THE IMPACT OF COVID-19 PANDEMIC ON THE DYNAMICS OF TUBERCULOSIS EPIDEMIOLOGICAL INDICATORS BEFORE AND DURING THE COVID-19 PANDEMIC IN THE REPUBLIC OF MOLDOVA AND UKRAINE

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ABSTRACT

The study aimed to assess the main epidemiological indicators of tuberculosis (TB) before, during, and after the COVID-19 pandemic in the Republic of Moldova and Ukraine, and to identify the key drivers underlying their trends. **Material and methods:** This study is based on the analysis of global WHO tuberculosis reports and national tuberculosis statistical data. **Results:** In RM and UA, the COVID-19 pandemic significantly impacted TB detection and case registrations. TB incidence declined before the COVID-19 pandemic, followed by an increase in subsequent years. In R. Moldova, the incidence decreased from 70.88 to 56.73/100000 population between 2015 and 2019, but rose again to 66.34/100000 by 2024. Similarly, in Ukraine, the incidence declined from 62.3/100000 in 2018 to 42.2/100000 before increasing to 45.1/100000 population in 2022. **Conclusions:** The number of reported tuberculosis (TB) cases decreased during the COVID-19 pandemic in both the Republic of Moldova and Ukraine due to common factors, including mobility restrictions, disruption of TB services, reallocation of healthcare resources, and reduced healthcare-seeking behavior associated with increased stigma and avoidance. A gradual restoration of TB services followed this. In the post-pandemic period (2023–2024), increases in certain indicators, such as global incidence and relapsed cases, may reflect improved case detection.

Keywords: Tuberculosis, COVID-19, epidemiological indicators, Republic of Moldova, Ukraine.

1. INTRODUCTION

WHO reports indicate that the COVID-19 pandemic significantly disrupted TB case detection and treatment outcomes, with globally reported cases declining from about 10 million (130/10,000 population) before the pandemic (2018) to 7.1 million in 2019 and 5.8 million in 2020, followed by a partial recovery to 6.4 million in 2021 and rising again to 10.6 million in 2022, 10.8 million in 2023, and around 10.7 million new cases in 2024, with similar levels estimated for 2025 [1-8]. In 10 high-burden countries (HBC), excluding the Eastern Europe Region, the largest decline (28%) was observed in 2022 compared with 2019 [10]. These reductions in TB notifications during the COVID-19 pandemic led to a significant increase in undiagnosed and untreated TB cases worldwide, especially during the initial phase (2020-2022). In 2022, there was a significant global recovery in the number of patients diagnosed with TB following two years of disruptions caused by the COVID-19 pandemic. In 2022, the global number of newly registered TB cases reached 7.5 million, the highest level recorded since the WHO began global TB surveillance in 1995. The value exceeded the pre-COVID indices (2018-2019) and the previous peak of 7.1 million cases reported in 2019, increasing from 5.8 million in 2020 and 6.4 million in 2021. In 2022, the global incidence indicator included a considerable number of individuals who developed TB during the COVID-19 pandemic. Still, diagnosis and treatment were delayed due to disruptions caused by mobility

restrictions, disruptions in the activity of TB services, and avoidance of TB services [2-5]. In the epidemiological context, the Republic of Moldova (RM) and Ukraine (UA) have remained on the WHO list of high MDR/RR-TB burden countries since 2016, which has been a main factor contributing to low treatment success rates [9-10]. UA is also included in the WHO list of high-burden countries for TB, HIV-associated TB, and MDR/RR-TB for the period 2021–2025 [4-8]. Globally, TB remained, from 2020 to 2022, the second-leading cause of death from a single infectious agent, after COVID-19 [3-5]. The study aimed to conduct a comparative assessment of the main epidemiological indicators of tuberculosis before and during the COVID-19 pandemic in the Republic of Moldova and Ukraine, including the trans-border region of Chernivtsi, to identify the key drivers of their trends.

2. MATERIAL AND METHODS

An analysis of global WHO tuberculosis reports and national TB statistical data was performed.

