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EPIDEMIOLOGY OF TUBERCULOSIS AMONG MILITARY PERSONNEL IN AZERBAIJAN

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Due to tuberculosis, military personnel are included in the occupational risk group. The compact barracks, shared sanitary and hygiene conditions, potential exposure in endemic areas, and the stressful activities during field exercises and military operations all increase the risk of tuberculosis occurrence and spread among personnel. Additionally, wars are one of the factors that promote the spread of infectious diseases [1, 2, 3, 4, 5, 6].

Key words: *tuberculosis, epidemiology, preventive measures, military medicine, risk factors.*

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ЭПИДЕМИОЛОГИЯ ТУБЕРКУЛЕЗА СРЕДИ ВОЕННОСЛУЖАЩИХ В АЗЕРБАЙДЖАНЕ

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Военнослужащие по причине туберкулеза относятся к группе профессионального риска. Проживание в тесноте казарм, общие санитарно-гигиенические условия, потенциальное пребывание в эндемичных зонах, стрессовые ситуации во время учений и боевых действий – все это повышает риск возникновения и распространения туберкулеза среди личного состава. Кроме того, военные действия являются одним из факторов, способствующих распространению инфекционных заболеваний [1, 2, 3, 4, 5, 6].

Ключевые слова: *туберкулез, эпидемиология, профилактические мероприятия, военная медицина, факторы риска.*

Due to tuberculosis, military personnel are included in the occupational risk group. The compact barracks, shared sanitary and hygiene conditions, potential exposure in endemic areas, and the stressful activities during field exercises and military operations all increase the risk of tuberculosis occurrence and spread among personnel. Additionally, wars are one of the factors that promote the spread of infectious diseases [1, 2, 3, 4, 5, 6].

Due to the closed nature of research among military personnel, no scientific investigation or epidemiological analysis of the spread of tuberculosis disease among military personnel has been conducted. For this reason, it is important to study the problem systematically. Wars are one of the factors that promote the spread of infectious diseases. Military personnel are classified as an occupational risk group for tuberculosis due to various contributing factors. These include living in crowded barracks, sharing hygiene facilities, potential exposure to endemic areas, and the physical and mental stress associated with field exercises and operations. This study aims to analyze tuberculosis cases first detected in military personnel and enhance preventive measures by examining cases by length of service and age, assessing geographic distribution, and identifying risk groups based on clinical forms and anthropometric data. Additionally, risk factors for the spread of primary tuberculosis and TB risk groups related to military service duration were identified through retrospective and operational analysis.

Most of the scientific works analyzed in the Republic of Azerbaijan discuss the clinical features of tuberculosis, diagnostic approaches, early detection, the incidence of drug-resistant tuberculosis, and issues related to the civilian sector in treatment. Since military personnel in Azerbaijan are in closed contingents, scientific research on the epidemiological analysis of tuberculosis in the troops has not been sufficiently conducted. This highlights the importance of studying the problem systematically.

Materials and Methods

We analyzed retrospective data from the Azerbaijani Ministry of Health, including archival materials and official statistical data (2009–2018). Clinical and laboratory examinations included X-ray diagnostics, clinical and radiological examinations (fluorography, CT, MRI), general blood and urine analysis, sputum microscopy by the Ziehl-Neelsen method, bacteriological and molecular-genetic methods (Xpert MTB/RIF). The following methods were used in the study: descriptive epidemiological method, epidemiological anamnesis, epidemiological examination and retrospective epidemiological analysis, microbiological method, biometric and statistical method.

Primarily, tuberculosis detection in military personnel was based on length of service and compared with factors such as age groups, clinical forms, detection methods (active/passive), seasonal influence (seasonality), geographical distribution, anthropometric indicators (body mass index, BMI), and bacterial excretion.

This study examines TB epidemiology in Azerbaijani military personnel (2009–2018), focusing on risk factors, temporal trends, and detection methods.

Periodic medical reports of the Ministry of Health of the Republic of Azerbaijan, archival materials, and official statistical data on the disease. To determine the clinical-epidemiological characteristics of tuberculosis primary detected among military personnel, statistical indicators from the medical records of military personnel who were discharged from the Lungs Diseases Hospital of the Armed Forces (LDH of the AF) due to the diagnosis of this disease were retrospectively analyzed (from 2009 to 2018).

