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CHANGES IN THE UKRAINIAN EXPEDITIONERS' PSYCHOLOGICAL STATES DURING LONG ANTARCTIC STAY

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Introduction. Extreme conditions of Antarctica and socio-spatial isolation of a small group of expeditioners' significantly affect their physiological and psychological state.

Aim. To empirically investigate the changes in the expeditioners' psychological state indicators during a year-long Antarctic expedition.

Methods. For statistical analysis were used Descriptive statistics (mean, standard deviation); One-Sample Kolmogorov-Smirnov Test; and Paired Sample T-Test.

Results. The self-assessed indicators of expeditioners' psychological states rise significantly during the first four months of the year-long expedition. Then their average self-esteem begins to decline gradually, reaching the lowest values in the last two months of stay at the Antarctic station.

Conclusions. This study confirms that the long stay and work within an isolated group of people is a factor that affects the expeditioners' psychological health at the first place.

Key words: Antarctic station, Antarctic expedition, expeditioners, socio-spatial isolation, psychological states.

Кокун Олег, Бахмутова Лариса. Зміни психологічного стану українських експедиторів під час тривалого перебування в Антарктиці.

Вступ. Екстремальні умови Антарктики та соціально-просторова ізоляція невеликої групи експедиторів істотно впливають на їх фізіологічний та психологічний стан.

Мета. Емпірично дослідити зміни показників психологічного стану експедиторів під час річної антарктичної експедиції.

Методи. Для статистичного аналізу були використані описові статистичні дані (середнє значення, стандартне відхилення); одновибірковий критерій Колмогорова-Смірнова; та парний Т-тест.

Результати. Було виявлено, що показники психологічного стану суб'єктивної самооцінки експедиторів Української антарктичної станції «Академік Вернадський» значно зростають протягом перших чотирьох місяців річної експедиції. Потім їхня середня самооцінка починає поступово падати, досягаючи найнижчих значень за останні два місяці перебування на антарктичній станції.

Висновки. Це дослідження підтверджує, що тривале перебування та робота в ізольованій групі людей є чинником, які впливають, перш за все, на зміни психофізіологічного та соціально-психологічного стану експедиторів.

Ключові слова: антарктична станція, антарктична експедиція, експедитори, соціально-просторова ізоляція, психологічні стани.

Кокун Олег, Бахмутова Лариса. Изменение психологического состояния украинских экспедиционеров за время длительного пребывания в Антарктике.

Вступление. Экстремальные условия Антарктиды и социально-пространственная изоляция небольшой группы экспедиционеров существенно влияют на их физиологическое и психологическое состояние.

Цель. Эмпирически исследовать изменение показателей психологического состояния экспедиционеров в течение годичной антарктической экспедиции.

Методы. Для статистического анализа использовалась описательная статистика (среднее значение, стандартное отклонение); одновыборочный критерий Колмогорова-Смирнова; и парный выборочный Т-тест.

Результаты. Выявлено, что показатели самооценки психологического состояния участников экспедиции значительно повышаются в течение первых четырех месяцев годичной экспедиции. Затем их средняя самооценка начинает постепенно снижаться, достигая самых низких значений в последние два месяца пребывания экспедиции на антарктической станции.

Выводы. Это исследование подтверждает, что длительное пребывание и работа в изолированной группе людей является фактором, влияющим в первую очередь на психологическое здоровье экспедиционеров.

Ключевые слова: антарктическая станция, антарктическая экспедиция, экспедиционеры, социально-пространственная изоляция, психологические состояния.

Introduction. Over the past decades, the activities of people in polar regions have significantly intensified, diversified and expanded. In the permanent research polar stations, people stay throughout the year. There are specialists both of scientific (biologists, geologists, physicists, geophysicists etc) and engineering profiles which maintain the monitoring investigations and life support of the station. These groups of people during a long time have been working in extreme environmental conditions and socio-spatial isolation. Preserving the physical and psychological health of expedition members requires monitoring of their psychophysiological and social-psychological state.

Analysis of recent publications. Adaptation, physical symptoms, biomarkers of stress, psychological effects and mental health during prolonged exposure to Antarctica's extreme environment has been repeatedly investigated by many authors: Alfano et al. (2021); Bhargava, Mukerji, & Sachdeva (2000); Chen, Wu, Li, Zhang, & Xu (2016); Chengli et al. (2003); Palinkas (2002); Palinkas, Reed, & Do (1997); Palinkas, & Suedfeld (2008); Rothblum (1990); Steinach, & Gunga (2021); Tortello, Barbarito, Cuiuli, Golomberg, Vigo, & Plano (2018); Weiss, Suedfeld, Steel, & Tanaka (2000); Zimmer, Cabral, Borges, Côco, & Hameister (2013) etc.