3. RESULTS

Analyzing national statistical reports in the RM, the TB incidence (new cases) declined, since 2015 from 70.88/100.000 (2859 cases), 2016: 70.57/100.000 (2845 cases), 2017: 66.66/100.000 (2682 cases), 2018: 60.99/100.000 (2450 cases), and in 2019: 56.73/100.000 (2279 cases). However, during the period from 2020 to 2024, an increase in indicators was registered, with the incidence rising from 56.68 to 66.34/100.000 population [9]. The upward trend contrasted with the previous 21.7% decrease observed from 2015 to 2020, which indicated a significant shift in TB epidemiology with evident regional disparities. On the Right Bank, the incidence increased from 1421 cases in 2020 to 1649 in 2024, while Transnistria (Left Bank) experienced a decline from 338 to 287 cases over the same period. Significant local variations included Stefan-Voda, which recorded the highest increase of 151% (from 29 to 73 cases), and Donduseni, with the notable decrease of 63% (from 22 to 8 cases). While comparing the global incidence (new cases and relapses) the improving trend with a decrease of 19.1% was noted during 2016-2019, as in 2019 was at 71.6/100.000 population (2877 cases), in 2018: 75.1/100.000 population (3016 cases), in 2017: 83.3/100.000 (3358 cases), in 2016: 88.5/100.000 population (3569 cases). Since 2020, the global incidence has shown a changing trend, rising from 56.68/100.000 population (1759 cases) to 66.34/100.000 (1936 cases) by 2024, representing a 17.1% rise over four years, contrasting with the previous declining trend observed from 2016 to 2019.

The incidence of TB relapses in 2024 was 12,92/100.000 (377 cases), in 2023: 14.87/100.000 (434 cases), while in 2022: 15.08/100.000 (453 cases) compared to 2021: 14.82/100.000 (454 cases), with an increase of 1.7% from 2021 to 2024. In 2020, the incidence of relapses was 12.37/100.000 (384 cases), in 2019: 14.86/100.000 population (597 cases), in 2018: 14.06/100.000 (565 cases), for 2017: 16.68/100.000 (671 cases), in 2016: 17.93/100.000 population (723 cases), and in 2015: 18.52/100.000 population (747 cases). A 18.6% decrease in the rate of TB relapses was observed during the period 2015-2020. Regional variations on the Right Bank included an increase in cases from 302 in 2020 to 328 in 2024, with the incidence rising to 16.4% from 11.46 to 13.34/100.000. In Transnistria (Left Bank), the cases decreased significantly from 82 in 2020 to 49 in 2024, and the relapse incidence rate dropped with 39.2% from 17.51 to 10.64/100.000. The notable changes in specific regions were in Ialoveni with the highest increase, from 16 cases (21.03/100.000) to 23 cases (32.44/100.000), Orhei from 11 cases (12.98/100.000) to 25 cases (32.57/100.000), and Ribnita with a substantial decrease from 20 cases (29.81100.000) to 4 cases (6.11100.000). The gender distribution showed that the rate of male cases decreased from 84% in 2020 to 79% in 2024, while the rate of female cases increased from 16% in 2020 to 21% in 2024. Chisinau (capital)

showed a slight increase from 66 cases (9.91100.000) to 71 cases (10.63100.000), while in rural areas, incidence rates increased more than in urban areas.

The analysis of TB prevalence revealed significant changes between the periods 2015-2019 and 2020-2024. During 2015-2019, the total number of TB cases decreased from 4056 in 2015 to 3186 in 2019, with the prevalence rate dropping from 100.55 to 79.31/100.000, and in 2020-2024, the total TB cases further decreased from 2220 in 2020 to 1589 in 2024, with the prevalence rate falling from 71.54 to 54.45/100.000. Regional variations in the Right Bank showed that during 2015-2019, the total number of cases decreased from 3254 to 2533, and during 2020-2024 further decreased from 1718 to 1325. In Transnistria (Left Bank), during 2015-2019, the number of cases decreased from 802 to 653, and from 2020 to 2024, significantly reduced from 502 to 264. Notable changes were observed in Chisinau (capital): in 2015-2019, cases decreased from 782 to 616, and in 2020-2024, further reduced from 425 to 332. During 2015-2019, Stefan Voda determined a decrease from 53 to 44 cases, and during 2020-2024, an increase from 33 to 45 cases, showing a reversal in trend. During 2015-2019, the rate of male cases remained stable at around 77-78%, and during 2020-2024, the rate slightly decreased from 80% to 79%. TB-caused mortality increased due to disruptions in diagnosis and treatment services: 5.2/100000 (207 deaths) in 2022, with an increase of 20% to 6.5/100000 (199 deaths) in 2021. In 2023, a rate of 3.1/100000 (125 cases) was reported, which decreased to 2.2/100000 in 2024 (99 cases). The general decline of indicators suggested a substantial increase in undiagnosed and untreated TB cases during the COVID-19 pandemic. The notification rate of rifampicin-resistant and multidrug-resistant tuberculosis (RR/MDR-TB) decreased from 16.3/100000 population in 2019 to 13.8/100000 in 2024, corresponding to 410 reported cases, while 93.5% of TB patients (new and relapse cases) were tested with WHO-recommended rapid diagnostic tests, with 1,808 of 1,934 patients. The treatment success rate for drug-susceptible TB was 89.9% and for MDR-TB was 76.5% in 2022.

