

# Physical activity and work capacity among fly-in fly-out workers in the Arctic region

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**Objective.** The aim of this study was to examine the specific features of physical activity and work capacity among fly-in fly-out workers in the Arctic region, aged 25–54 years.

**Methods.** The study sample consisted of a random representative selection of male workers aged 25–54, employed on a fly-in fly-out basis by the EURACORE industrial enterprise in the Arctic latitudes of the Tyumen region. Initially, 750 men aged 25–54 were recruited, with a response rate of 82.4%. The final sample included 618 men, divided into age groups: 25–34 years. (n=214), 35–44 years (n=206), and 45–54 years (n=198). Pearson's chi-squared test was used to assess the significance of differences between sample proportions in the two groups. When absolute frequencies were less than 5, Fisher's exact test was applied.

**Results.** Men aged 45–54 years reported no change in their physical activity significantly more often than men from 25–34 y.o. (85.3–67.7%,  $p<0.001$ ) and 35–44 y.o. (85.3 – 84.4%,  $p<0.001$ ) age groups, as well as the total sample (85.3–79.0%,  $p<0.001$ ). Concurrently, the youngest group (25–34 years) had the highest proportion of men with low physical activity compared to the 35–44 age group (18.7% vs. 4.4%,  $p<0.001$ ), the 45–54 age group (18.7% vs. 6.6%,  $p<0.001$ ), and the total sample (18.7% vs. 10.0%,  $p<0.001$ ).

In the 25–34 age group, work capacity had increased over the past 12 months more often than in the 45–54 age group (14.5% vs. 6.1%,  $p=0.0052$ ). No change in work capacity was reported more frequently in the 45–54 group

compared to the 25–34 group (85.8% vs. 73.4%,  $p=0.0017$ ). A significant decrease in work capacity was also observed in the youngest group compared to the overall sample average (8.0% vs. 3.1%,  $p=0.0011$ ).

**Conclusion.** Thus, less than one-fifth of the fly-in fly-out workers surveyed engaged in regular physical exercise, while more than one-fifth held the opposite stance on this matter. Less than a quarter of shift workers spent their leisure time passively. More than a quarter of the men rated their physical activity as significantly higher than that of their peers. Over the past year, age-related trends were identified to show not only a decrease in physical activity but also an increase in work capacity during the third decade of life.

**Keywords:** organized population, work capacity, physical activity, men, fly-in fly-out work, Arctic.

**Conflict of interest:** none declared.

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## Introduction

In recent decades, the issue of maintaining high physical activity and efficient work organization among shift workers in the Arctic region has remained relevant. Research confirms that expedition-based rotational work under intense operational loads in the West Siberian oil and gas extraction complex leads to fatigue and a decline in professional performance [1, 2]. An obvious reason may be the specific mobile nature of this work, which creates exclusively male teams, composed of individuals differing in age, cultural, and personal characteristics, who are forced to live and work together — a situation that can, in turn, lead to social and ethical issues [3].

Furthermore, the situation is exacerbated by the harsh natural and climatic conditions in which oil and gas workers operate. Additional negative factors include the remoteness of work sites from base enterprises, constant cyclical long-distance travel

from places of residence to worksites and back [4–6], increased work intensity during the rotation period, longer shifts, reduced rest time between shifts in the absence of days off, modest living conditions, and limited access to medical care [3, 6–8]. The inherent features of expedition-based rotational work: the duration and regularity of exposure, the increasing risk from severe and harmful production factors with longer service records, and the accumulation of pathology, classify this work method as a source of chronic occupational stress with an extreme impact character [8–11].

Consequently, a priority task is to study factors that can enhance physical activity and work capacity among individuals engaged in expedition-based rotational work in the Arctic. An active yet moderate physical lifestyle, along with high disease resistance, improves a person's general condition and well-being, increases social energy and work ca-

capacity, which, in turn, serves as an effective way of preventing health issues after exhausting work periods [12–16]. Physical exercise enhances functional recovery across all components of the musculoskeletal, cardiovascular, and other systems, and helps mitigate other risk factors (RFs) [14–17]. At the same time, working in such a mobile mode leads to constant strain and adaptation in the body's regulatory systems, necessitating the development of socially oriented preventive programs for rotational workers. Therefore, the scientific foundation required for developing such programs can be established by identifying population-based patterns in the prevalence of cardiovascular disease (CVD) risk factors, particularly regarding physical activity and work capacity under northern rotational work conditions.

