

Monitoring country progress and achievements by making global predictions: is the tail wagging the dog?



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The world has seen explosive growth in the use of estimates for key health indicators. UN agencies, such as WHO and UNICEF, and academic institutions, notably the Global Burden of Disease (GBD) work of the Institute of Health Metrics and Evaluation (IHME), have stepped up the frequency and scope of global health estimates. Funding agencies, led by the Bill and Melinda Gates Foundation, are making major investments in global health estimation. Several prominent, high-impact academic journals prioritise publication of global health estimates, which are usually received with great interest in the international health and development community and media. Mortality estimates generally make the headlines.

These trends were driven by the monitoring framework of the Millennium Development Goals (MDGs), which greatly enhanced the demand for annual and up-to-date progress assessment for key indicators with global and country targets, such as maternal and child mortality. In September, 2015, world leaders met to review final global, regional, and country achievements at the MDGs review summit in New York, USA. The deliberations were informed by a statistical report and a country database produced by UN agencies.¹⁻³ The final MDGs report provided predictions for 2015 for almost all targets. Academic journals, notably *The Lancet*, also published model-based estimates of the achievements of countries on maternal and child mortality.^{4,5} The monitoring of country progress towards the 169 targets of the Sustainable Development Goals (SDGs) appears to follow the tracks of the MDGs, with annual reports based on predicted (forecasted) statistics for a very recent year.⁶⁻⁸ The monitoring is expanding further to include estimate-based composite measures or indices that summarise the values of a range of health and other indicators, and is likely to be extended beyond national estimates given the emphasis on disaggregated statistics for SDGs.

The reliance on estimates is driven by the desire to fill data gaps and ensure temporal and cross-country comparability for global health indicators, and by an increased demand from development partners for timely statistics to show the effect of investments. Globally, considerable investments are being made in advanced statistical modelling, computation of uncertainty ranges, and the production of compelling visualisations of results. However, these advances could give the impression of abundant evidence that is actually based on very sparse empirical data. Unfortunately, global public health experts and academics are often oblivious to the limitations of these estimates and regularly overinterpret the numbers, especially if the estimates support their arguments.

Mortality of children under 5 years and maternal mortality were the most prominent health indicators in the MDGs. Many political leaders paid attention to the MDGs targets and claimed signs of progress as a validation of their policies. We assessed the extent to which the 2015 MDGs assessments of achievements were based on prediction, by using the 2015 report by the UN¹ and 2016 publications of the IHME in *The Lancet*.^{4,5} We focused on 81 countries in the Countdown to 2030 for women's, children's, and adolescents' health.⁹ Together these countries account for an estimated 90% of childhood deaths and 95% of maternal deaths worldwide.

The published UN estimates provided information on the country data sources used for the MDGs final analyses in 2015. Household surveys with birth histories were the most recent source of child mortality data for three-quarters of the 81 countries, generally a Demographic Health Survey (DHS) or Multiple Indicator Cluster Survey (MICS; appendix). For maternal mortality, surveys accounted for 68% of the most recent data sources, followed by high coverage death registration systems (15%), and censuses (7%). Seven countries had no new data collection since 2000 and five countries had no useable data.

The most recent empirical data collection efforts for child mortality on average ended around 3 years before the final MDGs reports in 2015 and, for maternal mortality, around 4 years before the 2015 MDGs reports. For vital events registration, the mortality data refer to the reporting year, but for surveys (and censuses) the period when deaths occurred was further back in time, as retrospective data are collected through birth histories for child mortality, and sibling survival histories for maternal mortality. A standard DHS report typically provides statistics for extended periods preceding the survey: 5 years for child mortality and 7 years for maternal mortality statistics. Despite the use of statistical prediction methods to generate estimates for more recent time periods,^{10,11} in practice the interval between the reference period for the indicator and the target year is considerably longer than the interval between the end of data collection and 2015. If we assume that survey data referred to deaths on average 2 years (child) and 3 years (maternal) before the data collection, only 38% of countries had child mortality data and 7% of countries had maternal mortality data for 2012 or beyond. The median year of the most recent datapoint for the 81 countries was 2010 for child mortality and 2008 for maternal mortality (appendix).

Even without considering uncertainty around datapoints and the availability of historical time series, this

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See Online for appendix

simple analysis brings home our first point. Assessing country achievements in 2015 involved an extraordinary amount of prediction, and more so for maternal mortality than for child mortality. Had countries been able to accelerate progress during the last 5 years of the MDGs and bend the predicted curve, it would not, in most cases, have been captured in the 2015 assessment of MDGs achievements in most countries. This outcome could be compared to awarding school qualifications on the basis of predictions made at the start of school.

Our second point focuses on the country perspectives. In a review of country uses and experiences, global estimates for countries were noted to be little understood, often ignored, and sometimes highly contested.¹² A common criticism is the frequent shifting of goal posts epitomised by substantive changes in country values for MDG indicators in subsequent rounds of global estimates as a result of changes in the methods and new data. This instability affected baselines, targets, and progress assessments.

In general, countries with functioning death registration systems tend to attach greater value to such vital statistics—even if they are incomplete—than to global health estimates. Countries without functioning death registration systems focus on the results of the most recent household survey, usually a DHS or an MICS. These national surveys are well integrated and accepted in countries as they are conducted by country institutions (with international technical assistance), are based on standardised methods and contents, have global recognition, and use transparent understandable methods of computations. The surveys have become socially robust¹³ and the results are often taken at face value, are heavily debated, and are used in a wide range of country policy, planning, monitoring, and review mechanisms. The retrospective nature of survey results, however, is often ignored.

The differences between survey results and global health estimates are not trivial. To illustrate this gap, we compared the MDG estimates for 2015 with the results of ten countries that conducted a DHS in 2015–16, published after the final assessment (appendix). For child mortality, the median DHS results for the 5 years preceding the survey differed by 15% from the UN predictions and 19% from the IHME MDG predictions for 2015 across the ten countries. In six countries, the survey statistics were outside the uncertainty ranges of the estimates (two for UN and four for IHME).

For maternal mortality, the new median DHS results differed 35% from the UN predictions and 55% from the IHME predictions for 2015 across eight countries with new survey data. In three countries, the survey statistics were outside the already wide uncertainty ranges for both predictions. The larger differences for maternal mortality than for child mortality are to be expected as datapoints are fewer and maternal deaths are much less frequent than child deaths, and therefore much more difficult to

measure accurately. The maternal mortality estimation models depend to a much greater extent than for child mortality, on the assumptions of the statistical model, including the definition of outliers, the use of independent variables for prediction, and the extent of weightings applied to different datapoints.

The main point of this comparison is not that survey (and census or registration data) results should be taken at face value and predicted estimates should disappear; global health estimates are needed to monitor global and regional trends and show current and future health challenges. The progress in the use of improved statistical methods, such as Bayesian methods and geospatial modelling, is impressive; however, the limitations of predicted estimates for country monitoring should be taken into consideration. These limitations pertain to maternal and child mortality, but also to causes of death as quality data are sparse for many countries. Regular updates of country statistics for indicators such as mortality associated with non-communicable diseases or suicide, or monitoring access and quality of health care by estimates based on mortality by cause data,¹⁴ should be interpreted with great caution for countries with poor cause of death data. The increasing frequency and scope of predicted estimates could even be counterproductive. Assessment of country progress by prediction might give a false impression of certainty about health status and trends, and detract from making much-needed investments in improving data collection and analytical capacity within countries.

We call for a repositioning of the production of global estimates, and the transition from MDGs to SDGs provides an opportunity to do so. Neither country policy makers nor the global development community are best served by a global flood of health estimates derived from complex models as investments in country data collection, analytical capacity, and use are lagging. First, we recommend a slow down in the production of estimates: the year for which the predicted statistics are published should lie much closer to the actual year of the most recent datapoints than is currently the case, thus avoiding extensive extrapolations of time trends into the future. Second, global publications and academic journals should be increasingly circumspect and transparent regarding the limitations of estimates; publications should pay increased attention to empirical country data presented with careful data quality ascertainment and adjustments for biases on the basis of transparent and reproducible methods. Clear presentation with attention to input data and code¹⁵ and unambiguous labelling of estimates as predictions are also necessary. Third, donors and global development partners should reconsider their role in the production and use of global estimates. Reduced demand for real-time tracking of impact and results and improved understanding of the real world would go a long way towards increasing sustainability, building capacities, and enhancing accountability to the intended beneficiaries of development.

Fourth, rather than increasing investments in the production and dissemination of global estimates, increased domestic and international support is urgently needed for public health institutes, universities, and research entities in low-income and middle-income countries to develop and sustain institutional knowledge and skills for data generation, analysis, interpretation, and translation. The approach adopted by UNAIDS since 2001 is a good example of how to ensure countries can analyse their own data and produce estimates that are accepted as their own, rather than those of global agencies.¹⁶ The UNAIDS approach is characterised by close involvement of country public health managers, academics, and policy makers and capacity strengthening efforts over a prolonged period with simple software tools for analysis of available country data. The Countdown to 2030 for women's, children's, and adolescents' health,⁹ the Data for Health project, and the National Evaluation Platform project, are other examples of global efforts to support analytical capacity strengthening in academic institutions and ministries of health in multiple countries, but further efforts are needed. These approaches resonate well with the increased demand for country-led monitoring in the context of the SDGs, called for in the 2030 agenda for sustainable development,¹⁷ and promoted by many health development partners as part of the Health Data Collaborative. Finally, persistent data gaps need to be reduced by strengthening data sources such as birth and death registration systems, as has been articulated in many fora.¹⁸

Contributors

TB wrote the first draft and all authors contributed to the revisions of the manuscript and approved the final version.

Declaration of interests

We declare no competing interests.

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For more on **Data for Health** see <https://www.bloomberg.org/program/public-health/data-health/#problem>

For more on **National Evaluation Platform** see <https://www.nationalevaluationplatform.org/>

For more on the **Health Data Collaborative** see <https://www.healthdatacollaborative.org/>