



**The utility of estimates
for health monitoring and decision-making:
global, regional and country perspectives**

Report of a technical meeting

*WHO, Glion sur Montreux, Switzerland
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Acronyms

BoD	Burden of Disease
DHS	Demographic and Health Surveys
GAVI	The Vaccine Alliance
GBD	Global Burden of Disease
ICD	International Classification of Diseases
IHME	Institute for Health Metrics and Evaluation
MDG	Millennium Development Goal
NBD	National Burden of Disease
OECD	Organisation for Economic Cooperation and Development
SDG	Sustainable Development Goal
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS

Background

The Millennium Development Goals (MDGs) universally endorsed by governments in 2000, ushered in an era of greatly increased investments in initiatives to reduce poverty, improve health, and provide access to education, employment and basic infrastructure. The eight MDGs were associated with time-bound targets and indicators and subject to regular reporting by countries and development partners. While this approach was of value in focusing the attention of national and international stakeholders on delivering results, insufficient attention and resources were directed to developing country systems and capacities to effectively measure and track the indicators.¹

In order to fill the data gap and monitor progress, development partners used statistical models to impute missing values and address bias and quality problems in available country data. This enabled the production of estimates for indicator values that could be compared over time and across countries but did little to address the development of country information systems per se. From modest beginnings in the UN system during the 1990s, the estimation ‘business’ has evolved into a significant, multi-institutional effort; development partners have come to rely upon statistical estimates for reporting progress on the MDGs and other important indicators. In the past decade, exceptionally well-resourced academic institutions have entered the scene, and the computing power and sophistication of the statistical modelling approaches has increased exponentially.² These developments have been particularly evident for health-related indicators but have also occurred across other domains such as poverty, education/literacy, environment, and infrastructure. However, countries and several global agencies have expressed concerns that the international estimates are not accurate reflections of country progress and that the focus by donors on cross-country comparability tends to undermine confidence in locally available data. Furthermore, the availability of estimates for countries with known deficiencies in data quality may reduce incentives to invest in data generation at country level. On the other hand, estimates can have a positive impact in promoting transparency and openness with regard to the quality of available country data. In the final analysis, the better the quality of country data, the more certain the estimates will be. Hence the need to direct increased resources and technical support to improving country health information and statistical systems.

At the end of 2015 the MDG era will draw to a close, to be replaced by the Sustainable Development Goals (SDGs) whose scope and reach is far beyond what was envisaged in the MDGs, covering many more issues and designed to enable tracking of progress along multiple dimensions, including equity. For health, the SDGs include an overarching goal of improved health and wellbeing for all at all ages by 2030. The goal is associated with 13 targets, and indicators (under development) for the unfinished MDG agenda of better maternal and child health, reductions in major infectious diseases (such as HIV/AIDS, tuberculosis and malaria) and access to safe water and sanitation. It also comprises entirely new targets for reductions in premature mortality in adults due to noncommunicable diseases, improved health security, reductions in mortality and disability due to accidents, and enhanced equity across multiple socioeconomic stratifiers, including wealth, geography, ethnicity, disability, nationality etc.

The expansion of goals, targets, and standardised indicators and the demand for real-time and comparable data will greatly challenge country statistical and health information systems. This is recognized by a UN Expert Advisory Group, which has called for a ‘data revolution’ to support countries in

¹ Chan M et al. (2010). Meeting the Demand for Results and Accountability: A call for Action on Health Data from Eight Global Health Agencies. *PLoS Medicine*, 7(1):1–4. doi:10.1371/journal.pmed.1000223.

² Mokdad AH (2015) Better data for better health: The role of the Institute for Health Metrics and Evaluation. Presentation to the WHO technical meeting in Glion 24–25 June 2015

responding to the monitoring challenges of the SDGs.³ Yet a data revolution cannot happen overnight and, notwithstanding the fact that it does not directly support the development of national health information systems, there is a continuing need for cross-country and temporally comparable indicator estimation for settings where the available data are inadequate. The challenge is how to encourage convergence between country reported statistics and international estimates. In the meantime, attention should focus on how to ensure that the utility of estimates developed for global monitoring can be maximized for national stakeholders, contributing to, rather than undermining, country health information and statistical systems.

