant.

Results

Self-assessment of physical state of Navy corps

The self-reported rates of common diseases in two fleets were sorted in descending order as following: muscle and skeletal system disease, respiratory disease, skin disease, oral disease, digestive disease, and ophthalmic and ear-nose-throat diseases. Such a trend was also found in the surface fleet or submarine force of Fleet A, or Fleet B. As to the submarine branch, the self-reported rates of all the common diseases were significantly higher in Fleet B than Fleet A (Table 1). In Fleet A, skin and respiratory diseases were significantly higher in the surface fleet than that in the submarine force, and other common diseases exhibited similar trend without significance.

The self-reported rate of each disease was obviously increased with the age (Figure 1). The frequencies of digestive, respiratory and skin diseases were rising steadily. Muscle and skeletal system disease kept about the frequency of 60% under age 30, while over age 30, the frequency approximately increased up to 80%. Two peaks of the frequency of oral disease occurred in the age group of 26-30 and 36-40, respectively. The self-reported rate of ophthalmic and ear-nose-throat diseases increased a lot over age 40.

We further investigated the self-reported rates of infectious diseases that the corps had in the past six months. Generally, the most common infectious diseases were influenza and diarrhea with the frequencies of 65.1% and 48.6%, respectively. Moreover, the corps with age of 21-25 was high risk group predisposed to these two common diseases, in which the frequencies of influenza and diarrhea were 42.4% and 46.2%, respectively. Other infectious diseases according to the frequency in descending order were malaria, hepatitis, and pulmonary tuberculosis. The self-reported rates of infectious disease in the submarine force of Fleet A and Fleet B were similar ($P>0.05$ Figure 2). In Fleet A, the frequencies of influenza and diarrhea in the submarine force were much higher compared to that of surface fleet ($P<0.001$). This indicated that airtight cabin of submarine force can effectively increase the possibilities of pathogen transmission. Specially, Fleet B, contributing 70% to the total malaria patients, reported more patients than the submarine force of Fleet A (2.7% (7/264) vs 1.3% (1/76), $P=0.690$).

Self-assessment of psychological health

The psychological problems were reported in 47.3% of the corps, and the frequency was definitely increased with the age. In the age group of 21-25, the reported frequency reached to 47.1%. The age

group of 31-35 took much higher reported rate of 62.5%. All the personnel with the age of 41-45 reported psychological problems, though it was partially because of small sample size. The total of 10% of the soldiers reported to be ever got psychological problems. Although the rate of **ever** being sick with psychological problems in the submarine force of Fleet A was higher than that of Fleet B (16.7% vs 8.1%, $P=0.028$), the self-reported rate of the **existing** psychological problem of the former was much lower than that of the latter (29.5% vs 52.6%, $P<0.001$). This indicated some intervention in Fleet A may be responsible for this change. Furthermore, in Fleet A, the frequency of the existing psychological problem of the submarine force was significantly lower than that of the surface fleet (29.5% vs 46.8%, $P=0.019$).

The events reflecting current psychological state were also exhibited in Table 1. Over half of the personnel suffered from trouble sleeping. Of those with the existing psychological problem, 70.15% was reported to have trouble in sleeping. More “trouble sleeping” (56.3% vs 38.5%, $P=0.007$) and “being awakened by horrible dream” (48.7% vs 33.3%, $P=0.02$) existed in Fleet B than that of the submarine force of Fleet A. In Fleet A, more “trouble sleeping” (56.4% vs 38.5%, $P=0.037$) while less “being worried about training injury” (48.1% vs 53.9%, $P=0.004$) were significantly reported in the surface fleet compared to the submarine force.

