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Current Epidemiological Situation of Tuberculosis in Ukraine and Chernivtsi Region

Military conflicts have a negative impact on the epidemiology of various diseases, among which tuberculosis is in the lead. The increased risk of TB morbidity and mortality associated with war has been observed since World Wars I and II, and several civil wars, among others. Separate data indicate that armed conflicts are associated with an increase in the risk of tuberculosis among the population by up to 20 %.

Objective – to analyze the state of the current epidemiological situation of tuberculosis in Ukraine and the Chernivtsi region during the period of hostilities on the territory of Ukraine and to compare the data with the pre-war period.

Materials and methods. A search was conducted in the abstract database of PubMed using the keywords «tuberculosis», «war», «military actions», «incidence», «epidemiology», «military conflicts» and analysis of data from official statistics on epidemiological indicators of TB in the period from 2017 to 2023 years.

Results and discussion. In 2020, there was a sharp decline in morbidity rates due to quarantine restrictions that were introduced in connection with COVID-19 – 1.4 times in Ukraine and 1.8 times in Chernivtsi region compared to 2019. The rate of increase in the incidence of active tuberculosis in Ukraine in 2020 was – 28.6 % and – 40.4 % in the Chernivtsi region. In 2021, there was a moderate increase in morbidity both in Ukraine and in the Chernivtsi region, but the changes were more pronounced in the region. And already in 2022 in the Chernivtsi region, the rate of increase in morbidity was +30.6 %, in 2023 – +16.1 %. The impact of the war on the epidemiological indicators of TB can be clearly traced: in 2022, in the Chernivtsi region, the total share of internally displaced persons and servicemen with a first confirmed diagnosis of tuberculosis amounted to 7.4 % of the total number of cases of this disease, in 2023 – 8.4 %.

Conclusions. Thus, the impact of military actions on the epidemiological situation with TB in Chernivtsi region is significant. The immediate consequences of military operations were reflected in the growth of the morbidity rate, however, distant consequences in the form of further deterioration of the epidemiological situation with a peak in the next few years should be expected.

Keywords

Tuberculosis, war, military actions, epidemiology, morbidity.

Despite the achievements in the fight against tuberculosis (TB), this disease still remains a challenge for the medical industry of Ukraine. Currently, Ukraine is still on the list of 30 countries with a high burden of multidrug-resistant TB and ranks fourth in terms of the incidence of TB in the WHO European Region [14]. Since the announcement of the TB epidemic in Ukraine, quite significant success has been achieved in the fight against

this disease, however, the events of recent years in our country have become real challenges that have slowed down the progress of the achieved results. In particular, in 2020, the COVID-19 pandemic caused significant damage to the work of the phthisiatric service, limiting patients' access to specialized medical care. The year 2021 marked the beginning of a slow phase of recovery of phthisiatric care after the postponed consequences of COVID-19 in both

the national and regional contexts [6]. However, soon after that, Ukraine faced an even bigger problem – military operations in many regions.

It is known that military conflicts have a negative impact on the epidemiology of various diseases, especially those of infectious origin. Living conditions caused by the military conflict, such as inadequate hygiene, crowding of people in shelters, etc. contribute to an increase in the risk of transmission of infectious agents, especially airborne ones, among which TB occupies a prominent place [15]. The population's vulnerability to TB as a result of military actions also increases due to the reactivation of endogenous TB infection as a result of the effect on the body of high-level chronic stress, insufficient nutrition, lack of sleep.

Limited access to health care due to the destruction of the infrastructure of health care facilities, the loss of medical personnel and other factors lead to a decrease in the rate of diagnosis and treatment of TB. Actions during military conflicts disrupt the normal functioning of health systems and the implementation of the TB control program, contributing to reduced vaccination coverage, disrupting the supply of drugs, and hindering other activities necessary for effective TB control.

There are data that after the start of the war, access to medicines was problematic for approximately 6 million internally displaced persons in Ukraine, among whom were TB patients, which creates risks for interruption of treatment and reduction of its effectiveness [14].