In June 2015, the WHO Department of Health Statistics and Information Systems invited producers and users of health statistics from a number of countries and institutions to a two-day meeting to review experiences and reach consensus on good practices for the production and use of global estimates. The stated objectives of the meeting were to:

- Assess the utility of health estimates for informing country policy and planning.
- Provide advice to WHO on how it can improve its work on global health estimates so that they are responsive to country needs.
- Identify ways of enhancing country capacities and use of country statistics to generate their own estimates using standardized methods and tools.⁴

Country participants, listed with other attendees in Appendix 1, came mostly from middle and upper-middle income countries with relatively functional health information systems. WHO staff from headquarters and regional offices attended, and there were also representatives from other health programmes, academia and the press. The meeting, held in Glion, Switzerland on June 24 and 25 2015, was underwritten by a Gates Foundation grant to WHO in support of the WHO Reference Group on Health Statistics

This report summarises the main points of discussion. Phrases in italics are verbatim quotes from participants at the meeting.

³ The United Nations Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development (IEAG). A World that Counts. Mobilising the Data Revolution for Sustainable Development. November, 2014.
<http://www.undatarevolution.org/wpcontent/uploads/2014/12/A-World-That-Counts2.pdf>

⁴ A more comprehensive background paper is available at
http://apps.who.int/iris/bitstream/10665/182157/1/WHO_HIS_HSI_2015.6_eng.pdf?ua=1

The table below summarizes the country presentations:

Country	Topic	Use of global health estimates
Brazil	From national to sub national mortality statistics: Brazil's quality improvement system	As a background statistic; media pick it up to show poorer performance
Thailand	Using global estimates to benchmark country health information: Thailand experience with maternal mortality, GBD	Limited use of global estimates, own NBD
South Africa	From predictions to empirical data: Use of rapid mortality surveillance for tracking national and subnational mortality trends	Focus on corrected statistics for monitoring; use global estimates to benchmark the country poor performance; provincial NBD every decade or so; HIV estimates use – different committees using different estimates
Iran	Strengths and weaknesses of health data sources and its use in burden of disease studies	Focus on corrected statistics from multiple sources in monitoring progress (393 indicators) - challenge; use BoD?
Ghana	Country monitoring of progress and performance in Ghana: indicators (21), data, methods and use processes	Fairly well established system of health data which is fairly adequate for policy reviews. Global health estimates rarely used beyond universities and research institutions. No trust in estimates.
Mexico	Uses of corrected and predicted statistics in Mexico	Considerable investment in corrected and predicted statistics; uses of estimates variable
Turkey	Interaction between estimates and improving data system	Estimates used and challenged by government
Chile	The role of data and estimates in decision making	Focus on corrected statistics (OECD), conducts NBD, but no major use of global health estimates;
Indonesia	Use of data and estimates for developing and monitoring the national plan	NBD conducted, possible link with GBD to compare results; estimates not used as baselines
Bangladesh	Use of data and estimates for monitoring the national plan	Monitoring with corrected statistics; estimates useful as benchmark but also adding to confusion – more data sources also adding to confusion

The role of estimates in monitoring health progress

The need for terminological clarity

In the general discourse, there is a tendency to use "data," "statistics", "indicators" and "estimates" interchangeably and it can be argued that all measurements are estimates given the variety of data sources used and the imprecision of many measurement tools. However, meeting participants expressed a preference for the use of the term "estimate" to describe "an approximate calculation or judgment" as contrasted with an empirically measured value derived from a particular data source using a specified measurement instrument, such as a survey or an administrative data collection procedure. Participants agreed, however, that the notion that there is simple dichotomy between "estimated" and "empirical" values is inappropriate. In practice, estimation covers different approaches to dealing with imperfections in a set of data. Building on a framework initially proposed by Murray in 2007,⁵ it is possible to distinguish three broad types:

Unadjusted, raw data

These data are often collected at the health facility or administrative level and aggregated up through sub-national to the national level. They include case reports (for example of notifiable diseases) and vital registration data (e.g. number of births), and yield absolute measures. Such data are often biased because they cover only those using the services. Population rates can be computed if the numerator (raw counts of events) are reliable and the denominator can reliably be obtained through population projections or other source. It can however be difficult to calculate population representative rates and ratios because there are gaps and biases in both the numerators and in the relevant denominators.