Table 1

Self-reported rates of physical or psychological problems in the Navy corps during March to September, 2014

Problems	Frequency of Fleet A (%)		Frequency of Fleet B (%)	Total (%)
	surface	submarine	submarine	
Physical				
Muscle and skeletal system	53.3	49.4	63.6**	59.0
Respiratory system	45.3*	35.0	50.0**	46.3
Skin disease	41.3*	22.1	45.3**	40.2
Oral cavity	25.3	18.2	38.8**	32.4
Digestive system	17.3	16.9	34.1**	27.8
Ophthalmic and Ear-nose-throat diseases	13.3	7.8	18.2**	15.4
Psychological				
Trouble sleeping	56.4*	38.5	56.3**	53.1
Being awakened by horrible dream	44.9	33.3	48.7**	45.2
Special scene flashed in the mind	48.7	43.6	50.5	51.0
Being worried about training injury	48.1*	53.9	66.4	61.1
Being affected by sailing over 7 days	58.4	49.4	42.6	47.0
Being confident with the mission assigned by the supervisor	90.8	92.3	87.8	89.2
Being friendly with others	96.2	98.7	97.8	97.7
* $P < 0.05$, When compared the surface fleet to the submarine force of Fleet A				
** $P < 0.05$, When compared the submarine force of Fleet A to that of Fleet B				

Although 89.2% of those surveyed were confident with the mission assigned and 97.7% of people reported to be friendly with others, the average score of self-evaluation on psychological health was relative lower (77.83 ± 13.61). The self-evaluated score of Fleet A was higher than that of Fleet B (81.70 ± 12.08 vs 75.75 ± 13.96 , $P < 0.001$). The surface fleet reported significantly higher score than all the submarine force (80.48 ± 12.11 vs 77.34 ± 13.86 , $P < 0.001$). For submarine force, the score of Fleet A was

much higher than that of Fleet B (82.17 ± 11.49 vs 78.30 ± 11.45 , $P < 0.001$). To further clarify the relationship between the evaluation score and related risk factors, we defined the personnel scored under 60 as the unsatisfied group and that over 95 as the satisfied group. The unsatisfied group enrolled 25 personnel, including 1 in the surface of Fleet A, 2 in the submarine force of Fleet A, and 22 in Fleet B. The satisfied group enrolled 22 personnel, including 14 of Fleet A (6 in the surface; 8 in the submarine force) and 8 in Fleet B. Particularly, the average types of disease each person reported in the unsatisfied group were almost double than those in the satisfied group (2.8 vs 1.4, $P = 0.04$), which indicated physical health was closely correlated to psychological health.

Risk factors related to health problems

To further explore the risk factors related to the health of the corps, the potential items related to living condition, working environment, living habits and health education were listed (Table 2). Closed working condition of long term, humid climate of costal location, heavy maintenance of vessels were considered by the submarine force as the top reasons to cause disease. Whereas in the surface force, closed working condition of long term, humid climate of costal location, poor dietetic hygiene and shortage of fresh water supply were the top reasons. Except for the items in the questionnaire, the surface fleet made supplementary items affecting health: 1) no time to be hospitalized due to busy work; 2) too short time of exercise; 3) only physical examination without further therapy; 4) unqualified fresh water and tableware.

Table 2
The cognition of the corps about potential causes of disease.

Problems	Frequency of Fleet A (%)		Frequency of Fleet B (%)	Total (%)
	surface	submarine	submarine	
Long-term closed working condition	53.2	35.4	65.9	57.9
Humid climate of costal location	44.3	38.0	63.0	54.9
Heavy maintenance of vessels	30.4	48.1	59.6	52.1
Over-training	13.9	13.9	37.8	29.0
Lack of health knowledge and consciousness of health care	21.5	24.1	30.7	27.8
No regular physical examination	19.0	20.3	34.2	27.6
Poor dietetic hygiene, shortage of fresh water supply	34.2	13.9	26.3	25.5
Shortage of specialist, such as otolaryngologist, dermatologist	15.2	13.9	31.5	25.2
Complicated referral systems	13.9	10.1	32.6	25.0
Unhealthy living and dietary habits	16.5	15.2	19.3	18.0
Simple living facilities	10.1	11.4	4.4	13.6
Others	32.9	8.9	15.9	11.0

The corps of different age group complained different top risk factor. Heavy maintenance of vessels was taken as the top factor to affect health by age group of 16-20 and 31-40, while closed working condition of long term was the top factor by age group of 21-30 and overloaded training was the top factor by age group of 41-45. About 77% of the corps considered both the working and living conditions should be improved.

