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LETTER

National survey on the impact of the war in Ukraine on TB diagnostics and treatment services in 2022

Dear Editor,

Ukraine has one of the highest TB incidences in the WHO European Region,[1] and one of the highest rates of multidrug-resistant TB (MDR-TB) worldwide. According to the latest WHO report, 4,257 patients with MDR-TB were notified in Ukraine in 2020, compared to 566 patients with MDR-TB in the entire European Union/European Economic area.[1] Until recently, Ukraine experienced significant shortages in TB diagnostics and anti-TB medicines.[2] However, over the past 5 years, a series of important control interventions have been implemented, including the availability of Xpert® MTB/Rif and Xpert MTB/XDR (Cepheid; Sunnyvale, CA, USA) and a stable supply of WHO-recommended medicines for the treatment of MDR-TB to improve treatment outcomes of patients with MDR-TB in Ukraine.

Since the military invasion by the Russian Federation on 24 February 2022, civilian infrastructure, including healthcare facilities, has been partly destroyed. By mid-2022, one quarter of the population of Ukraine (more than 10 million people) have been displaced, the majority having left the country.[3] In many regions, people have experienced prolonged stays in poorly ventilated, overcrowded air raid shelters – ideal conditions for the transmission of *Mycobacterium tuberculosis*.[4] Limited access to TB diagnostics and therapies were an expected consequence of this military conflict.[5] To assess the impact of the war, we conducted a point prevalence study on the availability of inpatient and outpatient care, diagnostics and anti-TB therapies.

On 15 August 2022, we undertook a countrywide prevalence survey among all regional TB centres in Ukraine. Representatives from Ukraine's regional TB care centres (TB dispensaries) were asked to complete a standardised questionnaire with 47 items to assess the number of patients in inpatient and outpatient care, the geographic origin of patients, condition of the medical infrastructure, and the availability of diagnostics and anti-TB medicines. To allow us to compare the situation on 15 August 2022 with previous periods, the representatives were also asked to answer the same questionnaire items for two additional dates, 23 February 2019 (before the COVID-19 pandemic) and 23 February 2022 (before the invasion of Ukraine).[6] With the exception of TB dispensaries from the occupied territories (Donetsk, Kherson, Luhansk and the autonomous Republic of Crimea), all 21/25 regional TB dispensaries were able to participate in the survey on 15 August 2022 (the infrastructure of the TB dispensary in the Chernihiv Region was destroyed at the start of the war, but it was restored by August 15, 2022).

Between 23 February 2019 and 23 February 2022, there has been a progressive reduction in the mean number of hospitalised adult TB patients (233.6 ± 152.9 vs. 100.7 ± 61.9; $P < 0.001$); in the period from 23 February 2022 to 15 August 2022, this remained relatively unchanged (100.7 ± 61.9 vs. 91.0 ± 66.3; $P = 0.085$). The number of patients in outpatient treatment did not increase between the three time-points (see Table). The mean proportion of TB patients who received medical care in a region different to that of their permanent residence increased from 23 February 2019 (0.7 ± 1.2%) and 23 February 2022 (1.3 ± 2.5%) ($P = 0.311$) to 15 August 2022 (7.0 ± 5.7%) ($P < 0.001$). Shortages of consumables for molecular diagnostics of TB and genotypic prediction of *M. tuberculosis* drug resistance using Xpert MTB/XDR were reported by 2/21 TB dispensaries (Kirovohrad and Volyn) for 15 August 2022. Xpert MTB/RIF was available in all 20/21 regions on 23 February 2022 and 15 August 2022. Drug susceptibility testing (DST) for moxifloxacin and levofloxacin was available in all 21 regions at all timepoints of the study. However, by 15 August 2022, shortages in the capacity for DST for linezolid was reported from the Poltava Region, for clofazimine from the Chernivtsi Region and for bedaquiline from the Kyiv, Dnipropetrovsk and Poltava Regions. The war had also impacted on DST for cycloserine, which was only available in Zhytomyr, Rivne and Chernivtsi. DST for pretomanid was not available in any part of Ukraine at the time of the survey.

On 15 August 2022, the first-line medicines (rifampicin, isoniazid, pyrazinamide and ethambutol) were available in all 21 TB dispensaries. Moxifloxacin, levofloxacin, bedaquiline, linezolid, clofazimine and delamanid were available in all of these regional TB centres, with the exception of the Kyiv Region, where there was a bedaquiline stock-out. Several regions experienced stock-outs of other medicines such as cycloserine (Zaporizhzhia and Ternopil Regions), ethionamide or/and prothionamide (Terno-

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Table TB patients, availability of diagnostics and anti-TB medicine in Ukraine prior to COVID-19 (23 February 2021), prior to the invasion of Ukraine by the Russian Federation (23 February 2022), and on 15 August 2022*