Corrected/adjusted statistics

- Corrected statistics adjust for factors affecting the completeness or representativeness of raw data. Imputation techniques can be used to fill data gaps or improve comparability and quality of data, for example where part of a time series is unavailable or data is missing from certain reporting units, such as civil registration offices or health facilities.⁶ Imputation may also involve reclassification of certain variables in data set to an international standard such as the International Classification of Diseases (ICD).
- Demographic methods to estimate and correct for reporting bias are commonly applied in censuses and surveys.⁷ In household surveys; correction for known bias includes use of sample weights and uncertainty can be expressed in confidence intervals.
- More elaborate methods of adjustment involve compiling, critically assessing and reconciling data from multiple sources on a country-by-country basis in order to synthesise a benchmark or 'best estimate' for key quantities of interest. This involves adjusting country empirical data on the basis of certain assumptions and statistical models.⁸ An example is the *Epidemic Projection Package* used to estimate adult HIV prevalence in countries with heterosexual epidemics.⁹

⁵ Murray CLJ Towards good practice for health statistics: lessons from the Millennium Development Goal health indicators Lancet 2007; 369: 862–73

⁶ WHO and USAID (2014) Analysis of health facility data: Methodological issues and solutions. Guidance for managers and analysts of health facility data

⁷ United Nations Population Division. Manual X: indirect demographic estimation. New York: United Nations, 1983.

⁸ United Nations Population Division. QFIVE: microcomputer program for child mortality estimation. New York: United Nations, 1989.

⁹ <http://www.who.int/hiv/strategic/surveillance/software/en/>

Statistical modelling and prediction

Predicted statistics involve more complex data reconciliations and statistical techniques that are applied at the global level to generate comparable and consistent indicator values for multiple countries. There are two types of predicted statistics: trend fitting and prediction using covariates to fill data gaps.

- **Trend fitting:** Observed values for an indicator from multiple sources are reviewed, adjusted, outliers are eliminated, and trend-fitting techniques used to estimate past trends over time and project likely future trends. This approach has been widely used by UN agencies and academic institutions to generate statistical estimates of levels and trends in under-five mortality.¹⁰ However, the end results in global and country indicator values often differ, sometimes substantially, particularly for the most recent years. A recent analysis concluded that the differences arise not only from the trend fitting procedures but also from the contents and construction of the underlying databases, the pre-processing of data, inclusion and exclusion of data series, and additional adjustment procedures.¹¹ Trend-fitting procedures tend to give more weight to the historical time series than to the most recent empirically observed measures, thus often underestimating the extent of progress at country level.
- **Complex predictive models:** A statistical model is developed relating the quantity of interest to covariates. This approach is frequently used to generate values for indicators in settings with no or very limited primary data on the quantity of interest, for example levels and trends in maternal mortality. A database is compiled of all available data from multiple sources, adjustment techniques are applied to maximize comparability across data sources, a multilevel regression model is used to identify appropriate covariates, which are then applied to generate values and trends in settings with limited empirical data. These models often involve multiple imputations and include covariates that are themselves based on estimates. They are most commonly used in academia and at the global level.
- **Global burden of disease and comparative risk factor assessment:** A complex statistical model is used with all sorts of data inputs to obtain a full picture of causes of death, years of life lost, years of lost to disability and disability-adjusted life years, or risk factors.

Reporting and interpreting different kinds of estimates

Participants agreed that the differences along the spectrum from raw data to complex predictive models relate to degrees of data adjustment, from very simple to highly complex. A general observation was that the more complex the statistical modelling approach, the less likely it is to be replicable at country level because of the greater demands on technical skills and computational power. Along with the inability to replicate may come diminished country ownership and use of the results.

Moreover, country participants expressed concerns with regard to the use of covariates in the statistical model. Whereas particular covariates may be predictive in some settings, they may not be relevant everywhere and may generate misleading conclusions. The problem is particularly acute when estimates are developed for countries that have very little or no input data for the indicator in question. The resulting estimates are derived entirely on the basis of statistical correlations with independent variables, including GNI per capita, an indicator that fluctuates as a result of changes in commodity prices. Rising

¹⁰ Alkema L, New JR, Pedersen J, You D, all members of the UN Inter-agency Group for Child Mortality Estimation and its Technical Advisory Group (2014) Child Mortality Estimation 2013: An Overview of Updates in Estimation Methods by the United Nations Inter-Agency Group for Child Mortality Estimation. PLoS ONE 9(7): e101112. doi:10.1371/journal.pone.0101112