The unhealthy living habits reported was ranked by smoking, alcohol intake, drinking strong tea, chewing arecas, biting nails, which were all traditional unhealthy habits in modern China¹¹ (Figure 3A). Such a trend was similar either for the surface fleet or the submarine force. Fleet B reported significant higher frequency of drinking alcohol than the submarine force of Fleet A (58.0% vs 34.8%, $P=0.01$). We also investigated the approaches the corps acquired the knowledge of health care. The most popular way was medical doctors and nurses either for different fleets or branches, followed by network, families and friends, professional books, and popular magazines (Figure 3B). In addition, about 76.1% of the corps

considered it necessary to set up the specialists including otolaryngologist and dermatologist when executing a mission on the sea. Above indicate that health workers including the specialist played an important and irreplaceable role to perform health care and health promotion for the Navy.

To investigate the unexpected factors which may affect performing medical service, the total of 20 Navy medics in Fleet A was personally interviewed, including 10 had bachelor degree and 10 had senior college degree. The most serious problem reported is the members can't be quickly adaptable to their job and working environment after graduation, which was mainly because their major was clinic medicine other than family medicine. Some of the medics just graduated even could not succeed in performing intravenous injection although they might join the complex surgery in the hospital during their intern. So the corps preferred nurses to young medical doctors for medical need, which made the medics frustrated for a long time even suffered from mental disease at the end. Thus family doctor was the first urgent medical need for Chinese Navy. The second problem is the air pollution caused by disinfection of ultraviolet radiation, especially in the confined space without good ventilation like the submarine. Most of the vessels made by iron and steel also limited the extensive application of the effective disinfectant acetic acid peroxide.

Discussion

In this paper, for the first time, we exhibited the major spectrum and frequencies of diseases of Chinese Navy in different sea areas, and further compared the health state and related risk factors in different fleets and branches including submarine force and surface fleet. The muscle and skeletal system disease, affected up to 59% of the population, was the top one complained by the Navy despite of different fleets or branches¹². The age was one of the most important risk factors affecting physical health¹³. As Figure 1 shown, 25 and 40 were considered as the age boundaries stratifying service time into three stages: Stage I: ≤ 25 yrs; Stage II: ≥ 25 yrs and ≤ 40 yrs; Stage III: ≥ 40 yrs. In Stage I, muscle and skeletal system disease, respiratory disease and skin disease were the main physical problems. Stage I was also susceptible to the infectious diseases. Except for these diseases, oral disease increased a lot since Stage II. The self-reported rates of ophthalmic and ear-nose-throat diseases increased rapidly since Stage III. The otolaryngologist and dermatologist were supposed to go along with the corps when executing the mission on the sea¹⁴. Therefore medical needs should be met with the age and mission related issues by utilizing multilevel prevention¹⁵. Although the physical health state was not confirmed by the physicians in this paper, the self-assessment seemed to provide more valuable information in a sense^{16,17}. Most of the Navy corps is young person and the naval service was of high density, so they prefer holding back the discomfort to seeing a doctor, especially for the chronic non-communicable diseases¹⁸. Therefore the self-assessment beyond clinical diagnosis may reflect the real world and urgent medical needs more extensively¹⁹. However, the evaluation on physical state in our study was somewhat superficial as to the Navy corps. Physical fitness including endurance, power, agility should also be assessed²⁰⁻²¹.