The increased risk of TB morbidity and mortality associated with war has been traced back to World Wars I and II, the Vietnam War, and several civil wars, among others. Separate data indicate that armed conflicts were associated with an increase in the risk of TB by approximately 20 % [11]. It is believed that the transmission of *M. tuberculosis* can lead to both an immediate increase in the incidence of TB and an increase in epidemiological indicators already in the following years of the war [10].

The war in Ukraine led not only to internal migration, but also to external migration – to neighboring countries, which even causes concern in the health sector of some countries about the spread of mycobacterial strains from Ukraine to countries with a low incidence of TB [12, 13]. Although there is currently no significant increase in the incidence of TB among the population of host countries, it is expected that the effects of migration may become evident in the coming years [12]. It is worrying that countries with a low incidence of TB have a limited number of the latest antimycobacterial drugs for resistant strains of the TB pathogen that are common in Ukraine, which, therefore, may worsen the situa-

tion with the treatment of patients with resistant forms of TB who arrived from Ukraine. Accordingly, there is a risk of interruption of treatment, expansion of the resistance profile, recovery of the patient's contagiousness. The return of such persons to the territory of Ukraine in the long term may also negatively affect the epidemiological situation.

The combination of the consequences of the COVID-19 pandemic and the movement of migrants and refugees, the destruction of medical infrastructure, the complication of access to medical care and medicines can significantly complicate the achievement of the goals of the Strategy to overcome TB [10].

Objective – to analyze the state of the current epidemiological situation of tuberculosis in Ukraine and the Chernivtsi region during the period of hostilities on the territory of Ukraine and to compare the data with the pre-war period.

Materials and methods

A search was conducted in the abstract database of PubMed using the keywords «tuberculosis», «war», «military actions», «incidence», «epidemiology», «military conflicts» and analysis of data from official statistics on epidemiological indicators of TB in the period from 2017 to 2023 years [1–6]. The period was chosen in order to objectify the analysis of indicators of the pre-war period, including the pre-war and post-war periods.

Results and discussion

The dynamics of the incidence of active TB, including its recurrences, in Ukraine and the Chernivtsi region from 2017 to 2023 is shown in Fig. 1.

The COVID-19 pandemic divided the considered period into time segments before 2020 and after 2020, changing the trends of the incidence rate both in Ukraine and in the Chernivtsi region. The given data show that until 2020, there was a tendency towards a gradual decrease in the incidence of TB. Although the incidence rates remained quite high in Ukraine as a whole, such dynamics could indicate the effectiveness of previously applied TB management and prevention measures [7].

As the Fig. 1 shows, in 2020 there was a sharp decline in morbidity rates due to the quarantine restrictions that were introduced in connection with COVID-19. In 2020, the incidence of TB decreased by 1.4 times in Ukraine and 1.8 times in Chernivtsi region compared to 2019. If we compare the situation in 2020 compared to 2017, the incidence dropped by 1.5 times in Ukraine and by 1.8 times in the Chernivtsi region. General limitations in the work of medical institutions and reduced access of patients to visiting medical institutions contributed

