Multidrug-/rifampicin-resistant TB (MDR/RR-TB): Update 2017
## The global TB situation (1)

<table>
<thead>
<tr>
<th>All forms of TB</th>
<th>Estimated incidence, 2016</th>
<th>Estimated number of deaths, 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.4 million (8.8–12.2 million)</td>
<td>1.3 million* (1.2–1.4 million)</td>
</tr>
<tr>
<td>HIV-associated TB</td>
<td>1.0 million (0.9–1.2 million)</td>
<td>374,000 (325,000–427,000)</td>
</tr>
<tr>
<td>Multidrug- / rifampicin-resistant TB (MDR/RR-TB)</td>
<td>600,000 (540,000–660,000)</td>
<td>240,000 (140,000–340,000)</td>
</tr>
</tbody>
</table>

* Excluding deaths attributed to HIV/TB

Source: WHO Global Tuberculosis Report 2017
The global TB situation (2)

TB incidence and mortality, 2000-2016

- TB incidence
  - All TB cases
  - Notifications of new and relapse cases
  - HIV-positive TB cases

- TB mortality (HIV-negative)

Global Project launched

SRL network launched

1994

1st ed. DRS guidelines

1st global DRS report

1997

2nd ed. DRS guidelines

2nd global DRS report

2000

3rd ed. DRS guidelines

3rd global DRS report

2003 2004

4th ed. DRS guidelines

4th global DRS report

2008

5th ed. DRS guidelines

M/XDR-TB report

2009 2010

2017

Global TB reports

Guidelines for surveillance of drug resistance in tuberculosis

Guidelines for surveillance of drug resistance in tuberculosis

Guidelines for surveillance of drug resistance in tuberculosis

Guidelines for surveillance of drug resistance in tuberculosis

Guidelines for surveillance of drug resistance in tuberculosis

END TB
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Measuring TB drug resistance

Periodic surveys vs. continuous surveillance
Measuring TB drug resistance

Year of most recent data

Map showing countries and their year of the most recent data on measuring TB drug resistance.
### Percentage of new and previously treated TB cases with MDR/RR-TB, 2016

<table>
<thead>
<tr>
<th>Region</th>
<th>ESTIMATED % OF NEW CASES WITH MDR/RR-TB</th>
<th>ESTIMATED % OF PREVIOUSLY TREATED CASES WITH MDR/RR-TB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEST ESTIMATE(^a)</td>
<td>UNCERTAINTY INTERVAL</td>
</tr>
<tr>
<td>Africa</td>
<td>2.7</td>
<td>2–3.5</td>
</tr>
<tr>
<td>The Americas</td>
<td>2.9</td>
<td>1.4–4.3</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>4.2</td>
<td>1.7–6.7</td>
</tr>
<tr>
<td>Europe</td>
<td>19</td>
<td>12–26</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>2.8</td>
<td>2.4–3.1</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>5.3</td>
<td>2.9–7.8</td>
</tr>
<tr>
<td>GLOBAL</td>
<td>4.1</td>
<td>2.8–5.3</td>
</tr>
</tbody>
</table>

\(^a\) Best estimates are for the latest available year.
Figures are based on the most recent year for which data have been reported, which varies among countries. Data reported before 2002 are not shown.
Figures are based on the most recent year for which data have been reported, which varies among countries. Data reported before 2002 are not shown. The high percentages of previously treated TB cases with MDR-TB in Bahamas, Belize, French Polynesia, Puerto Rico and Sao Tomé and Principe refer to only a small number of notified cases (range: 1–8 notified previously treated TB cases).
30 high MDR-TB burden countries

- Bangladesh
- DPR Korea
- Pakistan
- Philippines
- Russian Federation
- Viet Nam
- Angola
- China
- DR Congo
- Ethiopia
- India
- Indonesia
- Kenya
- Mozambique
- Myanmar
- Nigeria
- Papua New Guinea
- South Africa
- Thailand
- Zimbabwe

- Cambodia
- Sierra Leone
- Brazil
- Central African Republic
- Congo
- Lesotho
- Liberia
- Namibia
- UR Tanzania
- Zambia
- Botswana
- Cameroon
- Chad
- Ghana
- Guinea-Bissau
- Malawi
- Swaziland
- Uganda
Estimated incidence of MDR/RR-TB, 2016

for countries with at least 1000 incident cases
Trends in new TB (blue) and new MDR-TB (red) case rates

selected high MDR-TB burden countries
Isoniazid-resistant TB cases (Hr-TB)

Relative burden of Hr-TB among all new and all retreatment TB cases notified globally in 2016 (compared with RR-TB)
Pyrazinamide resistance