For analysis, the results of examinations conducted based on the clinical forms of tuberculosis, seasons, age groups, body mass index (BMI), detection methods, geographical locations, bacterial secretion characteristics, and service periods were determined.

The diagnosis of tuberculosis was made by the chief specialists of the Armed Forces medical specialists of the Central Military Medical Commission and the Lung Diseases Scientific Research Institute of the Ministry of Health it was approved by the medical experts.

Results were analyzed using SPSS 2800 software, correlation (x^2), Kruskal-Wallis, and Kolmogorov-Smirnov Z tests. Pearson's correlation coefficient (x^2) was $p < 0.001$ when comparing army units (military units), decisions of military-medical expertise, and service periods of detection characteristics. Using the Kruskal-Wallis test, the statistical confidence in comparing decisions of military-medical expertise, clinical forms, and detection characteristics by service period was 98.5 %. Using the Kolmogorov-Smirnov Z test, group diversity indicators were obtained with 0.001 accuracy in comparing decisions of the military medical examination, detection methods, with the length of service.

Results

Service periods of military personnel are divided into 3 groups: the first 3 months, 3–6 months, and more than 6 months. These groups are called group I, II, and III, respectively. So:

– I Group – those who got sick in the first 3 months of military service. Group I was infected before military service. The detection of tuberculosis in the first 3 months of military service can be considered as an indicator of preventing this disease. The vast majority of those who were released from the army with a diagnosis of tuberculosis in the first 3 months of military service (I Group) were infected before military service.

– II Group – those who got sick in 3–6 months of military service. The rise in the incidence of tuberculosis in the 3–6 months of military service requires increased attention to the adaptation of new military personnel to the service. Group II is mainly associated with the adaptation period of military personnel to new conditions. The occurrence of tuberculosis in 3–6 months of military service (group II), in most cases, occurs during the period of adaptation to new conditions of servicemen who have just started military service.

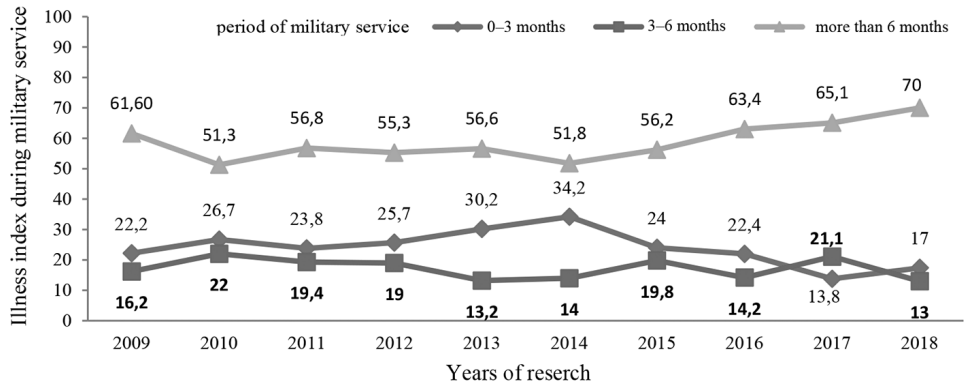
– III Group – those who got sick after 6 months of military service. The high incidence of tuberculosis after 6 months of military (group III) service indicates the importance of comprehensive preventive and anti-epidemic measures against this disease among military personnel.

The dynamics of changes in the incidence of tuberculosis in military servicemen over the years are reflected in Graph 1.

The number of people who fell ill in the III Group, that is, after 6 months of military service, was quite high compared to the previous groups. Therefore, the number of tuberculosis patients in each year was 51.3–70 % of the total tuberculosis cases. The number of tuberculosis cases in Group III was significantly higher, accounting for 51.3–70 % of the total cases each year. In the last four years of the study (2015–2018), there has been a rising trend in morbidity after 6 months of service.

Table 1 shows the distribution of the epidemiological characteristics of the primary detected tuberculosis among military personnel by service periods.