As known, not only the physical state but also psychological health affects the performance in military occupations²²⁻²³. It has been suggested that the research on the Navy, Army, Air force should be treated as separate entities¹⁹. Our investigation indicated psychological problems were the very common issue in the Navy²⁴. Moreover, the submarine of Fleet B complained more psychological problems than that of Fleet A, including trouble sleeping, horrible dreams in the last six months, being worried about military training injury, being affected by sailing over 7 days, being lack of confidence with the mission, low self-evaluation on psychological health. All these clues indicated that the psychological state of different branches of Navy corps were different²⁵, although they shared similar environment of submarine. Fleet B reported closed working condition of long term whereas the submarine force of Fleet A took heavy maintenance of vessels as the top reason to cause disease (Table 2), which indicated poor physical state of Fleet B may be due to the tasks with longer term. Furthermore, the submarine force of Fleet A reported more rates of ever being sick while less rates of existing psychological problem compared to that of Fleet B. According to the survey on the medic of Fleet A, the psychological guidance was performed regularly, including publicizing psychological health knowledge, outdoor expend training and group counseling. Thus the early psychological guidance in the Navy was suggested to be set up systemically and individually according to the different military branches and missions. Additionally, the psychological status was highly consistent with the related events including trouble sleeping in our investigation, although system checklist-90 (SCL-90), the classic questionnaire, was not applied to evaluate the state of the corps. For example, over 70% of the corps with existing psychological problem complained trouble sleeping, which was coincident with other studies²⁶. That over half of corps was trouble in sleeping in our study was also consistent to the study of sleeping deprivation on US.Navy²⁷.

Although both Fleet A and B have submarine branch, the self-rated health of Fleet B was relative poorer than that of the submarine force of Fleet A. The self-evaluation score was correspondingly lower in Fleet B than that of Fleet A. Smoking was reported more in Fleet B than the submarine force of Fleet A. These clues partially confirmed that military service could influence health via health behavior²⁸ and might heighten the risk of initiating smoking²⁹. Nevertheless, under such a limited space for physical activities, no sunlight exposure and noisy environment, submariners are the high risk population susceptible to the common diseases and infectious diseases, of which medical needs should be assessed comprehensively and independently³⁰. The epidemic of malaria by self-report in our study was more serious than US.Navy and Marine corps from 2013 statistics³¹, although the epidemic of malaria in China decreased in these years. Both navies either engage in the military missions or supply the aids in malaria-endemic regions. Thus quarantine restriction and isolated therapy was supposed to be the key issue contributing to the gap of malaria epidemic between Chinese Navy and US.Navy.

Conclusion

Fleets in different latitudes exhibited different frequencies of diseases. Submarine force was more susceptible to infectious disease than surface fleet possibly due to the closed environment. The detail medical service for submarine force of Navy should be special on control and intervention of infectious

disease. High effective medical care, including routine physical examination, rehabilitation and the support from specialists when executing long-term navigation, was supposed to be given separately according to the age threshold of 25 and 40. The physical health was closely correlated to the psychological health. Family doctor was the first urgent medical need for Chinese Navy.

Declarations

Acknowledgements

The authors thank all research participants during the investigation.

Authors' contributions

Drs. Yibo Ding and Shaoping Wu analyzed whole data independently and presented the same results. Drs. Yibo Ding, Hongwei Zhang and Xiaojie Tan were responsible for the questionnaire development and English translation. Drs. Yan Liu and Yujia Zhai were responsible for data entry. Drs. Hao Wang and Jiluo Liu were responsible for epidemiology investigation. Drs. Shaoping Wu was responsible for statistical analysis. Pros. Guangwen Cao and Xiaojie Tan designed and organized the study and drafted the manuscript.

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Availability of data and materials

The dataset used in this study could be supplied on request.

Ethics approved and consent to participate

All procedures performed in our studies involving human participants were in accordance with the ethical standards of the Institutional Ethical Review Board of Naval Medical University (reference number: TMEC2014-002) and with the 1964 Helsinki declaration. And verbal consent of the respondents was obtained before the interviews were conducted.

Consent for publication

Not applicable.