<table>
<thead>
<tr>
<th>Region</th>
<th>Azerbaijan</th>
<th>Bangladesh</th>
<th>Belarus (Minsk city)</th>
<th>Pakistan</th>
<th>South Africa (Gauteng)</th>
<th>South Africa (KwaZulu Natal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New tuberculosis cases</td>
<td>530, 10.2%</td>
<td>751, 2.6%</td>
<td>144, 30.0%</td>
<td>1299, 2.1%</td>
<td>648, 2.8%</td>
<td>444, 2.0%</td>
</tr>
<tr>
<td></td>
<td>(7.6-12.8)</td>
<td>(1.4-3.8)</td>
<td>(22.6-37.3)</td>
<td>(1.3-2.9)</td>
<td>(1.5-4.1)</td>
<td>(0.8-3.3)</td>
</tr>
<tr>
<td>Previously treated tuberculosis cases</td>
<td>218, 17.9%</td>
<td>203, 13.8%</td>
<td>57, 69.9%</td>
<td>201, 8.9%</td>
<td>145, 4.7%</td>
<td>128, 10.5%</td>
</tr>
<tr>
<td></td>
<td>(12.7-23.0)</td>
<td>(8.8-18.8)</td>
<td>(58.4-81.4)</td>
<td>(5.1-12.8)</td>
<td>(1.5-7.8)</td>
<td>(5.1-15.8)</td>
</tr>
<tr>
<td>All tuberculosis cases</td>
<td>748, 12.6%</td>
<td>955, 5.1%</td>
<td>201, 42.1%</td>
<td>1500, 3.0%</td>
<td>877, 3.1%</td>
<td>691, 3.9%</td>
</tr>
<tr>
<td></td>
<td>(10.1-15.0)</td>
<td>(3.4-6.8)</td>
<td>(35.4-48.8)</td>
<td>(2.0-4.0)</td>
<td>(1.9-4.4)</td>
<td>(2.4-5.4)</td>
</tr>
<tr>
<td>Rifampicin susceptible</td>
<td>619, 2.2%</td>
<td>892, 2.5%</td>
<td>103, 4.2%</td>
<td>1397, 0.5%</td>
<td>838, 1.3%</td>
<td>657, 1.3%</td>
</tr>
<tr>
<td></td>
<td>(1.1-3.4)</td>
<td>(1.3-3.6)</td>
<td>(0.1-8.3)</td>
<td>(0.1-0.8)</td>
<td>(0.4-2.2)</td>
<td>(0.4-2.3)</td>
</tr>
<tr>
<td>Rifampicin resistant</td>
<td>129, 59.9%</td>
<td>63, 36.7%</td>
<td>98, 81.3%</td>
<td>103, 39.5%</td>
<td>39, 39.1%</td>
<td>34, 49.1%</td>
</tr>
<tr>
<td></td>
<td>(51.0-68.9)</td>
<td>(25.9-47.4)</td>
<td>(73.7-88.9)</td>
<td>(30.1-48.9)</td>
<td>(22.9-55.3)</td>
<td>(32.7-65.5)</td>
</tr>
<tr>
<td>Resistance in rifampicin resistant vs rifampicin susceptible</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Resistance in newly vs previously treated</td>
<td>0.004</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>0.169</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Data are number tested, % resistant (95% CI) or p value.

Table 1: Results of sequencing of the pncA gene (associated with pyrazinamide resistance)
Countries ever notifying an XDR–TB case

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Moxifloxacin resistance

<table>
<thead>
<tr>
<th></th>
<th>Azerbaijan</th>
<th>Bangladesh</th>
<th>Belarus (Minsk city)</th>
<th>Pakistan</th>
<th>South Africa (Gauteng)</th>
<th>South Africa (KwaZulu Natal)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0.5 µg/mL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New tuberculosis cases</td>
<td>528, 2.2%</td>
<td>736, 3.8%</td>
<td>141, 6.3%</td>
<td>1301, 7.5%</td>
<td>709, 0.8%</td>
<td>421, 0.6%</td>
</tr>
<tr>
<td></td>
<td>(0.9-3.4)</td>
<td>(2.2-5.4)</td>
<td>(2.2-10.4)</td>
<td>(5.9-9.1)</td>
<td>(0-0.16)</td>
<td>(0-0.14)</td>
</tr>
<tr>
<td>Previously treated tuberculosis cases</td>
<td>220, 7.0%</td>
<td>196, 7.0%</td>
<td>55, 33.5%</td>
<td>202, 12.1%</td>
<td>152, 0.9%</td>
<td>123, 2.1%</td>
</tr>
<tr>
<td></td>
<td>(3.6-10.4)</td>
<td>(3.7-10.4)</td>
<td>(21.7-45.4)</td>
<td>(7.3-16.8)</td>
<td>(0-0.2-8)</td>
<td>(0-0.4-3)</td>
</tr>
<tr>
<td>All tuberculosis cases</td>
<td>748, 3.6%</td>
<td>933, 4.5%</td>
<td>196, 14.6%</td>
<td>1503, 8.1%</td>
<td>951, 0.9%</td>
<td>654, 1.0%</td>
</tr>
<tr>
<td></td>
<td>(2.3-5.0)</td>
<td>(2.9-6.1)</td>
<td>(9.6-19.5)</td>
<td>(6.7-9.6)</td>
<td>(0-0.17)</td>
<td>(0-2-17)</td>
</tr>
<tr>
<td>Rifampicin susceptible</td>
<td>618, 0.5%</td>
<td>873, 3.9%</td>
<td>99, 2.7%</td>
<td>1401, 7.7%</td>
<td>910, 0.5%</td>
<td>621, 0.3%</td>
</tr>
<tr>
<td></td>
<td>(0-0.11)</td>
<td>(2.4-5.3)</td>
<td>(0-0.5-9)</td>
<td>(6-1-9.3)</td>
<td>(0-0.1-1)</td>
<td>(0-0.0-8)</td>
</tr>
<tr>
<td>Rifampicin resistant</td>
<td>130, 17.9%</td>
<td>60, 12.2%</td>
<td>97, 26.8%</td>
<td>102, 13.8%</td>
<td>41, 8.4%</td>
<td>33, 12.2%</td>
</tr>
<tr>
<td></td>
<td>(11.2-24.5)</td>
<td>(3.7-20.7)</td>
<td>(18.0-35.7)</td>
<td>(6.3-21.4)</td>
<td>(0-0.18-4)</td>
<td>(2.2-22.2)</td>
</tr>
</tbody>
</table>

DR-TB RESPONSE
Diagnostic DST (1)

% of bacteriologically confirmed TB cases tested for RR-TB

Among new laboratory confirmed and retreatment cases; test results in cases with unknown previous history are not included.

The increase in the African Region from 2014 to 2015 was due to a big increase in reporting of laboratory results for cases in South Africa in 2015.
Diagnostic DST (2)

% of MDR/RR-TB cases with DST results for fluoroquinolones and 2nd line injectable agents

a 2015 data were used for 20 countries.
MDR/RR-TB detection and treatment

MDR/RR-TB cases detected (violet) and number enrolled on MDR-TB treatment (green) 2009-2016, compared with incident MDR/RR-TB cases in 2016 (uncertainty interval shown in blue)
MDR/RR-TB treatment coverage

Enrolments on MDR-TB treatment as a % of the incident MDR/RR-TB cases, 30 high MDR–TB burden countries, regions and globally, 2016
Countries that had used shorter MDR-TB treatment regimens by the end of 2016

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Number of patients with laboratory-confirmed XDR-TB started on treatment in 2016

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Outcomes of MDR/RR-TB treatment

Annual cohorts, by WHO region and global, 2007-2014
Outcomes of XDR-TB treatment

2014 cohort, by WHO region and global

*number of cases observed shown next to the bars
Use of SMS, video–supported treatment or electronic medication monitors to improve TB treatment adherence and delivery, 2016

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MDR/RR-TB and financing (1)

Funding for prevention, diagnosis and treatment by intervention area, 2006—2017
(constant 2017 US$ billions)
MDR/RR-TB and financing (2)

Estimated funding needed for TB control in low- and middle-income countries, 2016—2020

Source: Data from Stop TB Partnership Global Plan to End TB 2016–2020.
MDR/RR-TB and financing (3)

Funding for drug-susceptible TB (green) and MDR-TB (brown), 2006–2017, by country group (constant 2017 US$ millions)
MDR/RR-TB and financing (4)

*Estimated cost per patient treated for MDR-TB, 2016*

*Limited to 80 countries with at least 20 patients on MDR-TB treatment in 2016*
Conclusions

- Although only 4.1% of new and 19% of retreatment TB cases have MDR/RR-TB, globally they amount to ~600,000 incident cases each year, challenging the prospect of ending TB by 2035.
- Coverage of DST for first and second-line TB medicines is improving but only a minority of MDR/RR-TB and XDR-TB patients are being detected and placed on adequate treatment.
- Surveillance and monitoring continue to improve. Digital technologies offer an opportunity to help bridge some of the weaknesses in data management as well as for patient care (e.g. adherence support).
- New policy issued by WHO in 2016-2017 promotes novel treatment regimens. Scale-up of such treatment options is needed to impact global success rates for drug-resistant TB patients, especially in countries with large burdens.
In summary

490,000 incident cases of MDR-TB in 2016 (with another 110,000 rifampicin-resistant TB cases eligible for second-line treatment)

153,000 MDR/RR-TB cases detected in 2016

130,000 patients started on MDR-TB treatment in 2016

54% treatment success in MDR/RR-TB patients starting treatment in 2014

5 priority actions

1. Prevent the development of drug resistance through high quality treatment of drug-susceptible TB

2. Expand rapid testing and detection of drug-resistant TB cases

3. Provide immediate access to effective treatment and proper care

4. Prevent transmission through infection control

5. Increase political commitment with financing