Between 2009 and 2018, the occurrence of clinical forms of pulmonary tuberculosis, mainly detected among military personnel during their service, was as follows: focal pulmonary tuberculosis (50.8 ± 2.6 %), infiltrative pulmonary tuberculosis (46.3 ± 2.6 %), and other clinical forms of pulmonary tuberculosis (2.9 ± 0.9 %). During the first three to six months of military service, diagnoses included focal pulmonary tuberculosis (46.8 ± 3.3 %), infiltrative pulmonary tuberculosis (51.1 ± 3.3 %), and other clinical forms (2.2 ± 1.0 %). After six months of service, focal pulmonary tuberculosis was diagnosed (43.0 ± 1.7 %), infil-



Graph 1. Distribution of primary detected tuberculosis in military personnel by length of service

trative pulmonary tuberculosis (54.9 ± 1.7 %), and other clinical forms (2.1 ± 0.5 %); $X^2 = 8.13$; $p = 0.087$. Infiltrative and focal pulmonary tuberculosis were more common in group III of the study. Among extrapulmonary tuberculosis forms, tuberculous pleurisy was more prevalent among military personnel. The frequency of tuberculosis clinical forms during military service was: pulmonary tuberculosis (81.8 ± 1.8 %) and extrapulmonary tuberculosis (18.2 ± 1.7 %) within the first three months. In the 3–6 month period, pulmonary tuberculosis was diagnosed in (69.6 ± 2.5 %) and extrapulmonary tuberculosis in (30.4 ± 2.5 %). For those with more than six months of service, pulmonary tuberculosis was diagnosed in (78.1 ± 1.2 %) and extrapulmonary tuberculosis in (21.9 ± 1.2 %); $X^2 = 17.88$ ($p = 0.001$).

The incidence of tuberculosis primary detected in military personnel in the 18–25 and 26–45 age groups was as follows; tuberculosis in the first 3 months of military service in the 18–25 age group 99.4 ± 0.4 % (M ± m), in the 26–45 age group 0.6 ± 0.4 % (M ± m); 98.8 ± 0.6 % (M ± m) of tuberculosis in 3–6 months of military service, 1.2 ± 0.8 % (M ± m) in the 26–45 age group; After 6 months of military service, 18–25 age group 92.4 ± 1.3 % (M ± m) and 26–45 age group 7.6 ± 1.1 % (M ± m).

Table 1. **Distribution of the epidemiological characteristics of tuberculosis primary detected in military personnel by duration of service from 2009 to 2018**

Military epidemiological characteristics / Groups of military service			I Group (%)	II Group (%)	III Group (%)
Mycobacterium tuberculosis secretion indicators %	Mycobacterium tuberculosis secretors (AFB+)		3.38	2.96	9.52
	Non-secreting Mycobacterium tuberculosis (AFB–)		21.05	14.6	48.46
Detection strategy	Active detection		10.89	4.92	15.97
	Passive detection		13.55	12.65	42.01
By the season of the year	Spring season		4.07	3.81	12.80
	Summer season		6.72	3.39	12.75
	Autumn season		7.30	4.92	16.84
	Winter season		6.35	5.45	15.61
Age groups	18–25 age		24.3	17.34	53.53
	26–45 age		0.16	0.21	4.44
Clinical forms	Pulmonary tuberculosis	Focal pulmonary tuberculosis	10.32	6.02	20.28
		Infiltrative pulmonary tuberculosis	9.57	6.46	25.10
		Other clinical forms of pulmonary tuberculosis[1]	0.58	0.26	0.95
	Extrapulmonary tuberculosis	Tuberculous pleurisy	3.23	3.97	8.89
		Other clinical forms of extrapulmonary tuberculosis[2]	0.74	0.85	2.80

[1] Other clinical forms of pulmonary tuberculosis – forms of pulmonary tuberculosis detected in addition to infiltrative and focal clinical forms were calculated (are included).

[2] Other clinical forms of extrapulmonary tuberculosis – extrapulmonary forms detected in addition to tuberculous pleurisy are included.

The frequency of first detected tuberculosis cases among soldiers (cadets) after six months of service was high. This result is equivalent to the other analysis direction of the research, that is, according to the results of the analysis by age groups, 18–25 years old (18–25 years old group in the anthropometric analysis), and after six months of service, the incidence of the disease was high. Soldiers (cadets) are mainly included in the 18–25 age group. The results of the analysis of ranks and age groups form a correlational relationship.

