Video observed treatment for tuberculosis patients in Belarus

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Conflict of interest disclosure

I have no, real or perceived, direct or indirect conflicts of interest that relate to this presentation.
Belarus challenges \textit{M/XDR-TB}

**TB indicator** | **No. of patients** | **Per 100 000**
--- | --- | ---
Incidence | 1916 | 20.2
Prevalence | 4035 | 42.5
Mortality | 242 | 2.6

**MDR-TB**

\begin{itemize}
  \item Previously treated:
    \begin{itemize}
      \item 2011: 59.2%
      \item 2012: 66.4%
      \item 2013: 69.4%
      \item 2014: 66.7%
      \item 2015: 65.8%
      \item 2016: 67.6%
      \item 2017: 65.6%
      \item 2018: 64%
    \end{itemize}
  \item New cases:
    \begin{itemize}
      \item 2011: 27%
      \item 2012: 32.9%
      \item 2013: 33.8%
      \item 2014: 33.2%
      \item 2015: 34.3%
      \item 2016: 35.7%
      \item 2017: 36%
      \item 2018: 32%
    \end{itemize}
\end{itemize}
M/XDR-TB Treatment outcomes

Belarus country cohort

2015:
- Treatment success: 64%
- Failure: 16%
- Death: 9%
- LTFU: 11%

2016:
- Treatment success: 65%
- Failure: 16%
- Death: 6%
- LTFU: 12%
- Not evaluated: 0%
Key strategic directions of NSP

1. Scale up of case finding and prophylaxis

2. Full scale-up of rapid molecular diagnostics

3. Rapid uptake of new drugs and regimens

4. Expanding patients-centered models of care

5. Scale up TB research

Bedaquiline (June 2015)
Delamanid (June 2016)
Linezolid Clofazimine
Carbapenems, Amoxicilline/clavulonat
## Transition to ambulatory based TB care

### Treatment cost components (in USD)

<table>
<thead>
<tr>
<th>Modality</th>
<th>Treatment regimen group</th>
<th>Costs of care</th>
<th>Other costs</th>
<th>Total non-drug costs</th>
<th>Drug costs</th>
<th>Total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current practice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital-based</td>
<td>DS treatment</td>
<td>2491.52</td>
<td>63</td>
<td>2,555</td>
<td>55</td>
<td>2,610</td>
</tr>
<tr>
<td>Hospital-based</td>
<td>MDR</td>
<td>10170.43</td>
<td>205</td>
<td>10,376</td>
<td>3,782</td>
<td>14,158</td>
</tr>
<tr>
<td>Hospital-based</td>
<td>XDR</td>
<td>12646.19</td>
<td>237</td>
<td>12,883</td>
<td>7,600</td>
<td>20,483</td>
</tr>
<tr>
<td>Involuntary isolation</td>
<td>MDR</td>
<td>17700.00</td>
<td>0</td>
<td>17,700</td>
<td>3,782</td>
<td>21,482</td>
</tr>
<tr>
<td>Involuntary isolation</td>
<td>XDR</td>
<td>21240.00</td>
<td>0</td>
<td>21,240</td>
<td>7,600</td>
<td>28,840</td>
</tr>
<tr>
<td><strong>Alternative modalities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard ambulatory</td>
<td>DS treatment</td>
<td>1735.40</td>
<td>87</td>
<td>1,823</td>
<td>55</td>
<td>1,878</td>
</tr>
<tr>
<td>Standard ambulatory</td>
<td>MDR</td>
<td>6121.77</td>
<td>292</td>
<td>6,414</td>
<td>3,782</td>
<td>10,196</td>
</tr>
<tr>
<td>Standard ambulatory</td>
<td>XDR</td>
<td>7493.35</td>
<td>348</td>
<td>7,841</td>
<td>7,600</td>
<td>15,441</td>
</tr>
<tr>
<td>Standard ambulatory</td>
<td>MDR - short</td>
<td>3370.36</td>
<td>150</td>
<td>3,520</td>
<td>1,000</td>
<td>4,520</td>
</tr>
<tr>
<td>Incentivized ambulatory</td>
<td>DS treatment</td>
<td>1735.40</td>
<td>87</td>
<td>2,160</td>
<td>55</td>
<td>2,215</td>
</tr>
<tr>
<td><strong>Incentivized ambulatory</strong></td>
<td>MDR</td>
<td>6121.77</td>
<td>292</td>
<td>7,543</td>
<td>3,782</td>
<td>11,325</td>
</tr>
<tr>
<td>Incentivized ambulatory</td>
<td>XDR</td>
<td>7493.35</td>
<td>348</td>
<td>9,183</td>
<td>7,600</td>
<td>16,783</td>
</tr>
<tr>
<td>Incentivized ambulatory</td>
<td>MDR - short</td>
<td>3370.36</td>
<td>150</td>
<td>4,100</td>
<td>1,000</td>
<td>5,100</td>
</tr>
</tbody>
</table>
VOT in Belarus

