Assessment of determinants of unreached children in immunisation

Analyses of surveys data

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Outline

- **Objectives** describe the epidemiology of the ‘unreached’ children.

- **Methods** DHS and MICS surveys analyses.

- **Findings** magnitude of the problems; predictors and outcomes.

- **Conclusions** country-specific data.

- **Limitations** data quality and confounders.
Objectives

- To undertake a “more detailed analysis of children who have not been reached by immunization services” (SAGE)

- To describe which determinants and to which extent are associated with children:
  - not having received any dose of any vaccine
  - having received at least one dose by not being fully immunised
Methods

- DHS (174) and MICS (80) surveys with individual subjects data: 254 surveys
  - Excluded: sub-national (except Sudan North and South), without immunisation data, restricted
  - Final number of surveys: **242** in **95** countries (1986 to 2007*)

- Analyses: Stata I/C 10.0
  - Percentages with 95% Confidence Intervals, taking into account the multi-stage cluster design
  - Logistic regression, univariate, to estimate Odds Ratios with 95% Confidence Intervals

- Outputs: report on MS Access

(*) Year when the surveys took place.
Predictors and outcomes

PREDICTORS (21)
- Sex of the child
- Education of mother
- Martial status
- TT status
- Wealth
- ...

OUTCOMES (2)
1. Access. Either:
   - Non-vaccinated at all
   - Received at least one dose
2. Utilisation. Either:
   - Received at least one dose
   - Fully immunised
Global findings (1)

- 242 surveys, in 95 countries, in 3 regions
- from 1986 up to 2007 (21 years)
- including 1,112,000 children (0 to 59 months old)
- of which 92,280 (8.3%) had received no dose of vaccine
Global findings (2)

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All surveys</td>
<td>8%</td>
</tr>
<tr>
<td>Africa</td>
<td>9%</td>
</tr>
<tr>
<td>Asia</td>
<td>10%</td>
</tr>
<tr>
<td>LAC</td>
<td>4%</td>
</tr>
<tr>
<td>Europe</td>
<td>1%</td>
</tr>
</tbody>
</table>

**Examples**

<table>
<thead>
<tr>
<th>Example</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niger DHS 1992</td>
<td>59%</td>
</tr>
<tr>
<td>Zimbabwe DHS 2005</td>
<td>27%</td>
</tr>
</tbody>
</table>

**Decade**

<table>
<thead>
<tr>
<th>Decade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveys 1986-1996</td>
<td>15%</td>
</tr>
<tr>
<td>Surveys 1997-2007</td>
<td>6%</td>
</tr>
</tbody>
</table>

Percentage of children with no vaccination at all in different surveys or groups of surveys.
Proportion of unreached

Countries with 0%
- Albania-2005
- Belarus-2005
- Cuba-2006
- Guyana-2006
- Kazakhstan-2006
- Kyrgyzstan-2005
- Montenegro-2005
- Sao Tome and Principe-2000
- Serbia-2005
- Suriname-2000
- Trinidad and Tobago-2006
- Uzbekistan-2006
- Venezuela-2000
- Viet Nam-2015

Countries with more than 0% and less than 5%
- Armenia-2006
- Sudan North-2000
- Tanzania-2004
- Lesotho-2004
- South Africa-1998
- Gabon-2000
- Swaziland-2006
- Comoros-2000
- Bolivia-2006
- Namibia-2007
- Myanmar-2000
- Tunisia-1998
- Rwanda-2005
- Nicaragua-2001
- Bangladesh-2007
- Nepal-2003
- Central African Republic-2000
- Turkey-2004
- Mexico-1997
- Brazil-1996
- Sudan South-2000
- Sri Lanka-1997
- Colombia-2005
- Mauritania-2007
- Sierra Leone-2005
- Somalia-2006
- Cameroon-2006
- Jordan-2007
- Peru-2004
- Angola-2001
- Fiji-2006
- Guinea-Bissau-2006
- Honduras-2006
- Togo-2006
- Equatorial Guinea-2009
- Côte d'Ivoire-2005
- Tajikistan-2005
- Burkina Faso-2006
- Burundi-2006
- Ghana-2006
- Moldova-2010
- Belize-2006
- Jamaica-2005
- Malawi-2006
- Gambia-2006
- Morocco-2005
- Syrian Arab Republic-2006
- Macedonia-2005
- Mongolia-2005
- Bosnia and Herzegovina-2006
- Georgia-2006
- Thailand-2018