During the research period, 38.41 % of people were identified through active detection, and 61.59 % of people through passive detection.

The geographical features of the primary detected tuberculosis disease in military personnel were analyzed. In 2009–2018, the primary tuberculosis disease detected in military personnel in the Republic of Azerbaijan was grouped by the SSMC (State Service for Mobilization and Conscription) and regional units, and its geographical distribution was determined in the following zones:

Zone I – highland and foothill zone;

Zone II – foothill and plain zone;

Zone III – plain zone.

I Zone – 20.9 % of the people who were discharged from the hospital with a diagnosis of tuberculosis in the years 2009–2018 were found in the highlands and foothills (Fig. 1).

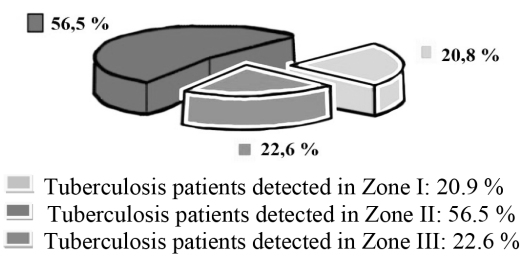


Fig. 1. Distribution of tuberculosis primary detected in military personnel by geographical zones of the Republic of Azerbaijan in 2009–2018

II Zone – 56.5 % of the people were found in the foothills and plains zone in 2009–2018. The incidence of tuberculosis among those conscripted from the II Zone in the Republic of Azerbaijan was higher than in other zones. These regions are included in the foothills and plains zone.

III Zone – 22,6 % of people who were discharged from the hospital with a diagnosis of tuberculosis in the period 2009–2018 were found in the plain zone.

The dynamics of TB detection characteristics among military personnel are analyzed in Graph 2. Tuberculosis cases in military personnel are determined by active and passive detection methods. Analysis of the primary detected tuberculosis among military personnel according to epidemiological indicators.

Epidemiological analysis shows that seasonal manifestations of tuberculosis agents are variable depending on geographical and climatic conditions. Those who served in the military for more than 6 months, in autumn, those who served in the first 3 months of military service, in autumn, and those who served for 3–6 months were higher in the winter season.

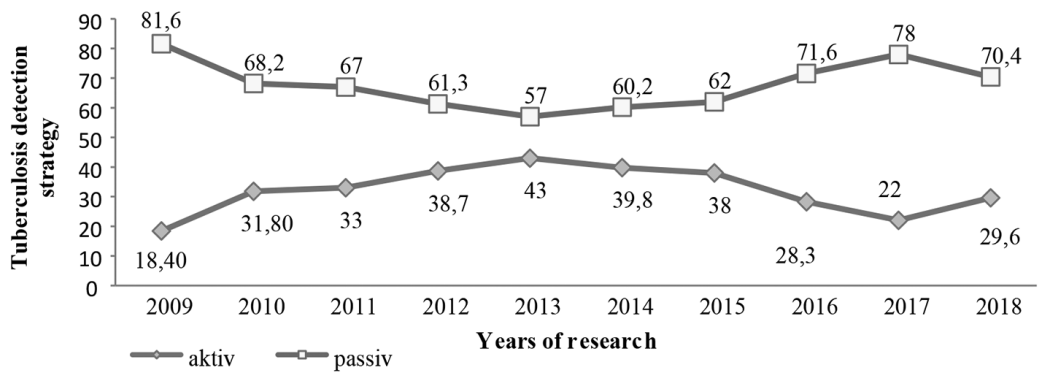
To assess nutritional status, the Body Mass Index (BMI) is used by dividing body mass (in kilograms) by the square of height (in meters)

Taking into account that BMI indicators are divided into two age groups, military personnel were grouped into the 18–25 and 26–45 age groups (Fig. 2).

It is clear from the presented results that the incidence of tuberculosis in the 18–25 age group was quite high compared to the 26–45 age group. The share of tuberculosis cases in the 18–25 age group was 92.12 % of the total number of cases.