Project milestones

- 2015 WHO/ERS digital health TPP
- Jan 2015 : feasibility assessment of VOT (WHO)
- Feb 2015: VOT included in GF project proposal; MoH VOT working group
- May 2015 : technical specifications for VOT app; software finished by Jan 2016
- Jan 2016 : pilot single center VOT project
- Oct 2016: programmatic expansion of VOT with GF support
Pilot study of VOT for TB, Minsk, 2016

Eligibility Criteria

- Patient informed consent
- Older than 18 years
- Completed in-person DOT for at least 2 weeks
- Practical test (2 consecutive successful uploads of VOT video) in the presence of the nurse
- Treatment scheme without injectable agents
- No alcohol or drug problems
- Android smartphone
Pilot study of VOT for TB, Minsk, 2016 (1)

Patient characteristics

- 10 TB patients enrolled (5 males, 5 females)
- Age 19-50 years
- 4 MDR-TB, 6 non-MDR-TB
- 6 employed, 1 unemployed, 3 students
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].

<table>
<thead>
<tr>
<th>Age-group years</th>
<th>Sex</th>
<th>Tuberculosis resistance pattern</th>
<th>VOT episodes (by May 12, 2016)</th>
<th>Video recording of insufficient quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–29</td>
<td>Male</td>
<td>MDR-TB</td>
<td>99</td>
<td>7 (7)</td>
</tr>
<tr>
<td>30–39</td>
<td>Male</td>
<td>Isoniazid-mono-resistant</td>
<td>102</td>
<td>5 (5)</td>
</tr>
<tr>
<td>20–29</td>
<td>Female</td>
<td>Drug-susceptible</td>
<td>99</td>
<td>1 (1)</td>
</tr>
<tr>
<td>&lt;20</td>
<td>Female</td>
<td>MDR-TB</td>
<td>91</td>
<td>1 (1)</td>
</tr>
<tr>
<td>40–49</td>
<td>Male</td>
<td>Drug-susceptible</td>
<td>82</td>
<td>1 (1)</td>
</tr>
<tr>
<td>20–29</td>
<td>Male</td>
<td>Drug-susceptible</td>
<td>43</td>
<td>1 (2)</td>
</tr>
<tr>
<td>30–39</td>
<td>Male</td>
<td>MDR-TB</td>
<td>28</td>
<td>2 (7)</td>
</tr>
<tr>
<td>30–39</td>
<td>Female</td>
<td>MDR-TB</td>
<td>22</td>
<td>0 (0)</td>
</tr>
<tr>
<td>20–29</td>
<td>Female</td>
<td>MDR-TB</td>
<td>14</td>
<td>0 (0)</td>
</tr>
<tr>
<td>30–39</td>
<td>Female</td>
<td>Drug-susceptible</td>
<td>15</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Data are presented as n or n (%). MDR-TB: multidrug-resistant tuberculosis.
Pilot study of VOT for TB, Minsk, 2016 (3)

- DOT – 1-3 hours to travel to and from the TB dispensary, patients on VOT saved from 1 to 3 hours daily
- VOT treatment was not interrupted at the weekends
- 8 of 10 patients reported spending less money for internet than for travel to TB facility (~1 USD per day)
- 8 of 10 patients confirmed that VOT is easier than visiting the TB facility daily
- All respondents confirmed acceptability of VOT and would recommend it to other TB patients
Programmatic expansion of VOT in Belarus (1)

from October 2016

- The GF-supported project
- All country regions
- 150 patients per year – planned recruitment
- Belarusian Red Cross is a country partner
- Smartphones (60 USD each) are provided
- cellular service (9 USD per month) is provided
Programmatic expansion of VOT in Belarus (2)

Patients

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Social data</th>
<th>DR profile</th>
<th>n=695 (by March 1, 2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-25</td>
<td>75 (11%)</td>
<td>372 (53%)</td>
<td>313 (45%)</td>
<td></td>
</tr>
<tr>
<td>26-35</td>
<td>236 (34%)</td>
<td>32 (5%)</td>
<td>28 (4%)</td>
<td></td>
</tr>
<tr>
<td>36-45</td>
<td>195 (28%)</td>
<td>254 (36%)</td>
<td>354 (51%)</td>
<td></td>
</tr>
<tr>
<td>46-55</td>
<td>100 (14%)</td>
<td>33 (5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56-65</td>
<td>76 (11%)</td>
<td>4 (1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;65</td>
<td>13 (2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n=695 (by March 1, 2019)
Programmatic expansion of VOT in Belarus (3)