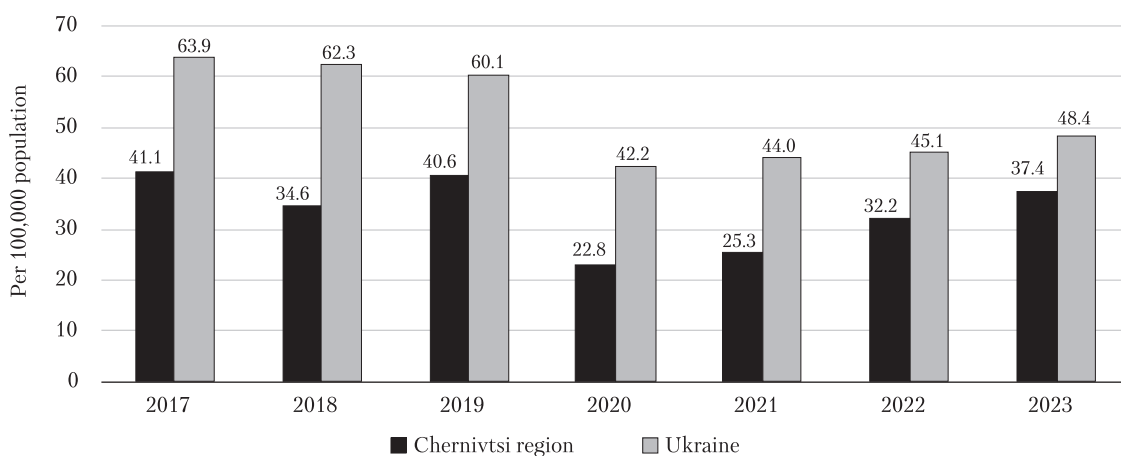


Fig. 1. Incidence of active tuberculosis, including its recurrences, in Ukraine and Chernivtsi region

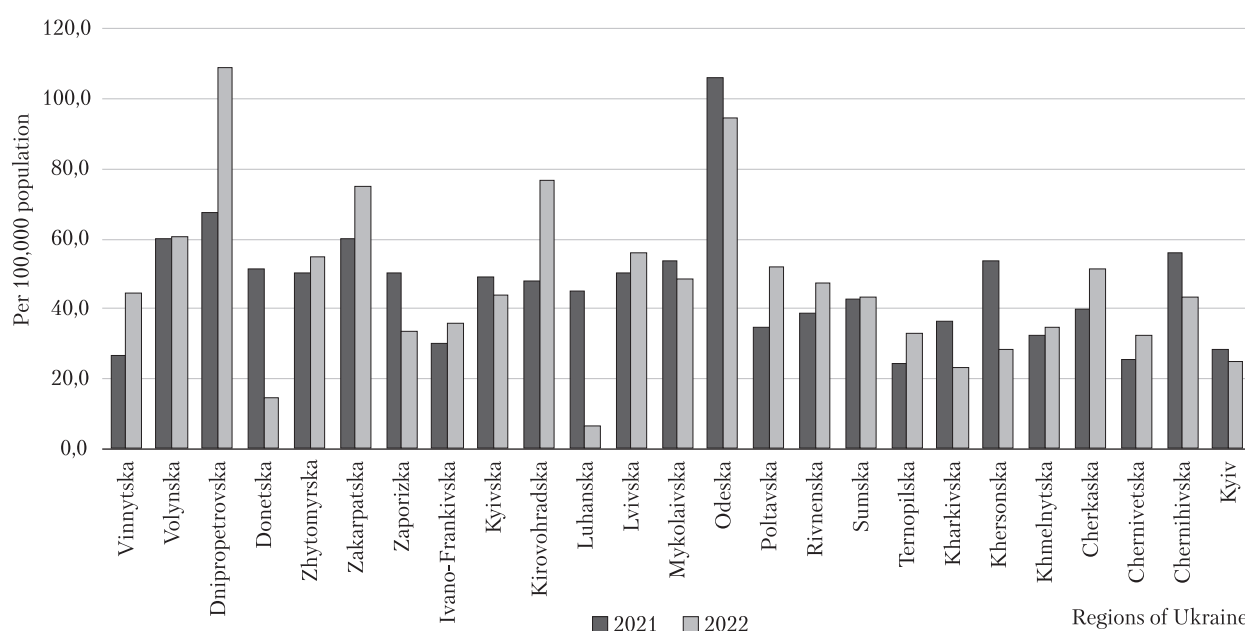


Fig. 2. Distribution of tuberculosis incidence by regions of Ukraine during 2020—2021

to a decrease in the amount of TB screening and TB diagnosis upon referral, in particular among vulnerable population groups [8]. There are opinions that quarantine measures during the COVID-19 pandemic, aimed at individual respiratory protection and mass restrictions on social contacts, partially affected the transmission of the TB pathogen.

However, taking into account that TB is not a highly dynamic disease, the most likely reason for such dynamics of indicators was the underdiagnosis of TB – starting from 2021, when quarantine restrictions were relaxed and access to medical care was restored, the incidence began to increase, as in Ukraine in as a whole, as well as in the Chernivtsi region.