In both age groups, the incidence of tuberculosis was higher among military personnel belonging to an undernourished status based on BMI. Body mass indices were calculated based on anthropometric indicators of military personnel with tuberculosdisThe multiyear dynamics of clinical forms of tuberculosis, primarily detected in military personnel, are shown in Graph 3.

During 2009–2018, among the clinical forms of tuberculosis among military personnel, pulmonary tuberculosis prevailed over other clinical forms. Regular



Graph 2. Multi-year dynamics of tuberculosis cases in military personnel determined by active and passive detection methods

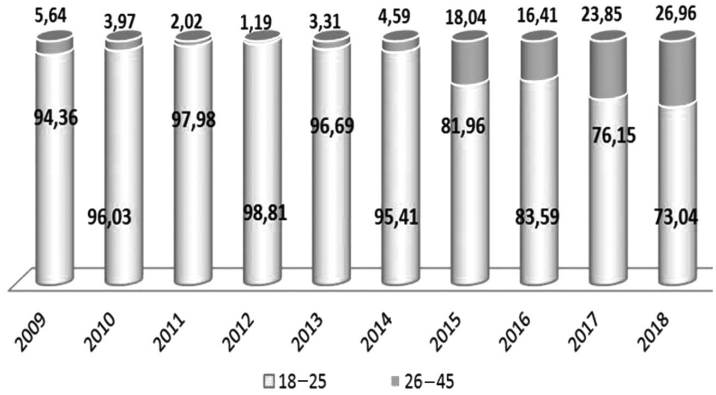
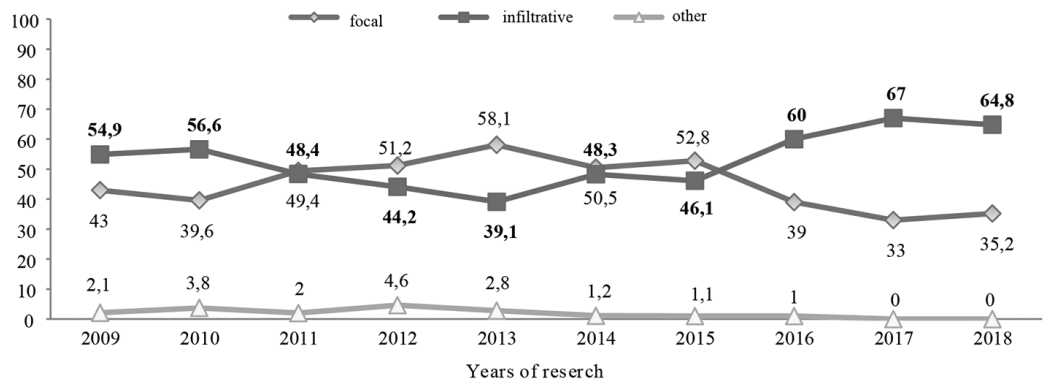


Fig. 2. The frequency of tuberculosis disease in the 18–25 and 26–45 age groups in the Armed Forces of the Republic of Azerbaijan from 2009 to 2018

Table 2. **Body mass index(BMİ) according to anthropometric parameters of the military servicemen with tuberculosis**

Years of research	Age group	TB patients are primarily detected in military personnel, with nutritional indicators based on «body mass index» (%)			
		Normal nutrition	Malnutrition	High nutrition	I and II class overnutrition
From 2009 to 2018	18–25 years old	38.15 %	46.19	6.35	1.00
	26–45 years old	2.59 %	4.55	0.74	0.42



Graph 3. Dynamics of military personnel on the clinical forms of primary detected pulmonary tuberculosis

preventive examinations among military personnel increase the rate of detection of focal pulmonary tuberculosis in the first three months of military service.

Conslusions

According to the analysis of the epidemiological features of primarily detected tuberculosis in military personnel, the incidence of the disease after six months of military service was high.

The highest number of cases occurred in autumn and winter. The incidence of tuberculosis was higher in the autumn season in the first 3 months and more than 6 months of military service, and in the winter season in those who served for 3–6 months.

Soldiers and cadets had the highest number of cases. Based on the analysis of tuberculosis cases by military service periods, the frequency of occurrence according to the indicators of ranks and age groups forms a correlative relationship.