### Objective

The aim of this study was to examine the specific features of physical activity and work capacity among individuals engaged in fly-in fly-out work in the Arctic region, aged 25–54 years.

### Methods

The study was conducted from March 2022 to February 2023. The study sample consisted of a random representative selection of male workers aged 25–54, employed on a fly-in fly-out basis at the EURACORE industrial enterprise in the Arctic latitudes of the Tyumen region. The initial sample included 750 men aged 25–54, with a response rate of 82.4%. The final sample comprised 618 men divided into age groups: 25–34 years ( $n=214$ ), 35–44 years ( $n=206$ ), and 45–54 years ( $n=198$ ).

Physical activity (assessed via 4 questions from the provided test) and work capacity (assessed via 1 question from the provided test) were analyzed using the standard WHO MONICA Psychosocial questionnaire “Knowledge and Attitudes to Own Health” [18].

Written informed consent was obtained from each participant for cardiovascular screening, and the Ethics Committee of the Tyumen Cardiology Research Center approved the study protocol.

### Statistical analysis

Pearson's chi-squared test was used to assess the significance of differences between sample proportions in two groups. When absolute frequencies were less than 5, Fisher's exact test was applied.

A  $p$ -value  $<0.05$  was considered statistically significant. Age-standardization of the studied parameters was performed to extrapolate the data to the entire population and to allow correct comparison with other population-based studies of this profile, in accordance with the latest Russian population census for the 25–54 year-old range and the age structure of the examined subjects in each of the three age groups (Table 1).

### Results

The study revealed that among workers engaged in fly-in fly-out work in the Arctic region, less than one-fifth (17.9%) regularly performed physical exercise, while more than one-fifth (20.9%) completely abstained from physical activity. The majority (over 60% of workers) either expressed a desire to exercise or exercised irregularly without significant success. No age-related trends were identified for any of these indicators among the respondents.

Regarding leisure time, no significant differences were observed between age groups either. Over 60% could not clearly define how they spend their free time and gave an indefinite response (“it varies”) concerning their leisure activities. Only 14.5% of individuals working on a rotational expedition basis spent their leisure time actively, while more than 20% preferred passive rest.

For the majority of workers engaged in fly-in fly-out work in the Arctic, physical activity had not changed over the past 12 months. Men aged 45–54 reported “no change” significantly more often than the younger groups: compared to men aged 25–34 (85.3% vs. 67.7%,  $p<0.001$ ) and 35–44 (85.3% vs. 84.4%,  $p<0.001$ ), as well as the total sample (85.3% vs. 79.0%,  $p<0.001$ ). At the same time, the youngest group (25–34 years) showed the highest proportion of men with low physical activity compared to the 35–44 age group (18.7% vs. 4.4%,  $p<0.001$ ), the 45–54 age group (18.7% vs. 6.6%,  $p<0.001$ ), and the overall sample (18.7% vs. 10.0%,  $p<0.001$ ).

Regardless of age, one-tenth of the shift workers considered their physical activity to be more passive or significantly more passive. On the other hand, more than a quarter of workers rated their activity as above average compared to other men of their age.

The majority of shift workers in the Arctic (62.1%) considered their physical activity comparable to that of their peers.

Table 1

**Physical activity and work capacity among fly-in fly-out workers across the age range**

Question / Attitude	Age groups (years)				ASP %
	25-34 (n=214) %	35-44 (n=206) %	45-54 (n=198) %	25-54 (n=618) %	
<b>Do you do physical exercise (besides work-related)?</b>					
I don't need it	22.9	20.4	19.7	21.0	20.9
I should exercise but I don't	49.9	39.8	40.4	43.5	43.1
I have tried but was unsuccessful	13.1	20.4	19.2	17.5	17.6
I exercise regularly	13.6	19.4	20.7	17.8	17.9
According to doctors, exercise is contraindicated for me	0.5	0	0	0.2	0.1
<b>How do you spend your leisure time?</b>					
Physically active (gardening, sports, walking, cycling, running, etc.)	14.0	14.1	15.7	14.6	14.5
It varies	58.4	61.6	61.5	60.5	60.4
Physically passive (lying down, sitting, watching TV, reading, writing, crafting, etc.)	26.2	18.0	17.7	20.7	20.4
I have no leisure time	1.4	6.3	5.1	4.2	4.3
<b>Has your physical activity (mobility, sports, etc.) changed over the past 12 months?</b>					
Yes, I have become more active	13.6	11.2	8.1	11.0	10.9
Has not changed	67.7	***84.4	***85.3	***79.0	79.1
I have become less active/mobile	18.7	***4.4	***6.6	***10.0	9.7
<b>How do you rate your physical activity compared to other people your age?</b>					
I am significantly more active	7.0	5.8	6.1	6.3	6.3
Somewhat more active	19.6	23.3	20.7	21.2	21.2
About the same as others	57.0	63.6	66.1	62.2	62.1
Somewhat less active	13.6	6.8	7.1	9.2	9.0
Significantly less active/passive	2.8	0.5	0	1.1	1.1
<b>Has your work capacity changed over the past 12 months?</b>					
Has increased	14.5	11.7	**6.1	10.8	10.6
Has not changed	73.4	83.9	**85.8	80.9	80.9
Has decreased	3.7	4.4	7.6	5.2	5.2
Has significantly decreased	8.4	0	0.5	**3.1	2.9