¹¹ Alkema L, You D (2012) Child Mortality Estimation: A Comparison of UN IGME and IHME Estimates of Levels and Trends in Under-Five Mortality Rates and Deaths. PLoS Med 9(8): e1001288. doi:10.1371/journal.pmed.1001288

GNI *per se* may have next to no impact on population health. If these discontinuities in covariate measurements are sufficiently strong, they can create a mismatch between the realities observed on the ground and the predictions of global models. Regular updates of the estimates often add to the confusion. Each revised iteration, based on new input data or covariates in a few countries or improved models, will in practice affect the whole time series, including baselines, and the results for all other countries too. Comparison between the previous and current estimates for the same years is considered inappropriate by the producers, but often leads to confusion among the users.

Meeting participants were critical of the way WHO and other international documents report estimates developed by way of very different methods, with no clear distinction between data sources and the statistical models used. *"It's already an expertise just to judge what you're looking at"*. Participants urged all agencies and institutions producing estimates, including WHO, to be more transparent and clear about the nature of the 'estimates' issued for individual countries, providing clear guidance on the underlying database for each country, the decision-making process regarding the identification and exclusion of 'outliers', the adjustments applied to country reported data, the covariates used and the statistical models and trend-fitting processes. They also urged WHO to involve countries more directly in the estimation process and communicate better with countries during the consultation period.

There was widespread support among participants for the WHO *"GATHER"* initiative, the aim of which is to define and promote best practice in reporting health estimates. A working group was convened in 2014 and an on-line survey conducted to gather feedback on reporting of estimates. Following a meeting in early 2015 to examine the findings, a draft statement was elaborated and is currently under review by multiple stakeholders. The proposed reporting guidelines include:

- Listing of inclusion and exclusion criteria, including ad-hoc exclusions;
- Listing of data sources with meta-data;
- Open access to data inputs in electronic data format;
- Conceptual overview of the analysis method and a mathematical description of all analytic steps;
- Information on how computer code can be accessed;
- Quantification and reporting of uncertainty in the estimates;
- Open access to estimates in electronic data format;
- Analytical discussion of estimates in the context of input data & previous estimates;
- Discussion of limitations.

Despite the endorsement in principle of the *GATHER* approach, participants acknowledged the challenges in implementation. Full documentation would require substantive technical appendices and ensuring open access to input data and computer code implies an additional reporting burden when publishing estimates. Quantifying uncertainty is an active area of research. Furthermore, while it is of value to offer greater transparency in the estimation processes, in many countries, the technical skills and computational power to benefit from the additional information may be lacking. Participants urged the global health and statistical communities to do more to support capacity development in countries, supporting not only ministries of health and national statistical offices, but also working with country academic institutions with skills in statistics, demography and epidemiology and forming links with the private sector for assistance in computational power.

Also the gains of more complex models need to be carefully considered. A simpler model that can be widely used is many times more effective than a high powered model that can only be run and understood by very few.

Diversity of users and uses of statistics

A recurrent theme in the country presentations was the diversity of perspectives in the utility and usability of estimates. Different users of health statistics have different data needs. The perceived credibility and utility of different kinds of statistics vary significantly by user. Broadly, national and subnational data users prefer empirically measured data that can inform decision-making at subnational and national levels. Several countries commented that they either do not use global estimates at all or only for the purpose of validation of their own estimation methods. By contrast, global users, including international agencies, donors and development partners find more value in estimates that are comparable across countries and over time. This translates into variations in the types of statistics that are considered most credible at different levels of governance. This, turn, affects the likelihood that statistics will be used to inform policy.

In-country contextualization and data use

At country level, most users prefer empirically measured data, in part for institutional reasons (their own colleagues or other government departments have usually been involved in data collection) and in part because measures that come from a surveillance system or national household survey, for example a Demographic and Health Survey (DHS), appear concrete and easy to interpret in the local context. In addition, several countries have made significant progress with their vital events registration and feel it inappropriate to resort to estimates. It is this contextualisation that most often leads to action (Ghana, Niger, Brazil). By contrast, complex modelled estimates are often perceived as derived from an impenetrable “black box.” Even with the best will in the world, it can be hard to explain the outcomes to non-technicians resulting in mistrust by national policy-makers: *“If you’ve just done a DHS, you don’t really want to hear about an estimate”*.