Patients regional distribution

<table>
<thead>
<tr>
<th>Region</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minsk City</td>
<td>138</td>
</tr>
<tr>
<td>Minsk region</td>
<td>107</td>
</tr>
<tr>
<td>Gomel region</td>
<td>118</td>
</tr>
<tr>
<td>Mogilev region</td>
<td>87</td>
</tr>
<tr>
<td>Vitebsk region</td>
<td>90</td>
</tr>
<tr>
<td>Brest region</td>
<td>71</td>
</tr>
<tr>
<td>Grodno region</td>
<td>84</td>
</tr>
</tbody>
</table>
Programmatic expansion of VOT in Belarus (4)

Video sessions quality

<table>
<thead>
<tr>
<th>good quality</th>
<th>insufficient quality to confirm intake of medication</th>
<th>No data/not received</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>83713</td>
<td>1077</td>
<td>255</td>
<td>85045</td>
</tr>
<tr>
<td><strong>98.4%</strong></td>
<td>1.3%</td>
<td><strong>0.3%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

1) 0 phones were lost
2) 6 phones were returned for repair under warranty
Treatment outcomes

Final treatment outcomes were notified in 317 TB patients on VOT:

- treatment success – 303 (95.65%)
- treatment failure – 4 (1.25%)
- death (XDR-TB) – 2 (0.65%)
- LTFU (MDR-TB) – 8 (2.45%)

- 378 patients are still on treatment
M/XDR-TB treatment outcomes

**Country cohort** (2016, n=1494)

- Treatment success: 65%
- Failure: 16%
- Death: 6%
- LTFU: 12%

**VOT cohort** (Oct 2016 – Mar 2019, n=90)

- Treatment success: 86%
- Failure: 4%
- Death: 2%
- LTFU: 8%
- Not evaluated: 8%
Lessons learned

• VOT works better on smartphones procured for the project purpose rather than relying on a patient’s device

• Clear written instruction to patients is needed

• Feedback to the patient on the quality of the videos is important

• The comments and additional instructions to patient during his/her visiting TB facility are also practical

• A drug container with at least 2 weeks’ drug supply is practical
Belarus VOT experience

ANNEX V. PROGRAMMATIC IMPLEMENTATION OF VOT IN BELARUS

Example of a 5-year timeline

<table>
<thead>
<tr>
<th>Objective(s)</th>
<th>To develop and implement a national VOT programme in Belarus in support of treatment adherence and supervision during the ambulatory phase of treatment, and to improve TB treatment outcomes</th>
</tr>
</thead>
</table>
| **Phase 1. Planning (Year 1 – 2015)** | - Conduct a feasibility assessment – conducted by WHO in January 2015 with support of the European Respiratory Society (ERS)  
- Engage stakeholders to provide input on solution – WHO survey of public views on priority areas in early 2015, WHO/ERS joint technical consultation to develop detailed technical TPP for VOT in February 2015  
- Develop a concept proposal – developed by the Global Fund in February 2015  
- Establish a working group to provide oversight and guidance – established by the Ministry of Health of Belarus in February 2015  
- Draft detailed technical specifications – drafted by local Belarusian company "BelPromProject" for VOT app in May 2015  
- Secure in-country ethics committee approval for pilot project – secured through Ministry of Health in September 2015 |
| **Phase 2. Development/adaptation (Year 2 – 2016)** | - “Prototype the software” – development finalized by BelPromProject in January 2016  
- Link solution to current national digital health systems – "VOT module" added to the Ministry of Health of Belarus’ national electronic tuberculosis patient registers in February 2016  
- Train staff – trained dispensary nurses in January 2016  
- Distribute hardware and train patients – distributed smartphones for patients in January 2016 |
- Monitoring and evaluation of pilot study results – monitoring by NTI, Ministry of Health of Belarus from January to October 2016  
- Publication of preliminary results – pilot findings published in European Respiratory Journal in March 2017 (IS) |
| **Phase 4. Maintenance/scale up (Years 2–5 – late 2016–2019)** | - Expansion of solution nationwide – expansion to all seven country regions with planned recruitment of 450 patients (150/year) with Belarus Red Cross and the Global Fund from October 2016 to 2019; 231 patients from all regions of the country were on VOT by 1 September 2017 |

10 Adapted from Box 4.1 (67)
Conclusions

Preliminary data of using VOT, among a diverse mix of TB patients in all 7 regions of Belarus demonstrate:

- high levels of patient acceptability and treatment adherence
- excellent treatment outcomes
- the experience gained can promote this approach for TB patients with
  - comorbidities (e.g. HIV, substance abuse) and
  - complex social issues
Thank You!