Extreme conditions of Antarctica and socio-spatial isolation of a small group of expeditioners' significantly affect their physiological and psychological state. This is characterized by psycho-physiological and psychoemotional instability such as: anxiety, reduced performance, grumps and depression, low activity and normative behaviour, fatigue, loss of self-control, relationship tension, self-isolation, formation of micro groups which affects to health, discomfort level, personalities interaction in isolated group (Bakhmutova, 2021; Belkin, Dyurgerov, Finaev, & Soroko, 2016; Kokun, & Bakhmutova, 2021; Nicolas, Suedfeld, Weiss, & Gaudino, 2016; Wood, Lugg, Hysong & Harm, 1999).

The impact of Antarctic climatic conditions on human bodies is exacerbated by living conditions at polar stations. These are monochrome and monotony of the environment, the effects of polar night and polar day, the monotony of the landscape, communication with the same people etc. According to Khandelwal, Bhatia, & Mishra (2017); Mullin (2006); Palinkas, & Suedfeld (2008); Roberts (2011) and other researchers this significantly affects to behavior, well-being and mental health.

The main stress factors for the crew members of well equipped polar stations, submarines and cosmic orbital stations are individual adaptation to the group, lack of confidentiality, sufficient personal space and interpersonal distance, habitual sources of emotional and physical pleasure (Mullin, 2006; Suedfeld, & Steel, 2000; Stuster, 1996; Weiss, Suedfeld, Steel, & Tanaka 2000). Prolonged socio-spatial isolation from the general public within a small group of people, lack of habitual external stimuli, comfortable living conditions, isolation from families and disruption of contact with relatives and friends are the main causes of emotional stress (Sandal, Leo, & Palinkas, 2006; Suedfeld, 1998). This can have a more significant effect on their physical and psychological condition than natural extreme conditions (Pagel, & Choukèr, 2016; Palinkas, & Suedfeld, 2021; Temp, Lee, & Bak, 2017).

During a long stay at the Antarctic station the people often have symptoms such as: deterioration in health, activity, mood, uneasiness, headaches, loss of sleep and performance (Collet et al., 2015; Folguesta et al., 2019; Kokun & Bakhmutova, 2020; Sandal, van deVijver, & Smith 2018), increased anxiety, tension, irritability, aggression, anger, and confusion (Chen, Wu, Li, Zhang, & Xu, 2016; Zimmer, Cabral, Borges, Côco, & Hameister, 2013). Sometimes the mood disorders of people are progressed to a generalized and social anxiety, panic disorders, phobias, neurotic or depressed state, obsessive-compulsive disorders. Anxiety and tension increase the most at the end of the Antarctic expedition (Bhargava, Mukerji, & Sachdeva, 2000; Khandelwal, Bhatia, & Mishra, 2017; Palinkas & Suedfeld, 2008; Roberts, 2011).

Expeditionary teams are characterized by the formation of micro groups and the emergence of intergroup and interpersonal conflicts on this basis (Chen, Wu, Li, Zhang, and Xu, 2016; Wood, Lugg, Hysong, and Harm, 1999). This negatively affects interpersonal relationships and efficiency of crew members. Therefore it is important to conduct careful psychological selection, training and psychological support of expeditioners' during the all period of activity (Grant et al., 2007; Leon, Sandal, & Larsen, 2011; Temp, Lee, & Bak, 2017).

Improving the ability to work, maintaining the psychological and physical health of expeditioners can be ensured by monitoring the subjective indicators of self-assessment of their psychological state. Such monitoring provides to increase the efficiency of people activities, because the information in real time allows to determine the nature and capability of psychological care and carry out the corrective actions if required (Karpoukhina, Kokun, & Zeltser, 2008; Kokun, Korobeynikov, Mytskan, Cynarski, & Korobeynikova, 2019).

Thus, the **aim** of our study is to examine the changes in the psychological state indicators of people during a one-year Antarctic expedition.

Methods. We used the modified method of scaled self-assessment of psychological states of people based on the Scaled Self-Assessment of Psycho-physiological State (Kokun, Korobeynikov, Mytskan, Cynarski, & Korobeynikova, 2019). This method allows fast and precisely assessing the various components of psychological states and allow to study the psychological condition of people when working in extreme conditions environments (Karpoukhina, Kokun, & Zeltser, 2008; Kokun & Shamich, 2016).