A major concern expressed by country participants was that each revision of global estimates, whether produced by UN agencies or by the Institute of Health Metrics and Evaluation, involves a complete re-estimation of the whole time series, often going back as far as 1980, rather than simply an updating to take into account most recently available input data. As a result, baseline estimates may change, with significant implications for the speed – and even the direction – of time trends. For example, in 2010 IHME estimated maternal mortality for Nepal in 1990 at 471 (290–722) per 100,000 live births. In 2014, the IHME 2014 estimate for the same indicator was 417.4 (295.9 to 540.8). While the differences fall within the margins of uncertainty, explaining to policy makers the changes in baseline values, and the impact on trends since 1990 can be challenging and adds to the suspicion with which estimates are viewed.

Many country participants noted that most predictive estimates offer figures at the national level. This is simply not granular enough for countries that need to plan, deliver and monitor services at sub-national levels (Brazil, Mexico, Ghana, Thailand among others). Within countries, the strongest demand for data is now at the sub-national level: *“For us, the national is nothing”*. Demand for actionable data at local level is stimulated by calls for accountability at both global and country levels. Moreover, accountability implies the need for detailed data not only on geographic disparities in health indicators but also in terms of socioeconomic stratifiers such as household wealth, ethnicity, etc.

When data are produced in response to this sort of user demand, they are far more likely to be used than when they come from a disembodied source, unrequested (South Africa). A corollary of this is that national health information systems should, first and foremost, collect the information they need to plan

and monitor local health outcomes, whether or not those fit tidily into the guidance provided by global partners. Brazil, for example, measures and reports coverage of a minimum of seven ante-natal visits during pregnancy, not the recommended minimum of at least four visits reflected in the global indicator.

Decentralised countries which have generated sub-national burden of disease estimates have found them very useful in planning health service provision at the level where most budgetary decisions are now taken (Mexico). However participants did not otherwise express the need for sub-national predictive estimates: they generally prefer to use empirically-measured statistics, adjusted as appropriate.

This is not to say that global predictive estimates have no value at all at the national level. They are sometimes used as stop-gaps for areas which have been relatively neglected by local health information systems (for example non-communicable diseases in Ghana and Iran). They also provide a powerful advocacy tool: "*Global estimates are completely useless for planning, but they are useful for political lobbying*". In addition, they are sometimes used for the validation of national estimation methods.

On the other hand, estimates that indicate major discrepancies between country-reported data and global estimates can be seized upon for political purposes. Favourable estimates may be used by governments to rally support for current policies. Conversely, unfavourable estimates bolster the political opposition and civil society criticisms of the government. Whereas external agencies view estimates as neutral, independent and objectives, country decision makers often perceive them as symptomatic of a lack of trust on the part of development partners. This could be particularly relevant when national authorities have made major and sustained investments in health information systems that do not appear to be reflected in the estimation process. This issue lies at the heart of many disagreements about estimation processes. In the final analysis, although technical considerations are important, statistical estimates are used in often highly charged political contexts largely ignored by development partners and academia.

Benchmarking national progress using global comparisons can help secure continued support for successful programmes. Technocrats in countries that perform badly compared with countries with similar income levels can use global rankings to needle politicians into action, improving both data systems and programme implementation (historically in Chile, more recently in South Africa and Iran). But rankings are a double-edged sword. Sometimes, poor performance relative to their neighbours or political rivals leads countries to refuse to share any more data with international bodies.

International users and uses of data

Data needs and preferences can be very different in international agencies and among development partners. There are strong pressures in the health and development communities to track progress towards the goals that they set for countries, pressure that will increase in the SDG era: "*We want data for all countries from the same year*". They too, then, need current and comparable statistics that can only really be produced by predictive estimates. The final assessment of the MDG results for the target year 2015 are largely based on predicted and projected statistics, all presented in a report mid 2015.

Many donors, funds and foundations, such as the Bill and Melinda Gates Foundation, GAVI, the Global Fund, and some bilateral donors, are interested in maximising the potential impact of their investments. They thus use data principally to compare different investment opportunities, to track progress towards their goals and specific results-based indicators, and to evaluate impact. They need data that are comparable, current, and that measure relative burdens of ill health. While country-reported data and

adjusted statistics are important, they lack an acceptable degree of quality, timeliness and comparability, resulting in reliance on estimates to classify countries, allocate resources and assess progress.

