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# The Impact of External Migration on the Epidemiology of Tuberculosis in Eastern Europe

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Despite the achievements in the field of overcoming tuberculosis (TB), this disease remains a challenge for the medical industry of Ukraine. Currently, Ukraine is among the top 30 countries with a high burden of multidrug-resistant TB and ranks 4<sup>th</sup> in terms of chemoresistant tuberculosis incidence in the WHO European Region. Since the announcement of the TB epidemic in Ukraine, quite significant success has been achieved in the fight against this disease, but the events of recent years in our country have become real challenges that have slowed down the progress of the results achieved. In 2020, the COVID-19 pandemic caused significant damage to the work of the TB service, limiting patients' access to specialized medical care. 2021 marked the beginning of a slow recovery of TB care after the consequences of COVID-19 both in the national and regional context. However, soon after, Ukraine faced an even greater challenge — military actions in many regions, which led to the formation of large internal and external migration waves.

**Objective** — to analyse the current epidemiological situation of TB in Ukraine and the Chernivtsi region and to assess the prospects for the impact of the COVID-19 pandemic on the epidemiology of TB in Eastern Europe using an AI mathematical model.

**Materials and methods.** A search was conducted in the Pub Med abstract database using the keywords: «COVID-19», «tuberculosis», «war», «military actions», «morbidity», «epidemiology», «military conflicts» and an analysis of official statistics on epidemiological indicators of TB in the period from 2017 to 2023.

**Results.** Tuberculosis is a major health problem affecting the population of peak economic and reproductive age. According to WHO reports, during the COVID-19 pandemic, the number of reported cases worldwide decreased by 18 % from 7.1 million in 2019 to 5.8 million in 2020, with a slight increase

to 6.4 million in 2021. During the same period, in the WHO European Region, the number of reported cases decreased by 24 % from 215,900 in 2019 to 153,700 in 2020, with a partial recovery to 166 100 in 2021. Barriers to rapid access to health services, screening and prevention methods have increased the rate of patients with coinfection.

The incidence of HIV worldwide has increased from 10 % in 2019 to 13 % in 2022. These problems have led to a decrease in the overall success rate of treatment of TB/HIV patients from 57 % in 2019 to 47 % in 2020. People living with HIV develop active TB in 14–18 times more often. Other risk factors for TB development also play a major role. In 2022, there were 2.2 million new cases of TB associated with malnutrition, 0.89 million with HIV infection, 0.73 million with alcohol abuse, 0.70 million with smoking, and 0.37 million with diabetes. Multidrug-resistant TB is a particularly challenging issue, as only 2 out of 5 patients with multidrug-resistant TB had access to treatment in 2022. Without proper treatment, about 60 % of HIV-negative TB patients and almost all HIV-positive patients with active TB die.

A similar epidemiological vector was found in 2 high TB-burden countries in Eastern Europe: the Republic of Moldova and Ukraine. The incidence of new cases and relapses in the Republic of Moldova was 75.1/100,000 population (3016 reported cases) in 2018, 71.6 (2877 reported cases) in 2019, 43.8/100,000 population (reported cases) with recovery to 51.5/100,000 population (2067 reported cases) in 2021. On the other hand, on the eastern border, Ukraine reported an increase in new cases and relapses. US\$13 billion is spent annually on preventing, diagnosing and treating TB. Efforts are aimed at achieving the global goal of ending TB, adopted at the UN meeting on TB in 2018. Ending the TB epidemic by 2030 is one of the health targets of the UN Sustainable Development Goals.

**Conclusions.** With the onset of the COVID-19 epidemic, as well as a full-scale invasion, the incidence of TB decreased by 27.3 % in 2023 (48.4 cases per 100,000 population) compared to 2018 (50.5 cases per 100,000 population), which, however, does not reflect positive dynamics on the path to overcoming TB in Ukraine, but, on the contrary, is an indicator of under-detection of cases of active tuberculosis. In Ukraine, until 2020, there was a tendency towards a gradual decrease in the incidence of TB, which was probably a consequence of previously effective measures for preventing and controlling TB. However, in 2020, the redistribution of medical resources to combat COVID-19 adversely affected the timely detection of tuberculosis, which was reflected in a sharp drop in incidence rates in 2020 due to underdiagnosis. The COVID-19 pandemic has had a significant impact on the epidemiological indicators of tuberculosis incidence both in Ukraine as a whole and in the Chernivtsi region. Since 2021, after the easing of

quarantine measures, the incidence rates of TB began to increase, in particular as a result of pre-diagnosis of cases not detected in the previous year. The outbreak of military action on the territory of Ukraine has become an impetus for active migration processes between different regions of the country, which is reflected in the epidemiological indicators of TB. In some regions of Ukraine, there was a significant increase in the incidence rate, which was especially pronounced in the regions to which residents of territories with active military action migrated to the greatest extent. In particular, in the Chernivtsi region in 2022, the rate of increase in the incidence of tuberculosis was +30.6 %. Analysis of statistical data showed that such dynamics in the region are partly due to the impact of military actions in the country – in 2022, the total share of internally displaced persons and military personnel with a first confirmed diagnosis of tuberculosis was 7.4 %, in 2023 – 8.4 % of the total number of first registered cases of the disease in the region. Thus, the impact of military actions on the epidemiological situation with TB in the Chernivtsi region is significant. The immediate consequences of military action are reflected in the increase in the incidence rate, but long-term consequences should be expected in the form of a further deterioration of the epidemiological situation with a peak in the next few years.