Video-observed treatment for tuberculosis patients in Belarus: findings from the first programmatic experience

To the Editor:

The treatment of tuberculosis requires daily intake of multiple medications for between 6 months and 2 years, or more [1, 2]. This long duration predisposes to the interruption of medications with the risk of the emergence of drug resistance, death, disease persistence and continued transmission of tuberculosis in the community. Directly observed treatment, together with patient support, has been recommended to improve adherence [3]. However, daily treatment observation presents challenges for both patients and observers, which have limited its implementation [4]. Digital technologies, like video (or virtually)-observed treatment (VOT) can help bridge the gap between patients and health services and promote adherence [5]. VOT usually requires patients to film themselves taking medications on a computer or mobile device and then transmit these images to a remote observer *via* the internet [6–9]. Video technology has been available for more than a decade, but the increasing availability of smartphones and broadband internet is making VOT practical to implement even in resource-constrained settings.

Belarus, an upper-middle-income country in eastern Europe with a population of 9.5 million reports high levels of multidrug-resistant tuberculosis (resistance to rifampicin and isoniazid), which requires many patients to start long second-line treatment regimens each year: 1949 patients in 2015 alone. These patients need directly observed treatment daily due to the high risk of loss to treatment follow-up [10, 11]. Regular travel to treatment services incurs substantial effort, expense and time lost in transit for the patients. Among multidrug-resistant tuberculosis patients starting treatment in Belarus in 2013, 12% interrupted medication. The Ministry of Health of Belarus and its Republic Scientific and Practical Centre for Pulmonology and Tuberculosis are investing in digital technologies to further strengthen the national tuberculosis programme. We describe the recent introduction of VOT in Belarus.

In late 2015 the Ministry of Health of Belarus, with support from the World Health Organization (WHO), implemented its first VOT intervention at Minsk Tuberculosis Dispensary number 2, a major tuberculosis clinic in the capital city with ∼26 000 outpatient consultations per year and ∼85 tuberculosis patients attending for observed treatment every day. Staff at the dispensary volunteered to introduce VOT as an additional option to support their patients. Procedures were developed in line with the digital health target product profiles developed by the WHO and the European Respiratory Society in 2015 [12]. The pilot project was approved by the ethics committee of the Ministry of Health and covered by a relevant ministerial order [13]. The intervention required the development of a smartphone application for Android, the most widespread mobile-phone platform in the country. A "VOT module" was added to the national electronic tuberculosis patient register maintained by the Ministry of Health; dispensary nurses were trained; and smartphones were provided to eligible patients who did not already own a suitable device to transmit VOT recordings to the dispensary.

Patients enrolled on VOT had to be aged ⩾18 years, ⩾2 weeks into their tuberculosis treatment (to test tolerance to medications) and have ⩾2 months planned treatment remaining; capable of operating the smartphone and transmit the video; and willing to provide signed informed consent for VOT. Individuals who were receiving injectable tuberculosis agents, used alcohol or other substances and had experienced adverse reactions to tuberculosis treatment were excluded. Patients were provided with pill-boxes which could store 2 weeks' supply of medicines. Patients filmed themselves daily taking their medication using the

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TABLE 1 Profile of tuberculosis patients in the pilot video-observed therapy (VOT) programme in Minsk, Belarus (2016)

Age-group years	Sex	Tuberculosis resistance pattern	VOT episodes (by May 12, 2016)	Video recording of insufficient quality
20–29	Male	MDR-TB	99	7 (7)
30–39	Male	Isoniazid-monoresistant	102	5 (5)
20–29	Female	Drug-susceptible	99	1 (1)
<20	Female	MDR-TB	91	1 (1)
40–49	Male	Drug-susceptible	82	1 (1)
20–29	Male	Drug-susceptible	43	1 (2)
30–39	Male	MDR-TB	28	2 (7)
30–39	Female	MDR-TB	22	0 (0)
20–29	Female	MDR-TB	14	0 (0)
30–39	Female	Drug-susceptible	15	0 (0)

Data are presented as n or n (%). MDR-TB: multidrug-resistant tuberculosis.

smartphone then transmitted the video to the dispensary *via* the internet. The nurses viewed the videos on the dispensary computers *via* the VOT module and classified each as either "good quality", "bad/insufficient visibility to confirm intake of all tuberculosis drugs", "no visibility of intake" or "no video received". Patients were contacted as necessary to provide feedback, training or reminders, such as when the ingestion of tuberculosis treatment could not be visualised because of the poor quality of the video recording. The patients were also instructed to contact the dispensary nurses in case of suspected adverse reactions.

The project recruited 10 patients of mean (range) age 31 (19–50) years, half of whom were female (table 1). Patients reported spending 20–60 min each day travelling to the tuberculosis dispensary for treatment observation. Six patients were employed at the time of contracting tuberculosis, three patients were students and one was unemployed. Four patients had fully drug-sensitive tuberculosis, one patient had isoniazid-monoresistant tuberculosis and five had multidrug-resistant tuberculosis. By May 12, 2016 there were 595 VOT episodes registered (100% of the planned video sessions), of which 577 (97%) were classified of good quality and 18 (3%) of insufficient quality to confirm intake of medication (16 of which were from male patients). Qualitative feedback from patients was supportive, with most welcoming the time and cost-saving attributes of VOT. Eight out of 10 patients felt that VOT was easier than daily commuting to take treatment at the tuberculosis dispensary and that the cost of internet connection was cheaper than tickets for public transport. All patients were prepared to recommend VOT to other patients. Dispensary staff appreciated the improved convenience to patients of VOT when compared with in-person direct observation; the high levels of adherence achieved; and the reduced risk of infecting other individuals during travel and clinic attendance.

This is the first known published use of VOT in tuberculosis patients in an eastern European setting with a high level of drug resistance. A randomised controlled trial of VOT is currently underway in Moldova. The outcomes of this study, as well as another trial recently concluded in London (UK), will provide more evidence on the application of VOT in tuberculosis care [14, 15].

The pilot intervention in Belarus attests the feasibility of VOT under programmatic conditions and shows good acceptability among a diverse mix of tuberculosis patients and among staff. The impact of VOT on programme performance cannot be extrapolated directly from this experience due to the small number of participants and the exclusion of patients at higher risk of interruption. However, the experience gained should be useful for other comparable countries. Our pilot data will be used by the Belarus Red Cross to guide the expansion of VOT to an additional 450 tuberculosis patients being recruited throughout the country within the programme until 2018 with the support of the Global Fund to Fight AIDS, Tuberculosis and Malaria.

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