International development partners and donors are often focused on low income countries. Since national poverty often goes hand in hand with weak government, this often means the very countries with the poorest health information systems. Here, estimates generated from statistical models with very limited inputs of country data are often the only recent "data" available.

Like countries, international users recognise the advocacy value of comparative estimates, though not for the same purposes. At the international level, estimates are used to underpin high-level visibility for a particular health challenge. This can lead to potential conflicts of interest, for example, when estimates appear to show improvements in certain indicators, programme managers may fear of loss of attention for "their" priorities. Funding issues often fuel debate about the relevance of the estimation process.

The advocacy machine drives another global user, the media. Journalists specialised in health reporting are now vanishingly rare. More generalist reporters are unlikely to understand the nuances of estimation, or the differences between adjusted and predicted statistics. However they tend to favour numbers produced by international organisations over those produced by national governments, regarding them as more authoritative. They also want to make headlines with comparable data that is very recent. In general only an estimate can fulfil that need on a global and regional scale.

The needs of data producers

Different potential users clearly have different data needs. But the producers of health statistics also have varying needs; these, too, influence how information is produced and used. International organisations such as WHO have a mandate that goes beyond the simple compilation of country-reported statistics: they seek to add value through technical advice and direct technical support at the country level. This can lead to an emphasis on technical accuracy rather than on process. The pressure to participate in global estimation rounds may also carry an opportunity cost for countries whose specific data collection timetables or data needs don't fit the global mould.

Producers that are structured as academic institutions, such as the Institute for Health Metrics and Evaluation, dedicate time that could be used in country capacity building to writing publications for peer reviewed journals that may be little read by potential users in countries: *"Running the analysis and reporting the results is easy bit. Preparing for peer reviewed publication, that's really hard"*.

National-level producers recognise the political constraints on their own data collection and analysis efforts. Especially where different sources of data are available, there is strong pressure to interpret data in line with stated policy. If a prime minister has campaigned on increased access to ARVs, for example, health staff are more likely to present estimates showing HIV falling down the burden of disease league table than competing estimates showing it rising. *"If it is in the policy, it is hard to interpret against that."*

What happens when different sources disagree?

Given the diversity of needs, it is not necessarily a bad thing that different users choose different types of data. Problems do sometimes arise, however, when those different data types (taken from different sources, or compiled using different methods) yield significantly different results.

Countries relying on adjusted statistics very often arrive at indicators that are quite different from those produced by global bodies using predicted statistics. This happens most frequently in times of rapid change, either of data systems or of health outcomes themselves. Most predictive estimates are made using curve-fitting models, some of which give greater weight to past indicator values than more recent ones. Such methods are not well suited to dealing with disruption, in either direction. In countries or regions undergoing massive, rapid social change, people's lives (and their health) can change more quickly than models would predict. When the change is for the better, the problem may be compounded; health services (and thus health outcomes) may be improving more quickly than national data collection systems so the base data, as well as the models, may not reflect the true magnitude of the change.

Countries with relatively strong health information systems often pick up empirical changes in key indicators before models do, both when health improves (Iran, UR Tanzania, Turkey) and when it deteriorates (South Africa). And yet the press, civil society, and funders (including, sometimes, national governments) may continue to regard predictive estimates based on models produced by international organisations as the more "true" (Brazil). This is immensely frustrating for public health officials in countries with relatively strong data systems, whose own adjustment techniques are often better grounded in local contexts than the universal assumptions used in global models: *"You can say it's about unadjusted versus corrected versus imputed statistics, but at the end of the day it's about country versus WHO estimates, and countries are very sensitive to that, politically"*.

Technical experts may modulate the problem of divergent estimates, arguing that the scientific method will inevitably come up with different results, especially when the underlying data are imperfect. The divergences may make consensus on public policy harder to achieve but is not a reason to stifle legitimate scientific debate. This may be an acceptable viewpoint from an international perspective but is rarely convincing at national level. There is, however, broad agreement that the most effective way of tackling the problem is for investment in country information systems to generate more reliable and regular empirical data. In addition, the production of estimates should go hand in hand with the development of tools and methods that build capacity in countries for data generation, analysis and interpretation.¹²

Like international rankings, dissonant health statistics can cut both ways. To some, they are immensely demoralising, undermining the ability or will to invest in programmes whose success is not recognised (Iran) and even encouraging treatment practices that endanger patients (Guinea Bissau). In other cases they have led to national debate and greater national investment in data collection and analysis (Thailand, Turkey). A key lesson that has emerged from such debate is the value of establishing an independent national body to provide objective analytical technical review of country reported data and to provide a critical evaluation of the strengths and limitations of estimates derived from global statistical models (South Africa, Thailand).

