Methodological Note

GRID – Save the Children’s Child Inequality Tracker

1. Introduction

In 2015, world leaders signed up to the United Nations Sustainable Development Goals (SDGs) – a set of 2030 targets for eradicating extreme poverty in all its forms. The Leave No One Behind pledge lies at the heart of the SDG framework – a commitment ‘to reach the furthest behind first’ and ensure that targets are met for all segments of society. To fulfil the ground-breaking pledge to Leave No One Behind, it is necessary to know who the furthest behind are, monitor their progress, and build public and political understanding about the importance of reaching them. To do so, we have compiled a dataset including selected children’s wellbeing indicators disaggregated by sex, location and wealth over time.

Save the Children has developed GRID, Save the Children’s Child Inequality Tracker, to help identify groups being left behind, monitor their progress, and build public and political understanding about the importance of reaching them. The tool shows inequalities in selected children’s wellbeing indicators across health, education and child protection, including more than 400 household surveys for more than 100 mostly low- and middle-income countries. All data is presented free and publicly available in our online tools (www.childinequality.org), providing a visual representation of the inequalities that persist between different groups of children across key SDG indicators.

The following note describes the methodology behind the GRID online tools. Section 2 gives an overview about the child outcome indicators presented in GRID and section 3 describes the various tools more in detail. Section 4 explains the data sources. Sector 5 describes the methodology to estimate trends and projections for both national averages and inequalities.

2. Child outcome indicators

The underlying database of GRID consists of more than 150 indicators and sub-indicators across health and nutrition, education, child poverty, child protection, and child rights governance. More than half of those are based on publicly available household surveys and allow therefore various levels of disaggregation (including gender, location, wealth, subnational region, ethnicity, disability).

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1 March 2020. For questions on the methodology, please contact Oliver Fiala (o.fiala@savethechildren.org.uk).
Table 1 shows a subset of indicators, which are presented in GRID’s online tool as they are particularly relevant to monitor progress on child development, with new indicators being included occasionally. While the methodology described below focusses on the subset of indicators included in the online tools, it applies in very similar ways to other indicators.
### Table 1: Indicators in GRID online tools

<table>
<thead>
<tr>
<th>Thematic area</th>
<th>Indicator</th>
<th>Definition</th>
<th>SDG Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health &amp; Nutrition</td>
<td>Under-five mortality</td>
<td>Number of deaths under the age of five, per 1,000 live births</td>
<td>3.2.1</td>
</tr>
<tr>
<td></td>
<td>Infant mortality</td>
<td>Number of deaths under the age of one, per 1,000 live births</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stunting</td>
<td>Prevalence of stunting, height for age (% of children under 5)</td>
<td>2.2.1</td>
</tr>
<tr>
<td></td>
<td>Careseeking for pneumonia</td>
<td>Children with acute respiratory infection (age 0-4) taken to a health facility (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic vaccinations</td>
<td>Children (12-23 months) received all basic vaccinations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exclusive breastfeeding under 6 months</td>
<td>Infants under 6 months of age who are exclusively breastfed</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Early Childhood Development Index</td>
<td>Children (aged 36-59 months) who are developmentally on track in at least three of the following four domains: literacy-numeracy, physical, socio-emotional, and learning</td>
<td>4.2.1</td>
</tr>
<tr>
<td></td>
<td>Primary school completion</td>
<td>Completion of primary school (% of young people age 15-24 years)</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Lower secondary school completion</td>
<td>Completion of lower secondary school (% of young people age 15-24 years)</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Upper secondary school completion</td>
<td>Completion of upper secondary school (% of young people age 20-29 years)</td>
<td>4.1</td>
</tr>
<tr>
<td>Child protection</td>
<td>Birth registration</td>
<td>Children whose births are registered (% of children under 5)</td>
<td>16.9.1</td>
</tr>
<tr>
<td></td>
<td>Child marriage</td>
<td>Women who were first married by age 18 (% of women age 20-24 years)</td>
<td>5.3.1</td>
</tr>
<tr>
<td></td>
<td>Teenage pregnancy</td>
<td>Prevalence of pregnancies among adolescents (% of young women 15-19 years)</td>
<td></td>
</tr>
</tbody>
</table>

In addition, the tool “equitable access to services” does also offer the following input variables to choose from (based on data availability):

- Skilled birth attendance (births attended by skilled health personnel)
- Mothers who had at least 4 antenatal visits (women who had a live birth in the three years preceding the survey who had 4+ antenatal care visits)
- Support for learning (children aged 36-59 months with whom an adult has engaged in four or more activities to promote learning and school readiness)
- Availability of children’s books (children aged 0-4 years who have three or more children’s books)
- Violent discipline (children aged 2-14 years who experienced any violent discipline method)
3. Online tools

Save the Children has released significantly updated and expanded online tools in March 2020. The website presents a global and country-facing dashboard, each with various views-tabs. Table 2 describes the various tools and highlights tool-specific methodologies for the global dashboard, Table 3 is doing the same for the global-facing dashboard.