Countries with 5% or more
- Ethiopia-1997
- Zimbabwe-2005
- Nigeria-2003
- Niger-2006
- Madagascar-2004
- Afghanistan-2006
- Chad-2004
- Congo DR-2007
- Mali-2006
- Guinea-2005
- Lao PDR-2000
- Mozambique-Liberia-2007
- Haiti-2006
- Indonesia-2007
- Paraguay-1990
- Philippines-2003
- Benin-2006
- Yemen-2006
- India-2006
- Zambia-2007
- Kenya-2003
- Pakistan-2006
- Uganda-2006
- Senegal-2005
- Guatemala-1998
- Congo-2005
<table>
<thead>
<tr>
<th>Predictor</th>
<th>Africa (N=46)</th>
<th>Asia (N=24)</th>
<th>Europe (N=7)</th>
<th>LAC (N=18)</th>
<th>ALL (N=95)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR &lt;1 OR &gt;1</td>
<td>OR &lt;1 OR &gt;1</td>
<td>OR &lt;1 OR &gt;1</td>
<td>OR &lt;1 OR &gt;1</td>
<td>OR &lt;1 OR &gt;1</td>
</tr>
<tr>
<td>2nd birth (1st)</td>
<td>0 5 11 0</td>
<td>0 14 1 9</td>
<td>0 17 0 0</td>
<td>0 6 23</td>
<td>0 23 0 0</td>
</tr>
<tr>
<td>3rd or more birth (1st)</td>
<td>0 8 0 27</td>
<td>0 18 0 4</td>
<td>0 5 0 0</td>
<td>0 30 0 0</td>
<td>0 30 0 0</td>
</tr>
<tr>
<td>Does not decide (decides)</td>
<td>0 32 0 57</td>
<td>0 32 0 16</td>
<td>0 9 0 0</td>
<td>0 57 0 0</td>
<td>0 57 0 0</td>
</tr>
<tr>
<td>Poor education (educated)</td>
<td>1 30 0 50</td>
<td>1 30 0 12</td>
<td>0 8 0 0</td>
<td>1 50 0 0</td>
<td>1 50 0 0</td>
</tr>
<tr>
<td>Partner poor education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority ethnic group (majority)</td>
<td>5 8 0 19</td>
<td>5 8 0 3</td>
<td>1 2 0 0</td>
<td>10 19 0 0</td>
<td>10 19 0 0</td>
</tr>
<tr>
<td>Many members household (less)</td>
<td>2 10 0 26</td>
<td>2 10 0 11</td>
<td>0 4 0 0</td>
<td>2 26 0 0</td>
<td>2 26 0 0</td>
</tr>
<tr>
<td>Alone (in couple)</td>
<td>7 10 0 18</td>
<td>7 10 0 5</td>
<td>0 2 0 0</td>
<td>7 18 0 0</td>
<td>7 18 0 0</td>
</tr>
<tr>
<td>No radio (radio)</td>
<td>0 30 0 45</td>
<td>0 30 0 18</td>
<td>0 7 0 0</td>
<td>1 45 0 0</td>
<td>1 45 0 0</td>
</tr>
<tr>
<td>Minority religion (majority)</td>
<td>6 11 0 21</td>
<td>6 11 0 22</td>
<td>0 4 0 0</td>
<td>9 21 0 0</td>
<td>9 21 0 0</td>
</tr>
<tr>
<td>Offspring dead (less)</td>
<td>1 24 0 42</td>
<td>1 24 0 10</td>
<td>0 8 0 0</td>
<td>2 42 0 0</td>
<td>2 42 0 0</td>
</tr>
<tr>
<td>Offspring in household (less)</td>
<td>1 13 0 27</td>
<td>1 13 0 10</td>
<td>0 4 0 0</td>
<td>2 27 0 0</td>
<td>2 27 0 0</td>
</tr>
<tr>
<td>Female (male)</td>
<td>1 1 0 6</td>
<td>1 1 0 1</td>
<td>0 1 0 0</td>
<td>2 6 0 0</td>
<td>2 6 0 0</td>
</tr>
<tr>
<td>Female head household (male)</td>
<td>1 3 0 15</td>
<td>1 3 0 4</td>
<td>0 1 0 0</td>
<td>2 15 0 0</td>
<td>2 15 0 0</td>
</tr>
<tr>
<td>No TT (at least 2 TT)</td>
<td>0 28 0 44</td>
<td>0 28 0 19</td>
<td>0 6 0 0</td>
<td>1 44 0 0</td>
<td>1 44 0 0</td>
</tr>
<tr>
<td>No TV (TV)</td>
<td>0 28 0 52</td>
<td>0 28 0 15</td>
<td>0 7 0 0</td>
<td>0 52 0 0</td>
<td>0 52 0 0</td>
</tr>
<tr>
<td>Rural (urban)</td>
<td>1 29 0 48</td>
<td>1 29 0 11</td>
<td>0 8 0 0</td>
<td>2 48 0 0</td>
<td>2 48 0 0</td>
</tr>
<tr>
<td>Poorest (vs poor)</td>
<td>1 16 0 34</td>
<td>1 16 0 11</td>
<td>0 7 0 0</td>
<td>3 34 0 0</td>
<td>3 34 0 0</td>
</tr>
<tr>
<td>Poorest (vs medium)</td>
<td>4 26 0 64</td>
<td>4 26 0 12</td>
<td>0 5 0 0</td>
<td>6 64 0 0</td>
<td>6 64 0 0</td>
</tr>
<tr>
<td>Poorest (vs rich)</td>
<td>2 30 0 53</td>
<td>2 30 0 15</td>
<td>0 8 0 0</td>
<td>3 53 0 0</td>
<td>3 53 0 0</td>
</tr>
<tr>
<td>Poorest (vs richest)</td>
<td>3 28 0 48</td>
<td>3 28 0 12</td>
<td>0 8 0 0</td>
<td>5 48 0 0</td>
<td>5 48 0 0</td>
</tr>
</tbody>
</table>