According to official statistics, an increase in the incidence of TB occurred in 16 regions of Ukraine in 2021 and in 15 regions in 2022. The consistently highest rates of TB incidence during 2021–2022

were registered in Odesa, Dnipropetrovsk, Zakarpattia and Volyn regions (Fig. 2). In Kherson, Mykolaiv, and Chernihiv regions, TB incidence rates were among the highest in Ukraine in 2021 and decreased in 2022 [5, 6]. In 2022–2023, Kirovohrad Oblast joined the leaders in morbidity. The sharp decrease of this indicator in the Kherson region attracts attention – it almost doubled in both 2022 and 2023.

In Fig. 3 shows the rate of increase in the incidence of active TB (including relapses) in Ukraine and the Chernivtsi region for 2018–2023.

The rate of increase in the incidence of active TB in Ukraine was moderately negative in 2018 and 2019, following the trends of previous years. In 2020, this indicator in Ukraine was –28.6 %, and starting from 2021, it became positive, slowly growing. In the Chernivtsi region during this time period, fluctua-

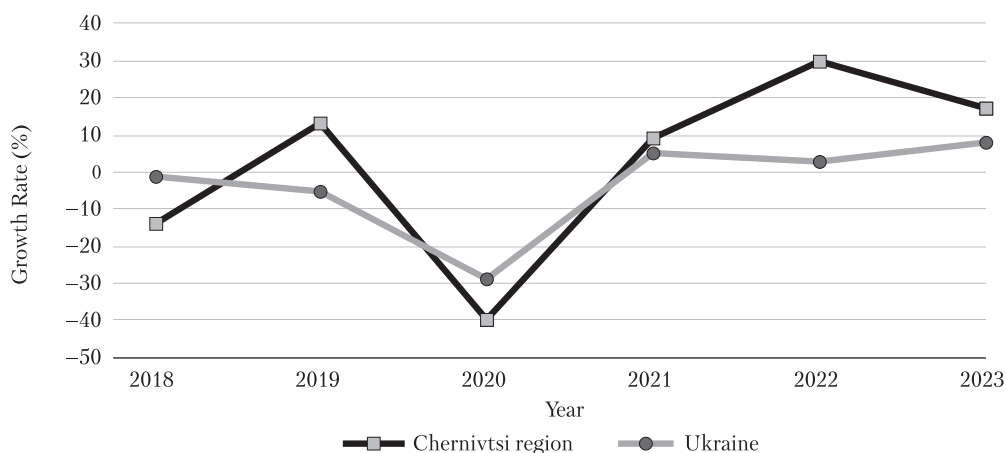


Fig. 3. Rates of increase in the incidence of active tuberculosis (including relapses) in Ukraine and the Chernivtsi region during 2018–2023

tions in growth rates were less stable than in Ukraine as a whole – after a negative increase in the morbidity rate in 2018 (–14.5 %), in 2019 there was an inversion of the growth rate trend – the rate was +13.4 %. In 2020, the «failure» of the growth rate was more pronounced than in Ukraine as a whole and amounted to –40.4 %. As in Ukraine, in the future, the growth rate of morbidity in Chernivtsi region changed to a positive one, but was significantly higher than the national indicator – in 2022, the indicator amounted to +30.6 %, in 2023, the increase occurred by 16.1 %. Such dynamics is explained, on the one hand, by the discovery of «hidden» cases of TB that appeared during the COVID-19 pandemic and were not diagnosed, and, on the other hand, by the increase in the number of cases due to migration processes among the population of Ukraine as a result of military operations. According to official statistical sources, the most pronounced decline in the rate of increase in morbidity was observed in areas where active hostilities are taking place, attacks on health care facilities and partial occupation are taking place, instead, an increase in the rate of increase was characteristic of areas in which the most active population migration took place.

Thus, in 2022, in Chernivtsi region, the share of internally displaced persons with a first confirmed diagnosis of TB was 5.6 % of the total number of cases of this disease in the region, in 2023 – 3.3 % of all TB cases in the region. In addition, the increase in the frequency of TB cases among military personnel, which accounted for 1.8 % in 2022 and 5.1 % in 2023 in the structure of new cases and persons with relapses, also had an impact on epidemiological indicators.