Table 2: GRID online tools – global-facing dashboard

<table>
<thead>
<tr>
<th>Tool</th>
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</table>
| Leave No One Behind Maps | Three maps introduce a global or world region perspective of Leave No One Behind, the pledge behind the Sustainable Development Goals to ensure that the 2030 goals are met for all segments of society.  
Are all groups on track to reach the SDGs?  
The first map shows whether all groups of children in society are on track to reach selected SDG targets by 2030. The colour coding distinguish between countries where all segments of society are on track; countries where the national average of a specific indicator is likely to reach the target, but not all groups; and countries where no group is on track to reach the SDG target, based on projections by Save the Children. Those projections do include sex (boys/girls), urban/rural, five wealth quintiles and subnational regions. The underlying projections follow the methodology described in section 4.  
Are gaps between different groups closing?  
The second map shows whether inequalities between different groups of children are closing, or whether some groups are being left behind. Countries achieving “inclusive progress” are moving towards SDG targets as a national average while at the same time reducing inequalities. The underlying projections follow the methodology described in section 4.  
How do averages compare across countries?  
The third map shows national averages for selected child development indicators across countries. A filter allows to choose instead to compare different groups of children in society across countries. The data is based on the latest available year in each country, hovering over the map does reveal source and year of a particular data point. |
| Group-based inequality   | This tool provides a snapshot of inequalities between children within and across countries. The data is based on the latest available year in each country, hovering over the data does reveal source and year of a particular data point.  
The group-based inequality tool allows to sort by absolute and relative inequality. The former measures absolute difference in the given indicator between disadvantaged and reference groups, while the latter measures how much more likely the disadvantaged group is to experience the given condition compared to the reference group. |
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<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>This tool presents a quick overview about inequalities for a selected outcome variable in a country. It shows a preview of the group-based inequality, the trends &amp; projection, and the subnational inequalities tool. Please refer to the specific tools below for more information.</td>
</tr>
<tr>
<td><strong>Group-based inequality</strong></td>
<td>This tool provides a simple snapshot of inequalities between children within a selected country for a selected indicator. The data is based on the latest available year in each country, hovering over the data does reveal source and year of a particular data point.</td>
</tr>
<tr>
<td><strong>Trends &amp; projections</strong></td>
<td>This tool analyses inequality trends across key SDG indicators. Projections to 2030 show variations in the rate of progress that different groups of children are making towards SDG targets, highlighting where accelerated progress is needed to ensure rights are fulfilled for all. The underlying projections follow the methodology described in section 4.</td>
</tr>
<tr>
<td><strong>Subnational inequalities</strong></td>
<td>This tool presents a map of inequalities between children living in different regions. By selecting a specific region from the map, a graph reveals inequality on a subnational level (inequalities by wealth, gender or location within that administrative region) and a reference point allows to compare the national equivalent values. The data is based on the latest available year in each country, hovering over the data does reveal source and year of a particular data point.</td>
</tr>
<tr>
<td><strong>Intersecting inequalities</strong></td>
<td>Children can face more than one form of disadvantage, for example experiencing discrimination based on both gender and wealth. This tool analyses how inequalities between groups can intersect to compound marginalisation and deprivation, pushing certain groups of children further behind. The data is based on the latest available year in each country, hovering over the data does reveal source and year of a particular data point. Data might not exist for all intersections due to availability in the source or sample size.</td>
</tr>
</tbody>
</table>
Equitable access to services

Equitable access to services is vital for reducing inequalities between children. Groups of children with the highest rates of deprivation across health, education and protection indicators should receive more investment to ensure they can access quality services. Research by Save the Children and others shows that the opposite is often true: those with the highest mortality and stunting rates have lowest access to services. This tool allows to analyse the relationship between access to services and inequalities for selected indicators and social groups. Outcome variables can be chosen from a filter based on the selection of the thematic area of interest (this tool does not currently allow to analyse those relationships in the field of child protection). Input variables can be chosen from any thematic area (including child protection). A trend line illustrates the relationship between both variables, without weighting the groups by size. The data is based on the latest available year in each country, hovering over the data does reveal source and year of a particular data point.