Indicators	23 February 2019 (n = 7,358) I n (%)	23 February 2022 (n = 4,570) II n (%)	15 August 2022 (n = 3,990) III n (%)	P value I vs. II	P value II vs. III
Beds allocated for TB patients	6,908 (93.9)†	3,330 (72.9)†	3,225 (80.8)†	<0.001‡	<0.001‡
Adults in hospital with TB	4,907 (66.7)†	2,115 (46.3)†	1,913 (47.9)†	<0.001‡	0.139
Patients in hospital with TB-HIV	1,088 (14.8)†	614 (13.4)†	519 (13)†	0.033‡	0.585
Adults in outpatient TB treatment, mean ± SD	403.5 ± 407.3	387.14 ± 355.3	412.4 ± 441.5	0.826	0.449
TB-HIV outpatients, mean ± SD	77.1 ± 160.6	74.2 ± 121.8	79.3 ± 132.1	0.871	0.369
TB patients from other regions of the country, mean ± SD	1.61 ± 2.17	1.66±2.59	6.23±4.97	0.946	<0.001‡
Availability of culture-based DST for second-line drugs					
MFX or LVX	21 (100)	21 (100)	21 (100)	nd	nd
BDQ	0	20 (95.2)	18 (85.7)	<0.001‡	0.294
PMD	0	0	0	—	—
LZD	20 (95.2)	20 (95.2)	20 (95.2)	nd	nd
CFZ	2 (9.5)	20 (95.2)	20 (95.2)	<0.001‡	nd
CS	6 (28.6)	3 (14.3)	3 (14.3)	0.259	nd
Availability of all first-line drugs:					
Rifampicin, isoniazid, pyrazinamide and ethambutol	21 (100)	21 (100)	21 (100)	nd	nd
Availability of second-line drugs:					
MFX or LVX	21 (100)	21 (100)	21 (100)	nd	nd
BDQ	8 (38.1)	21 (100)	20 (95.2)	<0.001‡	0.309
CFZ and LZD	19 (90.5)	21 (100)	21 (100)	0.147	nd
PMD	0	2 (9.5)	13 (61.9)	0.147	<0.001‡
CS	19 (90.5)	19 (90.5)	19 (90.5)	nd	nd
Delamanid	0	21 (100)	21 (100)	<0.001	nd
Imipenem–cilastatin or meropenem	18 (85.7)	16 (76.2)	15 (71.4)	0.433	0.723
Amikacin	17 (80.9)	18 (85.7)	17 (80.9)	0.676	0.676
Ethionamide or prothionamide	20 (95.2)	19 (90.5)	19 (90.5)	0.554	nd
p-aminosalicylic acid	19 (90.5)	15 (71.4)	15 (71.4)	0.115	nd
Staffing by doctors, mean ± SD	86 ± 17.73	88.08 ± 17.2	86.77 ± 18.59	0.705	0.818
Staffing by nurses, mean ± SD	90.48 ± 13.06	93.92 ± 10.75	92.03 ± 13.25	0.365	0.624

* Data from 21 regional TB dispensaries.
† Percentage of TB patients in the total number of beds in the institution.
‡ Statistically significant at $P < 0.05$.
SD = standard deviation; DST = drug susceptibility testing; MFX = moxifloxacin; LVX = levofloxacin; nd = no difference; BDQ = bedaquiline; PMD = pretomanid; LZD = linezolid; CFZ = clofazimine; CS = cycloserine.

pil and Chernivtsi Regions), imipenem–cilastatin or/and meropenem (Zaporizhzhia, Ternopil, Chernivtsi, Vinnytsia, Kyiv and Dnipropetrovsk Regions). Pretomanid was available in 13/21 TB hospitals on 15 August 2022.

Information on the infrastructure and availability of care for patients with TB was also assessed. For the remaining 21 TB dispensaries, molecular diagnostics for TB, rifampicin resistance and fluoroquinolone resistance were largely in place. Diagnostics for key second-line anti-TB medicines are limited in all Ukraine, but not as a consequence of the war. With minor exceptions, WHO group A and group B medicines were available in mid-August 2022 in all unoccupied regions of Ukraine. Shortages in Group C medicines are ongoing and capacity building will be jeopardised by the effects of war. There is an ongoing decrease in inpatient care, with an increase in outpatient capacity. This is likely not an effect of the war, but a programmatic plan to move patients from hospital into ambulatory care. The large increase in care of patients from other regions indicates displacement of populations.

In conclusion, data from this survey confirm that TB services have been sustained throughout the territories of Ukraine. These findings should not be misinterpreted. As a result of the invasion of Ukraine by the Russian Federation, war and the displacement of a substantial proportion of the population of Ukraine, are likely to place severe constraints on diagnostic capacities and clinical care of TB patients. We highlight the need for strong international support for the National TB Programme of Ukraine to help sustain and improve the management of patients affected by TB under these challenging conditions.

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