Number of countries showing significant OR (below and above 1) for each predictor, by region

(Only surveys with 95% CI NOT including 1 are depicted)

(Europe: all MICS surveys where few predictors were available)
By survey

95% CI too high (manually removed)

Likelihood of non-vaccination

Favours predictor without brackets

Favours predictor within brackets

Predictors

Predictor not available; or OR too high; or not enough observations

Chart (detail)
Chart (detail)

By predictor

Likelihood of non-vaccination

Surveys

Odds ratios

95% CI too high (manually removed)

Predictor not available in these surveys; or OR too high; or not enough observations
Survey: All, by region
Outcome: Access
Predictor: Caregiver education
Chart: By survey
Survey: All, by region
Outcome: Utilisation
Predictor: Household members
Chart: By survey
Findings: survey with predictors showing no differences

<table>
<thead>
<tr>
<th>Survey</th>
<th>Swaziland (DHS 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Access</td>
</tr>
<tr>
<td>Predictor</td>
<td>All</td>
</tr>
<tr>
<td>Chart</td>
<td>By predictor</td>
</tr>
</tbody>
</table>

![Odds Ratios Chart](chart.png)
Findings: survey with predictors showing inconsistent differences

Survey | Rwanda (DHS 2005)
Outcome | Utilisation
Predictor | All
Chart | By predictor
Findings: survey with predictors showing consistent differences

Survey | Peru (DHS 2000)
---|---
Outcome | Utilisation
Predictor | All
Chart | By predictor
Findings: predictor with hardly any difference

<table>
<thead>
<tr>
<th>Survey</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Access</td>
</tr>
<tr>
<td>Predictor</td>
<td>Sex of the child: female (male)</td>
</tr>
<tr>
<td>Chart</td>
<td>By survey (sorted by OR)</td>
</tr>
</tbody>
</table>
Findings: predictor with inconsistent differences

<table>
<thead>
<tr>
<th>Survey</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Utilisation</td>
</tr>
<tr>
<td>Predictor</td>
<td>Ethnic group: other (majority)</td>
</tr>
<tr>
<td>Chart</td>
<td>By survey (sorted by OR)</td>
</tr>
</tbody>
</table>
Findings: predictor with consistent differences

<table>
<thead>
<tr>
<th>Survey</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Access</td>
</tr>
<tr>
<td>Predictor</td>
<td>Wealth: poorest (richest)</td>
</tr>
<tr>
<td>Chart</td>
<td>By survey (sorted by OR)</td>
</tr>
</tbody>
</table>
Conclusions (1)

- There is a significant number of non-vaccinated children (‘unreached’) in LMIC.

- From univariate analysis, some predictors show a stronger effect on immunisation outcomes; for example:
  - who takes the decision for health care
  - caregiver and partner education (for ‘access’)
  - TT status (for ‘access’)
  - wealth related predictors.

- There is great variation in ‘unreached’ rates and their predictors between surveys. What happens in one country or region cannot explain what happens in another country or region.
Conclusions (2)

- Countries profiles provide detailed information of what predictors are more relevant and to which extent.

- These findings (together with evidence from other sources) should inform national policies targeting unreached children by immunisation.

- Given the extent and depth of this work, further analyses should be justified only where policy options exist at national level.
Limitations

- There is no data available for each possible country and year; countries conducting surveys are NOT representative of all countries.

- Data quality varies across surveys and types of surveys.

- The analyses presented so far are univariate and does not rule out interactions or confounding factors.
Acknowledgments

- Kaushik Banerjee (WHO)
- Antony Burton (WHO)
- Carine Weiss (SCIH/STI)
- Christian Schindler (ISPM)
Thanks for your attention
Findings: outcomes

- Percentages of ‘no access’ (zero doses) tend to be smaller than the proportion of ‘poor utilisation’ (at least one dose).

Survey: Nicaragua (DHS 2001)
Outcome: Access and utilisation
Predictor: All
Chart: By predictor
Findings: outcomes

- ORs for ‘access’ and ‘utilisation’ tend to be similar in the same survey.
- However, ORs for the ‘access’ tend to further away from 1 than the OR for the outcome ‘utilisation’.
- 95% CI of ‘access’ tend to be greater than those of ‘utilisation’.

<table>
<thead>
<tr>
<th>Survey</th>
<th>Congo (DHS 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Access and utilisation</td>
</tr>
<tr>
<td>Predictor</td>
<td>All</td>
</tr>
<tr>
<td>Chart</td>
<td>By predictor</td>
</tr>
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