Tables and data sources

This tool presents a table with the data shown in the various tools (except projection data). The table also highlights the source, reference year, sample size, and standard error (if applicable).

4. Data

Save the Children computes child outcome indicators based on currently around 320 Demographic and Health Surveys (DHS) between 1985 and 2018, as well as more than 120 Multiple Indicator Cluster Surveys (MICS) of rounds 3 to 5 between 2005 and 2017. All education data comes from the World Inequality Database on Education (WIDE) by UNESCO, which includes 459 surveys in 169 countries between 1999 and 2017. Data for malnutrition is taken from the WHO/UNICEF/World Bank Joint Malnutrition Estimates and covers currently 152 countries between 1983 and 2018. The final dataset as it is presented online covers currently 83 low- and middle-income countries, which have data no older than 2012 and cover at least 3 indicators from more than one thematic area. All surveys in this data set allow disaggregation at least by gender, location (urban/rural), subnational regions, and economic group (quintiles).

- **Gender:** Sex of the child as reported in the survey.
- **Urban/rural:** The definition is the same as the one used in DHS or MICS and normally follows the definition used in the census.
- **Economic groups:** DHS and MICS surveys estimate the wealth of households by asking questions on ownership of various assets and based on it construct an index. Quintiles are then constructed based on the distribution of household population. In GRID, quintiles computed by MICS or DHS were used. Since quintiles are computed for the total population, the child population in each quintile may not be exactly 20% and reported child population may vary between quintiles.
- **Subnational regions:** Region definition follows generally the definition provided in DHS and MICS, with a preference for administrative regions where possible. For trends and projections over time, regions were changed in some cases to keep them consistent over time and for this reason they may not be identical to the current administrative regional borders.
- **Disability:** The definition of disability follows that provided in MICS, distinguishing between children with and without functional difficulties.
For each group, the share of the group in the total population has been computed. The share of the group has been applied to the total child population of the relevant age group, depending on the chosen indicator. For each of these indicators and groups, sample sizes, standard errors and confidence intervals are also calculated (when possible). Groups with a sample size less than 50 were deleted from GRID. Thus, in some cases, groups will not appear in the visualisation tools as the sample size was too small to provide a reliable measure of the group average. As mentioned above, we do also exclude data older than 2012, except in the context of past trends.

5. Methodology for trends & projections

National average

To show trends in children’s well-being indicators over time, including their possible development until 2030, we need to calculate trends and projections of the national average at the country level. National trends are computed by using all available information at the national level, and missing points between two years are linearly interpolated.

We use national average data from the UN Inter-agency Group for Child Mortality Estimation (IGME) for under-five mortality and infant mortality. As national averages provided by IGME differ slightly from those reported by household surveys, we align group inequalities estimated in GRID accordingly by applying the ratio between estimated national averages and national rates from other sources to the group inequalities, keeping relative inequalities constant. In contrast, when only the last available data is presented, mortality rates follow those provided in the household survey.

In all cases, forward projections are required from the last available data point to 2030 and in some cases backward projections if there is no information for the first years from 2000. A broad range of methods is possible to project national trends, however for this particular application we want to ensure consistency and simplicity. We therefore use a logit model to project future changes based on the annual rate of reduction observed in the past. This allows, that our methodology is cohesive and comparable across various outcome indicators. Furthermore, it means that the projections do not rely on any additional assumptions and can be easily replicated.

Inequalities

Different methods for projections for all groups

Projecting values up to 2030 for all different groups (sex, urban/rural, wealth quintiles and subnational regions) can be challenging as there are usually few point estimates and relatively small sample sizes. Moreover, we assume projections at the group level need to satisfy some criteria to be credible. (1) Similarly to national projections, rates are naturally bounded between 0 and 1 and projections should all be in this interval. (2) Weighted averages of groups should always be equal to the national average. (3) Groups should not swap order as the result of projections. It is in theory possible that groups left behind catch up and overtake the most advantaged groups but usually the order of groups stay the same and what changes is their relative distance to
the average.\(^2\) (4) Projections at the group level should take into account the dynamic in the change in inequalities.

One simple method to project rates at the group level is to continue the observed trend that the group is following. Rates can be transformed into a logit to make sure that estimates will not exit the 0-1 interval. This method would satisfy criteria (1) and (4) by taking into account the dynamic of the group. If the national average is reconstructed from group average, criteria (2) can be satisfied but it may lead to a situation where national projections obtained from a type of group (say wealth quintiles) differ from the national projections obtained from another type of group (say girls and boys). One issue is that group dynamics can lead to cases where marginalized groups overtake best performing groups. This method also uses little information as usually data at the group level is derived from relatively smaller sample sizes and may vary greatly from one survey to another because of sampling error.