The frequency of passive detection was significantly higher than active detection. According to the analysis of the detection characteristics of tuberculosis, the frequency of passive detection was almost twice as high as active detection.

The incidence of tuberculosis among military personnel was higher among the 18–25 age group than in the other age groups.

The geographical and climatic characteristic analysis showed a higher incidence in the foothill and plain zones of the Republic of Azerbaijan. Most cases were acquired during military service. The most common forms of TB among military personnel were infiltrative and focal pulmonary tuberculosis, while tuberculous pleurisy was the leading extrapulmonary type. Infiltrative, focal pulmonary tuberculosis and tuberculous pleurisy were more common in periods after six months of military service.

The incidence of tuberculosis secretors was higher among patients with more than 6 months of service.

Among military personnel, the incidence of bacterial excretion after six months of service was high.

The frequency of occurrence of cases of tuberculosis primary detected in military personnel was as follows: among those who served for more than six months, the frequency of occurrence was high (57.99 %), average among those who served in the first three months (24, 44 %), the frequency of occurrence among those who served for three to six months (17.57 %) was low.

According to the analysis of the multi-year dynamics of those who were discharged with the decision of the military-medical expertise as the causal link, among the soldiers (93.5 %) in the summer (38.99 %) during the first three months of military service, there was an outbreak of pulmonary tuberculosis.

Tuberculosis bacilli secretion was detected in 34.1 % of patients with infiltrative pulmonary tuberculosis during the study period. 88.33 % of military personnel with bacterial secretion were diagnosed with infiltrative pulmonary tuberculosis. Among military personnel, the incidence of bacterial excretion after six months of service was high (60 %).

According to the analysis of the detection characteristics of tuberculosis, the frequency of passive detection was almost twice as high as active detection (68.2 %).

The incidence of tuberculosis was higher in the autumn season in the first 3 months and more than 6 months of military service, and in the winter season in those who served for 3–6 months. The incidence of tuberculosis was high among the I group (29.87 %) and III group (29 %) in autumn, and among the II group (31 %) in winter.

According to the analysis of the geographical and climatic characteristics of the Republic of Azerbaijan, the incidence of tuberculosis in the foothills and plains regions (56.5 %) was infected in military units, and according to the decision of the military doctor's examination.

The incidence of tuberculosis among military personnel was higher among the 18–25 age group (92.12 %) than the other age group (26–45 years). Military personnel with poor nutritional status in the body mass index (18–25-year-old group 50,37 %, 26–45-year-old group 54.78 %). Tuberculosis cases were more common among servants. Based on the analysis of tuberculosis cases by military service periods, the frequency of occurrence according to the indicators of ranks and age groups forms a correlative relationship (18–25 age group, 92.12 %, soldiers 83.01 %). Focal (36.6 %) forms of pulmonary tuberculosis, infiltrative (41.11 %) forms of pulmonary tuberculosis, and tuberculosis pleurisy (16,08 %) were more commonly observed in cases of extrapulmonary tuberculosis. Infiltrative pulmonary tuberculosis, focal pulmonary tuberculosis, and tuberculous pleurisy were more common in periods after six months of military service.

Recommendation

For the early detection of tuberculosis among military personnel, it is recommended to carry out immunological skin allergy tests along with X-ray examination to allocate conjurers and volunteers to risk groups in relevant military units and to increase attention to the detection of latent TB infection in military units reserved for young soldiers.

It is recommended to use immunological diagnostic methods along with X-ray examination when conscripting to military service from regions with a high morbidity rate, and to organize a phthisiatrist or pulmonologist consultation in military medical commissions.

If military collectives are deployed to regions with high rates of tuberculosis in the future, it is recommended to pay more attention to anti-epidemic measures against this disease. Recommendation for the creation of a mobile medical team under the command of the land forces and the implementation of appropriate measures for the active detection of tuberculosis among military personnel in the age group of 18–25 years with more than six months of military service is being made. It is recommended to strengthen anti-tuberculosis measures in the military units under the army units of the ground forces. According to the decision of the military medical commission, it is recommended to increase attention to the detection of focal pulmonary tuberculosis in the first 3 months of service in the 18–25 age group to reduce the frequency of those discharged with tuberculosis.

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