¹² AbouZahr C (2010). Making sense of maternal mortality estimates. Working Paper No. 11. University of Queensland School of Population Health, Health Information Systems Knowledge Hub, Brisbane, Australia. Retrieved 22 August 2012 from: <http://www.uq.edu.au/hishub/all-publications>

Balancing technical soundness and robust processes

Country engagement in estimation processes

The issue of conflicting statistics was at the centre of the second recurring theme of the meeting: the need for robust processes. Overwhelmingly, countries feel excluded from or marginalised in the process of producing global estimates. This rankles even with those who claim to make almost no use of the global estimates. It cannot be divorced from the different needs of different data producers and users.

On the one hand, funders put WHO and other producers of international predictive estimates under extraordinary pressure to produce timely, standardised estimates for all countries. On the other hand, countries should be able to expect consultation and accommodation to their timetables and processes: *"There's a tension between inclusiveness and productivity. It's easy to say that we need to have a great process, but we still have to get numbers out, to meet deadlines, to resist political pressure to fudge the numbers."*

Currently, the UN agencies, including WHO, as well as IHME appear to respond more to the global pressure for productivity than to the country demand for inclusiveness and fair consultation. This is in part for professional reasons: people hired to provide technical advice quite properly tend to prioritise the technical robustness of the estimates they produce. Technically sound estimates made with limited country input probably go a very long way to meet the needs of one of WHO's constituencies: the international funders of global health programmes. The productivity bias, however, can make the estimates less "productive", and even counterproductive, at the national level.

Turkey provided an example. A change in methods led the Inter-agency Group for Child Mortality Estimation to produce an estimate for infant mortality in Turkey for 2013 that was significantly higher than that published in 2012. The new methods produced a whole new curve, as they generally do, showing a smaller decline than estimated a year earlier. While comparing the results of two rounds of estimates is not correct practice (one needs to look at the new time series only), it still led to considerable confusion and political concerns, especially when the press picked it up. The standard country consultation should have dealt with these issues, but it was unfortunately only raised after the damage had been done

Failing to think about the contexts in which statistics or estimates will be understood and used, particularly in the context of political goals such as MDGs, undermines the trust upon which honest exchanges about data quality rest: *"We're using an academic process to produce highly political numbers, and then we are expecting people to respond academically. That's just not going to happen."*

On the other hand, technical experts may have a legitimate rationale for producing estimates that differ from country reporting. The political contexts within which indicators are measured and reported can exert powerful pressures on data producers. In countries with weak health information and statistical systems, there is often insufficient technical expertise to undertake a critical and independent review of data quality. This raises the issue of WHO's and other international agencies' mandate and obligation for capacity building. Problems may arise in relation to both the numerator data – for example, numbers of deaths occurring in infants below the age of 12 months – and the denominator data needed to calculate the infant mortality rate – total live births. The latter can be particularly problematic in settings where the registration of births and deaths is less than complete. In such circumstances, the measurement of infant mortality through household surveys helps to provide a comparator against which to assess the findings from routine health facility or administrative reports. But estimates from household surveys are

subject to margins of uncertainty due to survey design (which can be quantified) as well as issues of respondent recall (which cannot be quantified). The challenges of coming up with a single value for a given indicator are particularly acute when the events in question are relatively rare, as is the case, for example, for maternal mortality and, increasingly for infant/child mortality, as well.

The WHO and many of its partners engage countries in a consultation process in order to introduce new global estimates and explain the reasons for discrepancies with country reported values. The consultation is specifically not intended to have a clearance function, unlike for estimates produced by UNAIDS, in order to focus on technical issues and avoid coming under political pressure. There is a genuine attempt to integrate new data provided by countries if they appear robust. But WHO technical staff are overstretched, and contacts with countries (and inside national bureaucracies) are not always smooth: *"If you give countries only three weeks to respond and they don't respond, it might not mean that they have nothing to say... It probably means that email didn't get off the desk it landed on or they are still trying to translate this into their national language."*

There are other limitations, too. Expertise is sometimes outside of government systems; the WHO cannot easily pull in other partners from other sectors and from academia without counterpart agreement. In addition, countries often have fragmented data systems, with vital registration answering to the statistics bureau but surveillance data coming from health, for example: *"However badly we want to consult, it's not always easy to know who we should be consulting with"*.