**Note.** \* to the left of a value denotes a statistically significant difference between the 25-34 year age group and other age groups; \* to the right denotes a significant difference between the 35-44 year age group and other groups; \* to the bottom left denotes a significant difference between the 45-54 year age group and the 25-54 year age group. \* — p<0.05; \*\* — p<0.01; \*\*\* — p<0.001; ASR — age-standardized parameter.

Regarding work capacity, an increase was observed in onetenth of individuals working on a rotational expedition basis over the past twelve months. In the 25–34 age group, work capacity had increased over the past 12 months more often than in the 45–54 age group (14.5% vs. 6.1%,  $p=0.0052$ ). No change in work capacity was reported more frequently in the 45–54 group compared to the 25–34 group (85.8% vs. 73.4%,  $p=0.0017$ ). A significant decrease in work capacity was also observed in the youngest group compared to the overall sample average (8.4% vs. 3.1%,  $p=0.0011$ ).

## Discussion

This study is part of a project investigating CVDs and their RFs among men engaged in flyin flyout work at the oil extraction complex in Western Siberia. Various aspects of this project have been published in Russian journals [2, 9, 11].

Among rotational expedition workers at the oil and gas extraction complex in the Arctic, physical activity among middleaged men generally prevailed over that among younger men. A similar trend was noted in studies by our colleagues from Novosibirsk concerning men of the same age groups [5].

The present study showed that the majority of young men do not meet their need for regular physical exercise, despite their desire and the necessity to do so. Furthermore, no positive trend towards increased active leisure time is observed among young men, which leads to a decline in physical activity and work capacity even when there is an intention to engage in regular physical exercise. This age group is also characterized by a low level of selfassessment regarding physical activity.

Based on the analysis of this study, it can be stated that approximately equal numbers of shift workers were identified to regularly engage in physical exercise and those with a negative attitude towards it. Correspondingly, an equal number of participants preferred passive leisure activities. Although more than a quarter of those working on a rotational expedition basis consider their level of physical activity

higher than that of their peers, a decrease in physical activity was noted in the young age group.

Consequently, young men with low physical activity are at risk for developing CVDs, as scientific research confirms the link between physical inactivity and increased risk of allcause mortality.

At the same time, this study revealed an increase in work capacity among shift workers during the third decade of life over the past year. However, this is accompanied by a lowered sensitivity threshold, posing a threat to their health when working in the extreme conditions of the Arctic region and on a rotational expedition schedule.

Health risks are exacerbated by limited opportunities for adequate rest after the working day in this age category, likely due to the specifics of the twelvehour work regime, living away from family, and the close quarters of an exclusively male cohort. An additional factor contributing to increased health risks, especially among young men, is hesitancy regarding the early diagnosis and treatment of diseases.

## Conclusion

Thus, less than one-fifth of all shift workers who participated in the study regularly engaged in physical exercise, while more than one-fifth held the opposite stance on this matter. Less than one-fourth of the shift workers spent their leisure time passively. More than one-quarter of the men rated their physical activity as significantly higher than that of their peers. Over the past year, age-related trends were identified to show not only a decrease in physical activity but also an increase in work capacity during the third decade of life.

The results of this study can be used for evidence-based planning of preventive measures among workers engaged in fly-in fly-out operations at oil and gas extraction facilities in the Russian Arctic zone. The research data can provide a foundation for developing effective programs aimed at health preservation and well-being enhancement of workers under these conditions.

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