Competing Interests

The Authors declare that there is no conflict of interest.

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Figures

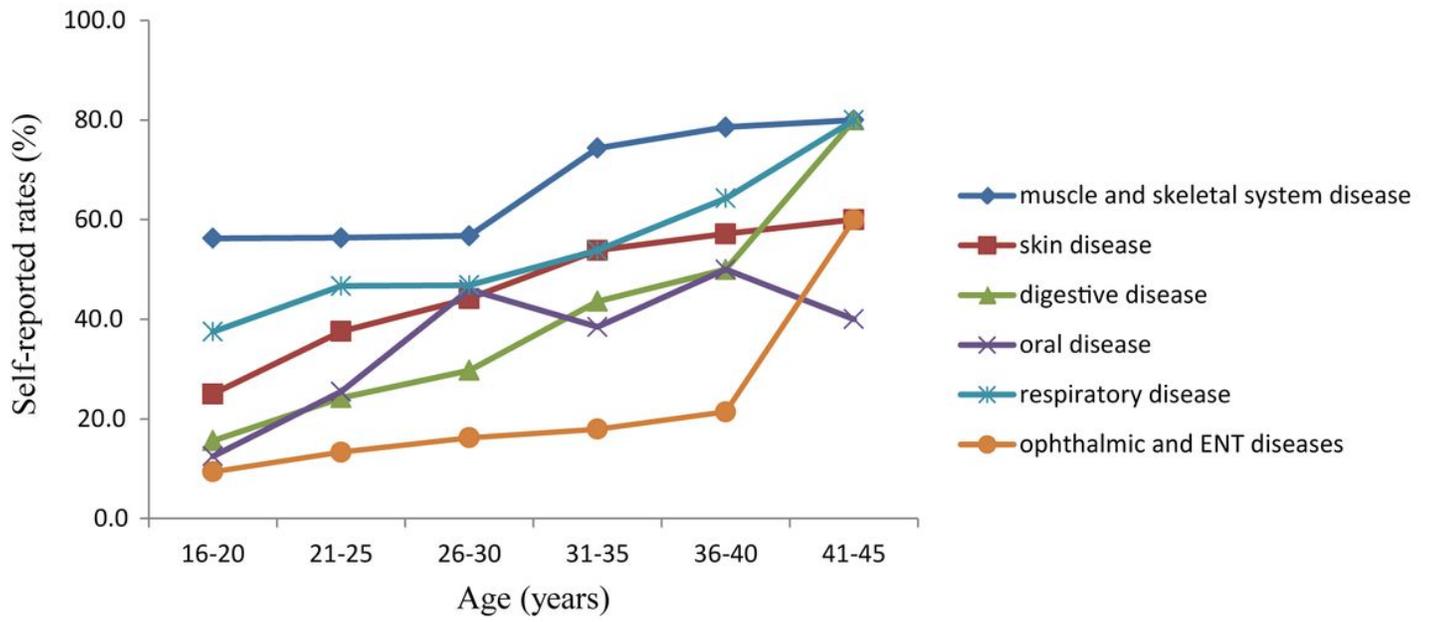