Overall, however, meeting participants felt that the current consultation process over-emphasises the technical soundness of the international estimates at the expense of the interactions and relationships that would make the numbers more socially and politically robust, and thus more acceptable and useful to those countries that cannot meet all their data needs from national sources: *"We need to think less about producing the perfect estimate and more about producing good process"*.

Although highly time and resource intensive, inclusive processes are likely to lead to better international estimates, especially in countries that have relatively strong data systems. Failure to consult South African experts, for example, meant estimates made at the international level by IHME predicted fewer deaths even than those captured by the country's incomplete vital registration system, while the distribution of death was skewed by a failure to understand the nature of national death certificates.

Examples of strong processes that successfully combine technical soundness with a satisfactory process and country ownership do exist, for instance in HIV estimation. A series of regional workshops has over time developed national capacity to draft estimates in most countries; these are refined in an iterative process together with technical specialists from UNAIDS. The process has taken many years and many millions of dollars to develop; it has unquestionably led to better data at national and sub-national levels, as well as much better use of data by countries. Though the process has had important benefits nationally, it was made possible because HIV was overwhelmingly prioritised by international funders for close to two decades, and there was high level policy support for efforts to improve the availability and quality of country based data. Similar efforts in the field of estimation of child mortality and maternal mortality are ongoing but with considerably fewer resources than HIV, which means that not enough people and countries can be reached on a recurrent basis.

How accurate is accurate enough?

The level of international priority also tends to influence considerations about how technically robust an estimate needs to be. There is no single answer to the question: how accurate is accurate enough? At

international level, there is widespread acknowledgement that both empirically collected data and statistical estimates are subject to margins of uncertainty which may be relatively narrow or very wide depending on the data sources and the model design and assumptions. Thus, international estimators invest time and energy in developing methods to provide margins of error for their statistics, though there is still lots of methodological work to be done. This is a technically correct approach because all measurement is to some extent imprecise. Nonetheless, it is routinely ignored by the media and country policy makers who feel compelled to come up with a single figure. *"I can't say in parliament or to the media that [an indicator] could be 40 or could be 100. It implies we don't know. It's just not possible. We pick a number and that's it. We're certain"*. And again: *"What the ministry needs to know is not maternal mortality could be between 50 and 600, but is it going up or down?"* In fact, this is a catch 22 situation as trends will also be highly unreliable in such a situation which can only be solved by better data.

Increasingly sophisticated statistical methods and computational power are now put to work in the hope of increasing the accuracy of health estimates. On occasion, this spurs countries to collect more and better data to feed into the models. Some country decision-makers have used model-based estimates to inform priority-setting, especially when currently available data on a specific topic is sparse (Chile). In other instances, estimation is perceived as disempowering. *"The complexity and impenetrability of the modelling process makes it hard to engage with."* When marginal gains in accuracy take the estimation process out of national hands, the result is unlikely to be significant gains in the planning and monitoring of health programmes. *"There's a belief that with lots of computerisation you get good data. That's really dangerous"* (Chile).

Finally, there was some concern that sophisticated methods creates an illusion of quality which can be misleading, and which can reinforce underinvestment in essential data collection. An example is the mapping of malaria data. *"The maps seduce you, they are a good approximation at a continental, maybe even a national level, but they are useless at the local level. You can't substitute for surveillance on the ground"*.

What investments are needed?

There was consensus among participants that estimates have been of considerable value in generating an overview of the health situation and emerging trends and for reporting on country and global progress towards international goals and targets such as the MDGs. However, the growing sophistication of statistical estimation methods risks that they can be understood only by a technical audience and challenging to explain to policy-makers and planners. The availability of an elaborate modelling strategy does not obviate the need for more reliable, accurate and regular empirical data generated through country statistical and health information systems.

Since 2005, there has been an increase in interest on the part of the international development community to invest more in strengthening country health information and statistical systems.^{13 14 15 16 17} The World Health Assembly and many of the WHO regional committees have issued resolutions and developed strategies to support for health information systems. However, despite good intentions, many of these initiatives have been short-lived and sustained support to countries has

¹³ Laliberté L. