Background
Existing global epidemiological estimates of childhood tuberculosis disease burden are plagued with a number of limitations which hinder their use, leaving important unanswered questions for global surveillance, and ultimately preventing the control of the childhood TB epidemic. These limitations are mainly associated with: a) the misclassification of childhood TB cases due to difficulties in diagnosis of TB in children b) the missed childhood TB cases from the national surveillance systems due to the under-reporting of children identified by the private sector (most often paediatricians), c) the missed childhood TB cases from the national surveillance systems due to the under-diagnosis of children who exist in the community but are never identified.

WHO is currently leading a concentrated effort to improve childhood TB estimates, in collaboration with the Childhood TB subgroup of the Stop TB Partnership. This document briefly describes the first attempt at producing global estimates of childhood TB incidence and mortality, based on existing data, and outlines the suggested next steps (both short- and long-term) in the process.

A. Incidence

1. Data source:
   – New TB case notifications reported by countries to the WHO Global TB Database, by case type, age (and sex).

2. Rationale/short description of the method:
   – Not every country in the world is reporting notifications disaggregated by age (see Table 1).
   – For countries disaggregating data, use notified childhood TB cases.
   – For countries not disaggregating data:
     (i) Method 1: assume (for each case type) the proportion of children with TB over total number notified is the same as in those countries who disaggregate by age.
     (ii) Method 2: use the proportion of SP/(SP+SN+EP) among childhood cases from countries disaggregating all case types, to estimate childhood burden in the rest of the countries.
   – Once total number of childhood cases is estimated (according to each of the two methods described above), use the global case detection rate 65% (62%-69%) to get to incidence.
**Table 1**

<table>
<thead>
<tr>
<th>New TB case notifications 2010</th>
<th>Smear positive</th>
<th>Smear negative¹</th>
<th>Extrapulmonary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total notifications</td>
<td>2,655,389</td>
<td>1,830,300</td>
<td>806,352</td>
</tr>
<tr>
<td>Among countries disaggregating by age</td>
<td>2,595,210</td>
<td>1,036,943</td>
<td>323,292</td>
</tr>
<tr>
<td>Among countries not disaggregating by age</td>
<td>60,179</td>
<td>793,357</td>
<td>483,060</td>
</tr>
<tr>
<td>(% notifications not disaggregated over total)</td>
<td>(2)</td>
<td>(43)</td>
<td>(60)</td>
</tr>
</tbody>
</table>

| Number of countries disaggregating notifications by age | 197 | 156 | 155 |
| Notified childhood TB | 49,062 | 110,133 | 37,475 |
| (% over total notifications among countries disaggregating) | (2) | (11) | (11) |

| Number of countries not disaggregating notifications by age | 19 | 60 | 61 |
| Method 1: total estimated childhood notifications | | | 339,000 |
| Method 2: total estimated childhood notifications | | | 340,000 |

¹This category includes smear unknown and not done

3. **Estimation of incidence (absolute numbers):**
   - Methods 1 and 2 produce very similar estimated totals for childhood TB case notifications.
   - Applying the CDR on the total notifications from method 2 we get an estimate of incident childhood TB cases for 2010 of: 520,000 (490,000-550,000)
     - This translates to about 6% of the total 8.8 million incident cases in 2010

4. **Limitations:**
   - We assume the case detection rate for children is the same as the global 65% (62%-69%). However, we have quite a lot of anecdotal evidence that this might be much lower, due to greater numbers of children (compared to adults) going under-reported (private sector; paediatricians) and under-diagnosed¹ due to the associated difficulties with diagnosis of TB in children.
   - The uncertainty around the lack of representativeness of the countries with data is not accounted for.

¹Over-diagnosis of children is also observed in some countries.
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- Case type unknown and re-treatments are not disaggregated by age in the WHO Global TB Database. We assume 0 children among those.

5. Next steps:

   **Short-term**
   - Collect existing disaggregated data from countries that do not report.
   - Commission full literature review to collect existing data on under-reporting and under-diagnosis of childhood TB, in order to improve the estimation model (e.g. household contact tracing efforts, TB REACH projects).
   - Hold a global consultation among international experts of childhood TB to engage the appropriate stakeholders, ensure buy-in of the new estimates and discuss:
     - the best way to compile existing data,
     - what new data to produce (e.g. set up sentinel sites in various countries in the world and extrapolate globally).

   **Long-term**
   - Revise the WHO-recommended quarterly data collection forms to allow age disaggregated data to also be collected for smear negative and extrapulmonary TB.
   - Conduct nationwide inventory surveys to measure the level of under-reporting and under-diagnosis (through capture-recapture modelling) of childhood TB.
   - Adapt existing statistical methodologies for the indirect estimation of childhood TB, among countries where age disaggregation is not done.

B. Mortality

1. Data source:
   - Age-specific, vital registration data reported to WHO.

2. Rationale/short description of the method:
   - Not every country in the world has a well-functioning, nationally representative vital registration system, where age-specific mortality according to the cause of death is recorded.
   - For countries with VR data, calculate the ratio of childhood to adult TB-specific mortality.
   - For countries without VR data, use a statistical model to predict the ratio of childhood to adult TB mortality.
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- Apply these ratios onto the total estimated TB mortality, for each country, and produce a global estimate of childhood TB mortality for 2010.

3. Estimation of mortality (absolute numbers):
   - 64,000 (58,000-71,000).
     - Translates to a case fatality rate of about 12% (compared to the global 16%=1,400,000/8,800,000).

4. Limitations:
   - There are 68 (out of 215) countries and territories with VR data used for this calculation; they are all middle to high income.
   - The uncertainty around the lack of representativeness of the countries with data is not accounted for.

5. Next steps:
   Short-term
   - Collect existing, as well as generate new, data from: (i) sample vital registration systems and/or (ii) mortality surveys (e.g. China, India, Indonesia, South Africa).

   Long-term
   - Advocate for the further development of and investment in vital registration systems in countries around the world.

C. Prevalence

1. Data source:
   - Some nationwide prevalence surveys among the general population in the past have included children, but the data are very limited.

2. Limitations:
   - There is currently no diagnostic algorithm adapted to the design of the nationwide tuberculosis prevalence surveys among the general population that allows the inclusion of children.

3. Next steps:
   - Develop a diagnostic algorithm to be used in prevalence surveys among the general population or surveys among households of TB cases.