To avoid these problems, Lange (2014)\(^3\) uses all information available at the country and global levels to estimate a country-specific transition speed that is applied to all groups in the country. The rationale is that all groups will tend to follow the same path of progress and that the most likely future outcome for a group can be deduced by looking at progress of all groups in the country. Moreover, using information from other countries makes possible to estimate transition speeds with more precision and avoid extreme estimates coming from small sample sizes. This method satisfies our desired criteria (1) to (3) but fails to take into consideration the country dynamic in changes in inequalities. Actually, by applying a uniform transition speed for all groups in the country, relative inequalities from projected values will remain constant.

A third alternative is discussed by Guerreiro Osório (2008)\(^4\) in a technical paper on projections of education indicators by groups in Latin American countries. His proposed solution is to estimate the rate of progress of all groups relative the highest possible value of the indicator. One assumption is that the rate of progress tends to decrease when the value is close to 100\% (for indicators when 100\% is the maximum desirable value). To estimate how the rate of progress slows down close to 100\%, he suggests using all available information from all groups over time and estimates the rate of progress for all observations over two periods. The expected rate of progress is obtained by estimating a linear model where the dependant variable is the rate of progress and the explanatory variable is the distance to the maximum value. The linear model is constrained to be 0 when the maximum value is achieved such as there is no more progress at this stage. His method satisfies criteria (1) and (3) but it is not clear how group averages are related to national averages. Dynamics in inequalities are captured in the sense that countries where groups further behind have experienced more rapid progress will tend to converge faster.

*Method chosen for projection: estimation of a convergence index*

Our method chosen for this project builds on these different methods and should satisfy all the desired criteria (1) to (4). We assume that group progress is relative to national progress, that is group progress can be either

\(^2\) This does not restrict the possibility that trends between existing data points are swapping order, but limits the projections after the last observation to reflect the last measured group order.

\(^3\) Lange S (2014) Projections to Zero

faster or slower than national progress. Thus, in cases where left behind groups tend to progress faster than the national average, they will eventually converge with the national average.\footnote{Left behind groups can never exceed the national average in our method as this would violate either assumption (2) that the average of groups is equal to the national average, or assumption (3) that groups do not swap order.}

To estimate the rate of convergence of groups left behind we observe group rates of progress relative to the national rates of progress for any two consecutive years of observations (thus, in a country with three available data points, we observe two points) by country and types of group. In countries exhibiting convergence, the rate of progress will be faster for groups left behind whereas, in the case of divergence, rates of progress will be slower for groups left behind.

A linear model is fitted to have an estimate of the rate of progress relative to the national average.\footnote{Linear model is weighted by the size of the sample used to compute the group estimates, such as larger sample sizes carry more weight, and by the length of the period between two points, such as convergence observed across a longer period carries more weight.} The explanatory variable is the difference in logit points between the group average and the national average and the dependent variable is the difference in rate of progress between the group and the national average, measured as the difference in logit points between the two periods. The estimated coefficient, the convergence index, is estimated separately for all indicators, country and types of groups. This parameter captures the evolution in inequalities in the country and makes our projections satisfy criterion (4).

The model is constrained to pass by 0, such as the group rate of progress equals the national rate of progress when a group average equals the national average. This ensures that group averages cannot cross the national average and that group position relative to the average is unchanged in the projections, thus respecting our desired criterion (3).

Figure 1 shows cases of convergence, divergence and no change over time. For instance, for stunting in Egypt, groups left behind (that is at the right of the national average rescaled at 0) have on average decreased faster than the national average (that is below the rate of progress of the national average rescaled at 0). The red line depicts the line of best fit across all points and represents the convergence index used at different values relative to the national average. The second case shows divergence in child marriage in Serbia where groups left behind have on average experienced a smaller decrease than the national average. Finally, the last example shows a case where group rate of progress is independent of the position of the group relative to the national average. In the case of child marriage in Kenya, we do not observe faster or slower progress of groups left behind and in this case the convergence index is 0 and indicates that relative inequalities have remained constant.
Based on the estimated national average until 2030, we estimate (starting from the latest available point) in an iterative process the likely rate of change of the group, considering the position of the group relative to the national average and the convergence index for this country and type of group. To ensure that characteristic (2) is satisfied group averages are rescaled at each iteration such as they equal the national average. This matters in the case of divergence when the best performing groups reach 0% or 100% (dependent on the indicator) and left behind groups need to progress to reflect national progress.