Figure 1

The common diseases the Navy reported with age increasing

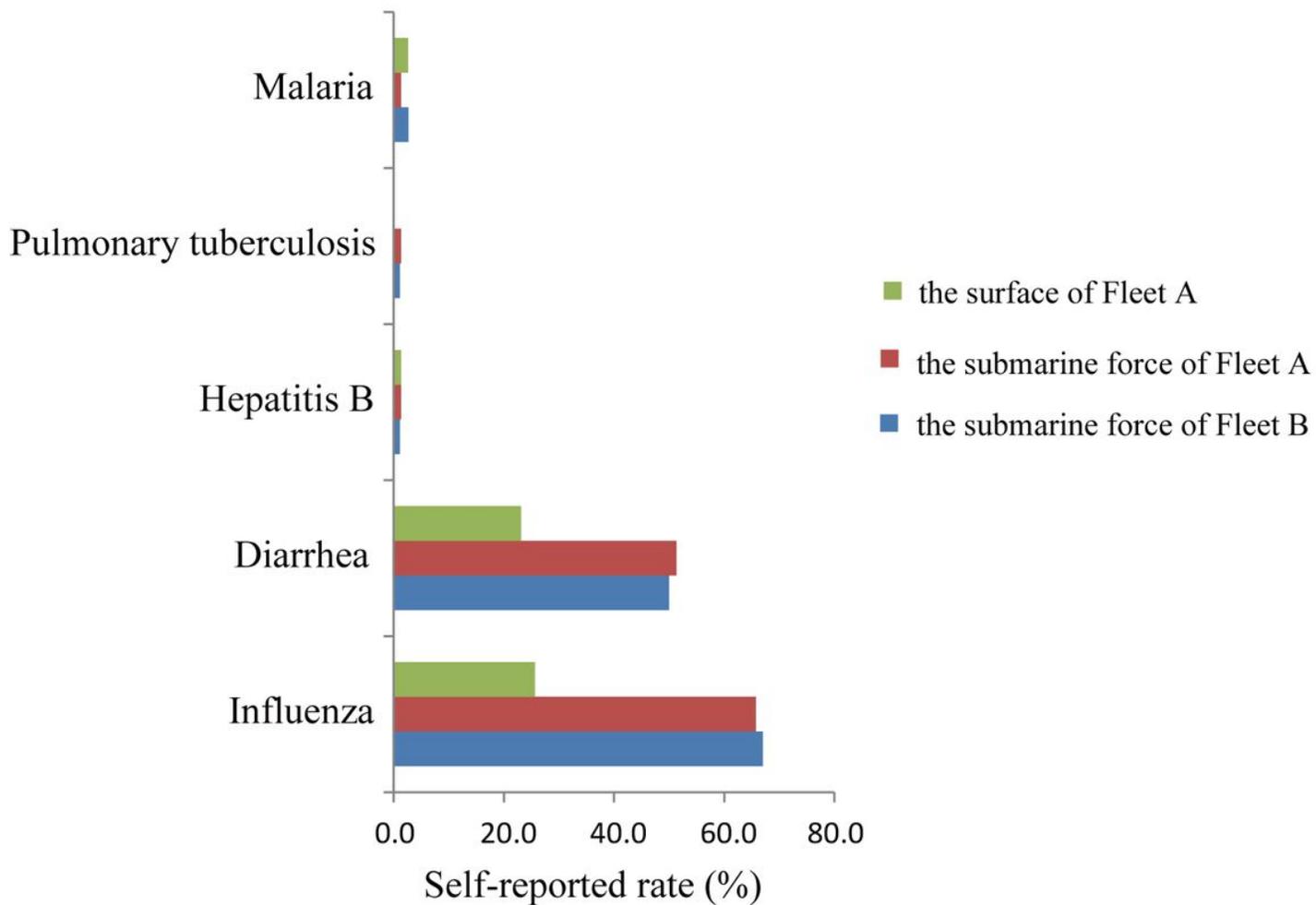
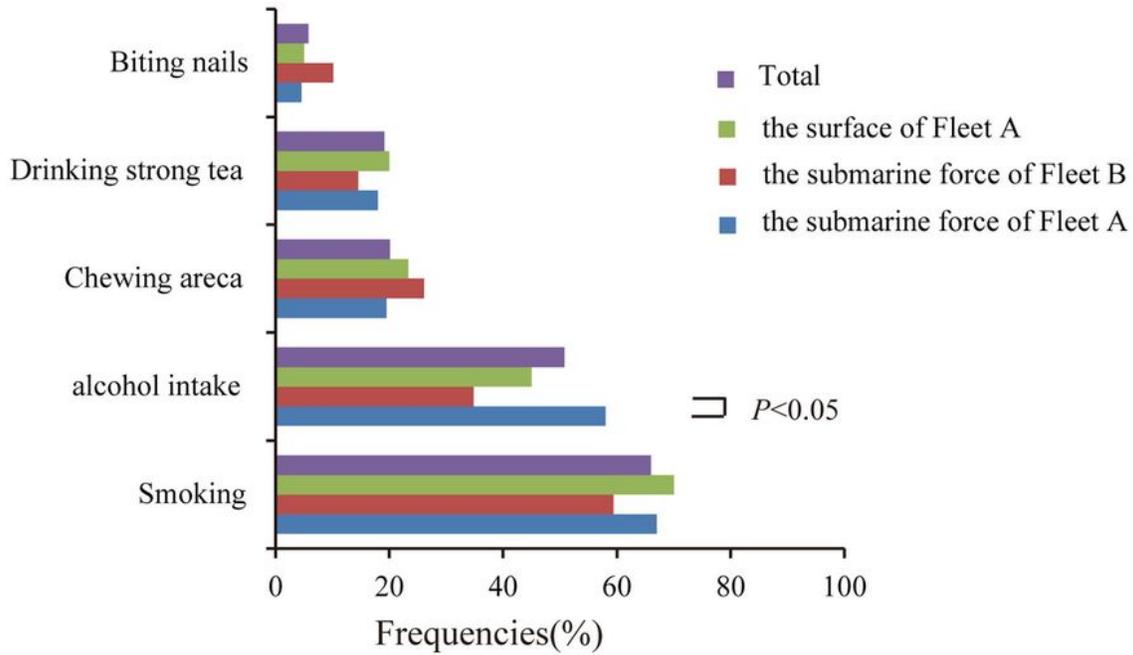