After the introduction of molecular-genetic diagnostic methods into the diagnostic process, the proportion of people with bacterial discharge gradually increased as the coverage of these diagnostic methods expanded both in Ukraine as a whole

and in the Chernivtsi region, stabilizing over time. However, in 2020–2021, there was a kind of «jump» in the share of people with bacterial excretion in the Chernivtsi region.

Fig. 4 present the ratio of the share of TB cases with and without bacterial isolation registered for the first time in the current year. As graphically depicted in the chart, there has been a steady increase in the proportion of TB with bacteremia throughout the period from 2017 to 2022, indicating an increase in the number of potential sources of infection and later diagnosis of cases. Probably, the increase in the frequency of bacterial isolation was influenced by quarantine restrictions due to the COVID-19 pandemic, since the first «jump» of the indicator is observed precisely in 2020. Chernivtsi region was one of the regions where quarantine was introduced the earliest, and the measures themselves were quite strict. This became one of the reasons for the late detection of both active and passive TB. The analysis of the structure of clinical forms of TB in the region in recent years showed the dominance of the widespread specific process with more than 3 segments affected (from 29.7 % in 2020 to 41.8 % in 2023).

According to official statistics (Fig. 5), in Ukraine as a whole, the share of people with MBT-positive sputum in recent years has been more stable compared to the Chernivtsi region – from 70 % in 2019 to 71.7 % in 2022, which is due to the uneven distribution of the share of people with bacterial discharge in different areas. In 2022, the share of microbiologically confirmed cases ranged from 62.7 % in Kirovohrad to 90.6 % in Chernivtsi oblasts, which can probably be related to the different incidence of HIV/TB co-infection in the oblasts and somewhat different approaches to microbiological diagnosis of TB.

According to official data (Fig. 6), mortality from TB decreased after 2018 and remained at a stable

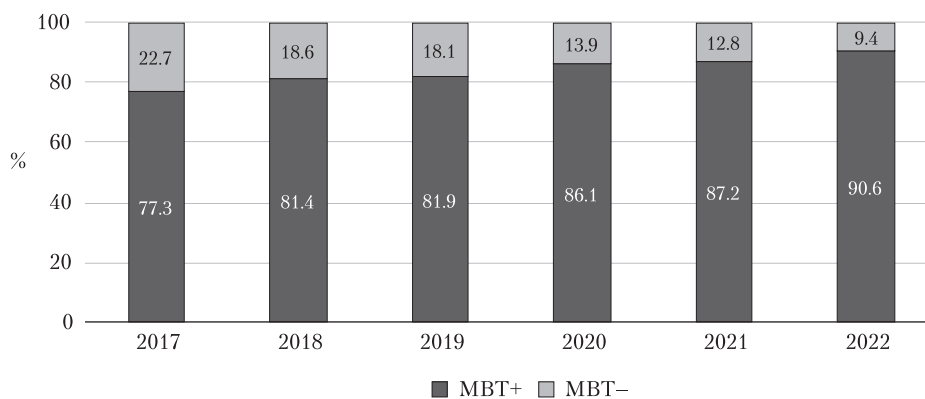


Fig. 4. Ratio of the MBT-positive and MBT-negative cases (new + relapses) in Chernivtsi

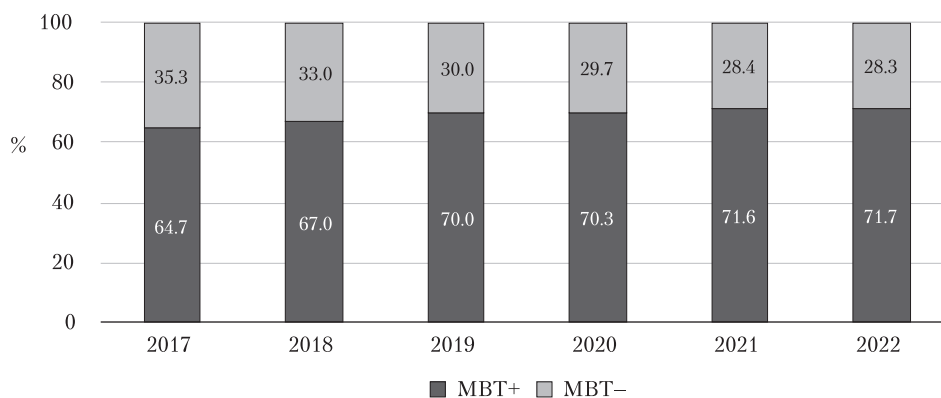


Fig. 5. Ratio of the MBT-positive and MBT-negative cases (new + relapses) in Ukraine

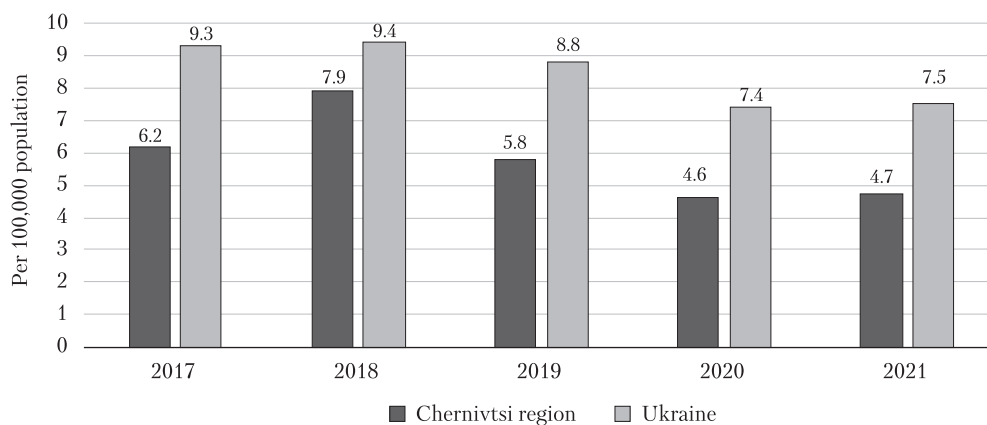


Fig. 6. Mortality from tuberculosis in Ukraine and the Chernivtsi region from 2017 to 2021

level during 2020–2021. The death rate in Chernivtsi Oblast remains one of the lowest in Ukraine – at the level of 4.6–4.7 per 100,000 population in Chernivtsi Oblast against 7.4–7.5 per 100,000 population in Ukraine in 2020–2021.

The incidence of HIV infection has a significant impact on epidemiological indicators of TB, since HIV-positive status is a significant risk factor for the development of TB. The epidemiological situation of HIV infection is heterogeneous in different regions of Ukraine, which leads to an uneven distri-

bution of HIV/TB co-infection cases. However, in the country as a whole, the incidence of combined pathology after a decline in 2020 remained relatively stable over the past 4 years (Fig. 7).

In the annual cohorts of 2017–2021 in Ukraine, on average, about 20 % of new cases and relapses of TB occurred among HIV-positive patients (Fig. 8).

In the Chernivtsi region, the share of HIV-associated TB varied from 6.4 % in 2017 to 10.8 % in 2020, after which there was a decline from 7.6 % in 2021 to 4.1 % in 2023 (Fig. 9).

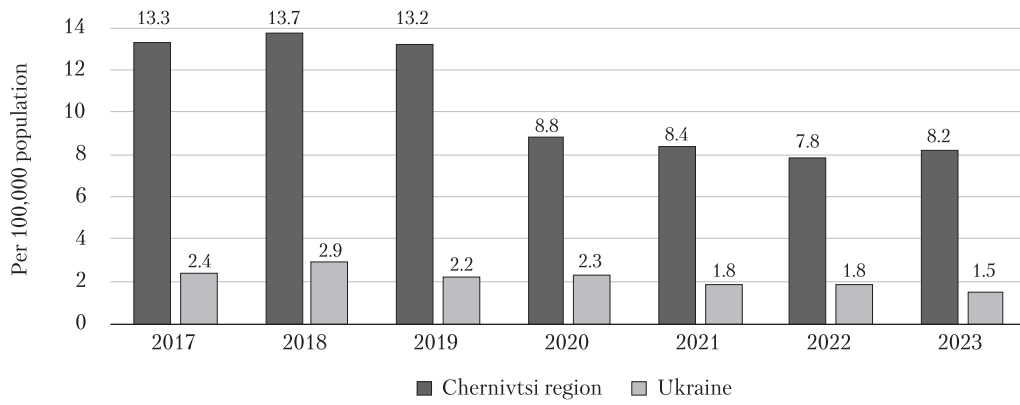


Fig. 7. Incidence of tuberculosis in combination with HIV/AIDS (new cases + relapses)

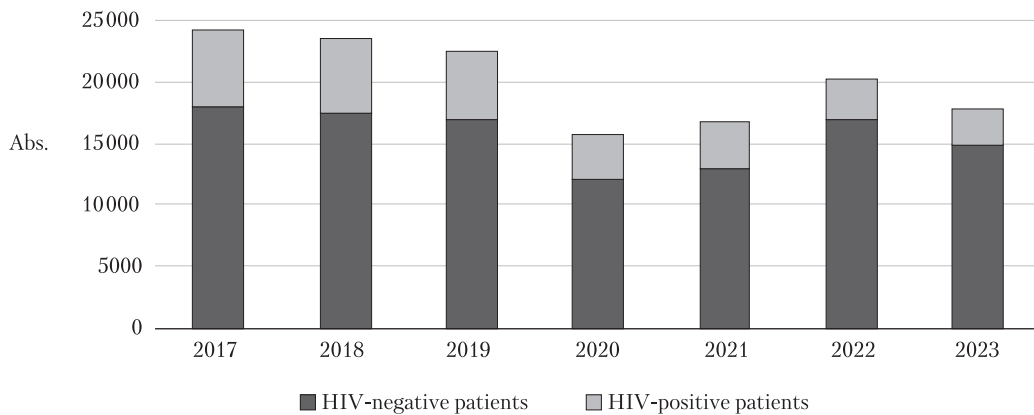


Fig. 8. Dynamics of tuberculosis cases (new cases + relapses) depending on HIV status in Ukraine for 2017—2023

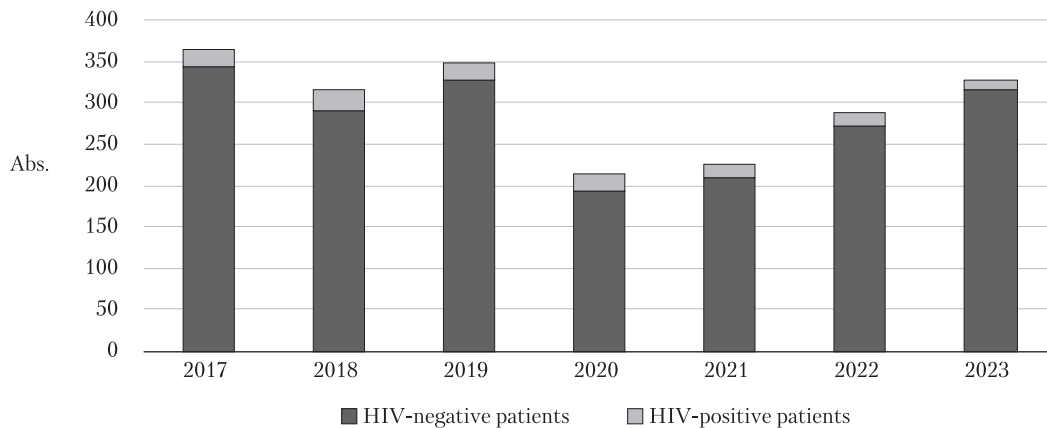


Fig. 9. Dynamics of tuberculosis cases (new cases + relapses) depending on HIV status in Chernivtsi region for 2017—2023

Thus, the share of TB patients from other regions registered in Chernivtsi region and TB patients of military personnel was close to the share of HIV-associated TB, i.e., it has an equally significant impact on the epidemiological situation.

Thus, in Ukraine, until 2020, there was a tendency to a gradual decrease in the incidence of TB, which was probably a consequence of the previously effective TB prevention and control measures.

However, in 2020, the redistribution of medical resources to fight against COVID-19 negatively affected the timely detection of TB, which was reflected in a sharp drop in morbidity rates in 2020 due to underdiagnosis. The COVID-19 pandemic significantly affected the epidemiological indicators of TB incidence in Ukraine in general, but the changes were significantly more significant in the Chernivtsi region.

Since 2021, after the relaxation of quarantine measures, the incidence of TB began to increase, in particular due to the diagnosis of cases not detected in the previous year. The start of hostilities on the territory of Ukraine became the impetus for active migration processes between different regions of the country, which was reflected in the epidemiological indicators of TB. In some regions of Ukraine, a significant increase in morbidity was observed, which was especially pronounced in the regions to which residents of territories with active hostilities migrated to the greatest extent. In particular, in the Chernivtsi region in 2022, the rate of increase in the incidence of TB was +30.6 %. Analysis of statistical data showed that this dynamic in the region is partially due to the influence of military operations in the country – in 2022, the total share of internally displaced persons and servicemen with a first confirmed diagnosis of TB was 7.4 %, in 2023 – 8.4 % of the total the number of newly registered cases of the disease in the region.

No conflict of interest.

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Thus, the impact of military actions on the epidemiological situation with TB in Chernivtsi region is significant.

The immediate consequences of military actions were reflected in the growth of the morbidity rate, however, distant consequences in the form of further deterioration of the epidemiological situation with a peak in the next few years should be expected.

Conclusions

1. The beginning of hostilities on the territory of Ukraine was the impetus for a significant increase in the incidence of TB, which was especially pronounced in the regions to which residents of territories with active hostilities migrated to the greatest extent.

2. In the Chernivtsi region in 2022, the rate of increase in the incidence of TB was +30.6 %; in 2023, the total share of internally displaced persons and servicemen with a first confirmed diagnosis of TB was 7.4 %, in 2023 – 8.4 % of the total number of first-time registered cases of the disease in the region.

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Сучасна епідеміологічна ситуація з туберкульозу в Україні та Чернівецькій області

Воєнні конфлікти негативно впливають на епідеміологію різних захворювань, серед яких одним із найпоширеніших є туберкульоз. Зростання захворюваності та смертності від туберкульозу, пов'язане з війною, зареєстровано після Першої та Другої світових війн, багатьох воєн меншого масштабу. Є дані, що збройні конфлікти асоціюються зі збільшенням ризику захворювання на туберкульоз серед населення до 20 %.

Мета роботи — проаналізувати стан сучасної епідеміологічної ситуації з туберкульозу в Україні та Чернівецькій області в період воєнних дій на території України та порівняти дані з довоєнним періодом.

Матеріали та методи. Проведено пошук у реферативній базі PubMed за ключовими словами «туберкульоз», «війна», «воєнні дії», «захворюваність», «епідеміологія», «воєнні конфлікти» й аналіз даних офіційної статистики з епідеміологічних показників туберкульозу у 2017–2023 рр.

Результати та обговорення. У 2020 р. порівняно з 2019 р. зареєстровано різкий спад показників захворюваності на туберкульоз, пов'язаний із карантинними обмеженнями, впровадженими через пандемію COVID-19, — у 1,4 разу по Україні та 1,8 разу в Чернівецькій області. Темп приросту захворюваності на активний туберкульоз у 2020 р. становив –28,6 % в Україні та –40,4 % у Чернівецькій області. У 2021 р. відбулося помірне зростання захворюваності як в Україні, так і в Чернівецькій області, однак зміни були виразнішими в області. У 2022 р. у Чернівецькій області темп приросту захворюваності становив +30,6 %, у 2023 р. — +16,1 %. Вплив війни на епідеміологічні показники з туберкульозу чітко простежується: у 2022 р. у Чернівецькій області сумарна частка внутрішньо переміщених осіб та військовослужбовців із вперше підтвердженим діагнозом туберкульозу становила 7,4 % від загальної кількості захворівших на туберкульоз, у 2023 р. — 8,4 %.

Висновки. Вплив воєнних дій на епідеміологічну ситуацію з туберкульозом у Чернівецькій області є значним. Найближчими наслідками воєнних дій є зростання показника захворюваності. Слід очікувати подальшого погіршення епідеміологічної ситуації з піком через кілька років.

Ключові слова: туберкульоз, війна, воєнні дії, епідеміологія, захворюваність.

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