Our study was conducted on two types of subjective psychological indicators: 1 – Indicators of psychophysiological state; 2 – Indicators of social-psychological state. According to these indicators (Table 1), *thirteen series of monthly* surveys of *twelve expeditioners* (all men aged from 29 to 60 years) of Ukrainian Antarctic station *Akademik Vernadsky* was carried out. The poll was conducted with voluntary consent.

Table 1

Indicators of the changes psychological states

1– Indicators of psychophysiological state	2 – Indicators of social-psychological state
• well-being	• satisfaction with relations with colleagues
• activity	• satisfaction with the environment
• mood	• satisfaction work performed
• performance	• life satisfaction
• health status	

For statistical analysis (programming package SPSS 22.0.0) we used Descriptive statistics (mean, standard deviation); One-Sample Kolmogorov-Smirnov Test; Paired Sample T-Test ($p \leq 0.05$).

Sample. The research was done by support of the State Institution National Antarctic Scientific Center of the Ministry of Education and Science of Ukraine (NASC) which organize the annual scientific expeditions to the Ukrainian Antarctic station «Akademik Vernadsky» located on Galindez Island, Argentine Islands (65°15'S, 64°16'W). This is main operator in Ukraine for coordination of logistic operation and scientific research in Antarctica according to State Special-Purpose Research Program in Antarctica for 2011-2023.

Results and discussion. The analysis of subjective indicators of self-assessment of psychophysiological state of expeditioners of Ukrainian Antarctic station «Akademik Vernadsky» allows to considering the change of its components (well-being, activity, mood, performance, health status) in dynamics for 13 months. Figure 1 shows that all five indicators of subjective self-assessment of the psychophysiological component of the psychological state significantly increase during the first four months of expedition (April–July) compared to the result obtained during team training before departure to Antarctica (March 2018).

The highest self-esteem indicators of psychophysiological state are «mood» and «health status» (April, May, June, August, September, December, January, February – Fig. 1). These display a quality medical and psychophysiological selection of expedition members. All five indicators of psycho-physiological components are group approximately on the same level in July and the highest is well-being. It shows that despite of polar night time when the strongest negative impact of the environment on the human body is felt, the feeling of well-being of the expeditioners' is achieved through the mobilization of their mental and physical resources.

Then from August the average self-esteem of all indicators begins to decrease gradually (Fig. 1). They reach the lowest values in the last two months of expedition. The largest decreases were self-assessments of performance, mood, and health status.

The deterioration of these indicators are conforming to the laws of nature due to the gradual depletion of mental and physical resources of the body, oversaturation of communication with the same people, scarcity and monotony of perceptual stimuli, long-term exposure to extreme environmental condition and other life and work factors mentioned in Introduction.

The dynamics of the four indicators of the social-psychological component are presented in the Figure 2. They are similar to psychophysiological state indicators presented above, but not identical. These indicators are: «satisfaction with relations with colleagues», «satisfaction with the environment», «satisfaction work performed», «life satisfaction».

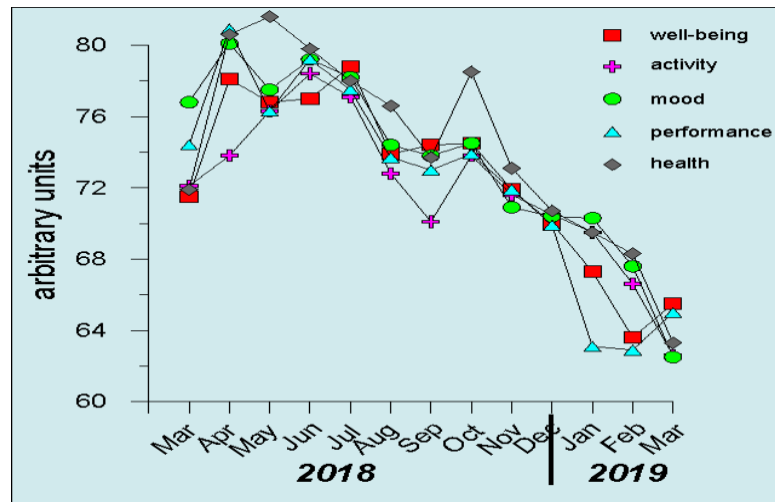


Fig. 1. Indicators of psycho-physiological components of the expeditioners' UAS *Academik Vernadsky*

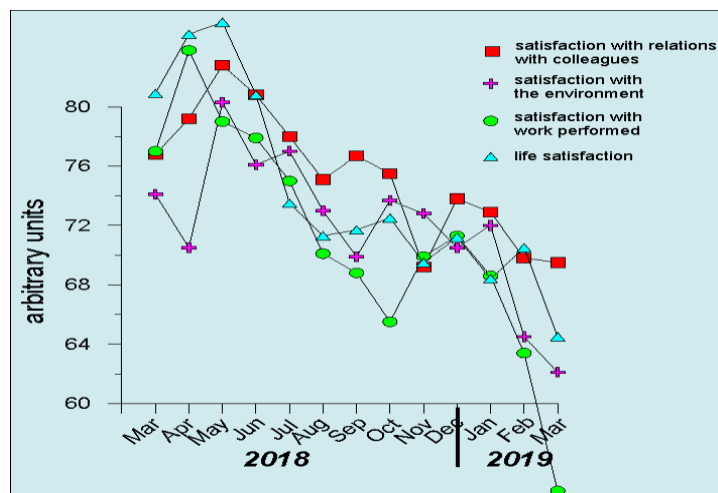


Fig. 2. Indicators of the social-psychological component of the expeditioners' UAS *Academik Vernadsky*

During the first part of expedition (April–July) there is an increase of three indicators: «satisfaction with relations with colleagues», «satisfaction work performed», «life satisfaction». These confirm the interpersonal compatibility of the expedition team, social cohesion and professional interaction of team members.

Upon arrival at the Antarctic station in April the «satisfaction with the environment» factor is decrease probably due to the fact that the environment in reality was much stricter than expected, causing some psychological stress. In the next three months (May–July) this factor increased which indicate a psychological adaptation to the extreme environment condition of Antarctica. From August until the end expedition all indicators are demonstrate a gradual decrease which confirms the difficulties of a long stay in the Antarctic station. Euphoria from being in the «new» conditions of Antarctica for recently arrived expeditioners' is quickly subsided. The place gradually became habitual and eventually even boring.

In the last month of the expedition the indicator «satisfaction work performed» was lowest. Probably this is due to routine performance of expeditioners' work in almost uninspired conditions with limited choice of transition to other activities, as well as limited choice of recreation, depletion of psychophysiological resources, fatigue and growing desire to return home.

It should be noted that the indicator «life satisfaction» began to fall rapidly not in August, like all other factors, but two months before, starting in June. This indicator is most sensitive to increased physical activity,

mental fatigue and psychological stress from experiencing unusual for routine life impressions and emotions at the beginning of the expedition.

We have to mention about indicator «satisfaction with relations with colleagues» in 8 series of studies out of 13 remained the highest compared to the other three indicators. This is observed even in the last month of expedition which confirms the importance of interpersonal relationships and significant role of healthy «psychological climate» in the expedition team.

Conclusions.

In our opinion stable and optimal level of subjective self-assessment of the psychophysiological component of the psychological state of expeditioners' during the first third of expedition can be explained by the mobilization of their psychological, mental and physical resources and quality selection of team. Further deterioration of these indicators is quite natural due to the gradual depletion of mental and physical resources, the onset of the polar night and the impact of other negative environmental factors, life and work conditions at the Antarctic station.

Our results are consistent with the results of other studies related to activities in extreme polar expeditions. The gradual deterioration of the physiological and psychological condition of people was recorded in monitoring studies in all-year expeditions conducted by Alfano, et al (2021); Kuwabara, et al (2021); Sandal, Van de Vijver, & Smith (2018); Wencheng, Wen, & Yongzhong (1995). In these articles also noted about deterioration in the psychological state of people after six months of the expedition. In the last phase of the Antarctic all-year expeditions some authors (Bhargava, Mukerji, & Sachdeva, 2000; Khandelwal, Bhatia, & Mishra, 2017) note a marked increase in anxiety and stress.

In our study the «Indicators of psychophysiological state» and «Indicators of social-psychological state» in the final monitoring session did not acquire values that would indicate a critical psychological state of individual members of team or the whole group. Naturally the polar conditions and socio-spatial isolation cause changes in the psychophysiological and social-psychological state of a person to deterioration, however, may not cause a systematic reduction. This is confirmed by some indicators of our study. They show the often alternations of decreasing and increasing during next months. This suggests that in polar awful environmental the expeditioners' can feel quite good during long stay in an Antarctic station and cope with the challenges of the environment with positive results. This is preceded by a qualitative selection of team members taking into account interpersonal compatibility and psychological training of the expedition group. It should be noted that in some articles namely, for example Weiss, Suedfeld, Steel, & Tanaka (2000); Suedfeld (1998) authors urge not to ignore the attractive features of work in Antarctica noting the salutogenic effects.

Further research. The prospect of further research in small groups of expeditioners' by «Indicators of psychophysiological state» and «Indicators of social-psychological state» is a identification of subjective positive effects such as «salutogenic results» arising from successful adaptation to environmental adversities.

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