Figure 2

The common diseases the Navy reported with age increasing

A



B

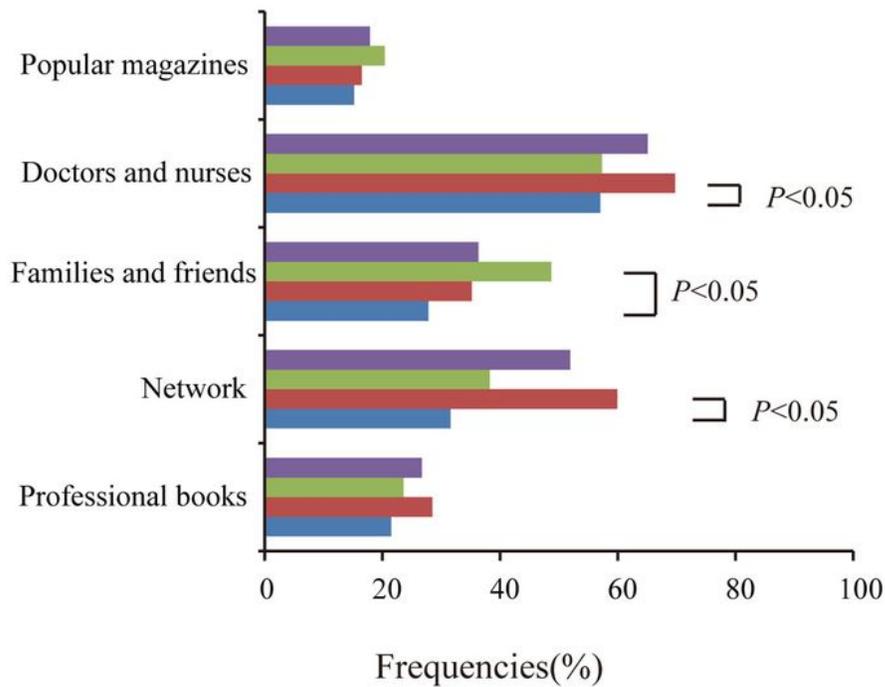


Figure 3

Frequencies (%) of unhealthy living habits (A) and the approaches by which the corps acquired health care knowledge (B).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AppendixA.docx](#)