Reviewing national statistical reports in Ukraine (UA), the global incidence (GI) decreased from 62.3/100000 population in 2018 (26321 cases) to 60.1/100000 (25257 cases) in 2019, representing a 2.2% reduction, followed by a further decline of 17.7% to 42.2/100000 (17593 cases). Subsequently, the GI increased to 44.0/100000 (18241 cases) in 2021 and to 45.1/100000 (18510 cases) in 2022, including 4744 women and 13766 men, among them 3909 started the treatment for MDR-TB. Meanwhile, the GI of MDR-TB cases showed a continuous decline, decreasing from 13.7/100000 (5788 cases) in 2018 to 13.2/100000 (5524 cases) in 2019. It further dropped by 4.4% to 8.8/100000 (3675 cases) in 2020, followed by reductions to 8.4/100000 (3489 cases) in 2021 and 7.8/100000 in 2022 [10].

The TB GI in the trans-border Chernivtsi region was 32.2/100000 population in 2022, including 286 new and relapse cases. The GI showed a fluctuating trend over the study pre- and COVID-19 period: from 34.6/100000 (313 cases) in 2018, it increased to 40.6/100000 population (366 cases, +17%) in 2019, followed by a sharp decline of 80% in 2020 to 22.8 per 100,000 population (205 cases). It then slightly increased to 25.3/100000 population (226 cases) in 2021 and further rose to 32.2/100000 population (286 cases) in 2022. Meanwhile, the GI of MDR-RR/TB cases constantly decreased during the study period from 2.9/100000 population (26) in 2018, to 2.2/100000 population (20) in 2019, 2.3/100000 population (21) in 2020, 1.8/100000 population (16) in 2021 and 1.8/100000 population (16) in 2022, with an overall decrease with 60%. The treatment success rate among MDR/RR-TB cases registered in 2020 was 65.2%, with a death rate of 15%, a loss to follow-up rate of 10.6%, and a treatment failure rate of 8.5%. Meanwhile, in the Chernivtsi region, the treatment success rate among MDR/RR-TB cases registered in 2020 was 66.6%, with a death rate of 15.2%, a loss to follow-up rate of 12.1%, and a treatment failure rate of 6.1%.

Reviewing the published reviews and reports was established that the key factors which decreased the TB case detection during the COVID-19 pandemics (2020-2022) were related to several exogenous factors: a) mobility restrictions, lockdowns and other measures which limited patients access to TB diagnosis, treatment, and care services; b) disruption of TB services: national TB programs were reduced as health system prioritized COVID-19 response: c) resource reallocation: human, financial, and technical staff, including laboratory equipment, were diverted from TB to COVID-19 services; d) reduced healthcare seeking as patients which avoided medical facilities due to COVID-19 exposure; c) increased stigma, potentially discouraging patients from seeking TB-related health care [10-14].

5. CONCLUSIONS

The COVID-19 pandemic significantly disrupted tuberculosis detection and case registration in the RM and UA, leading to a temporary decline in reported cases during 2020–2022 due to restricted mobility, reduced healthcare-seeking behavior, and reallocation of healthcare resources. With the gradual restoration of TB services in the post-pandemic period (2023-2024), key epidemiological indicators increased, reflecting improved case detection and the recovery of diagnostic and surveillance activities. In the Republic of Moldova, the incidence of TB cases decreased between 2015 and 2019, from 70.88/100000 population (2859 cases) to 56.73/100000 (2279 cases). However, during the period 2020–2024, the indicator increased again, rising from 56.68 to 66.34/100000 population. In Ukraine, the TB global incidence decreased from 62.3/100000 population in 2018 to 60.1/100000 in 2019, followed by a sharper decline to 42.2/100000, then increased, reaching 44.0/100000 in 2021 and 45.1/100000 population in 2022. Several factors contributed to the disruption of TB control, including mobility restrictions and lockdowns that limited access to diagnosis and treatment, interruptions in TB services as health systems prioritized the COVID-19 response, reallocation of human, financial, and technical resources to COVID-19 care, reduced healthcare-seeking behavior due to fear of infection, and increased stigma.

DECLARATIONS

Conflict of Interest Statement: The authors declare that they have no conflict of interest.
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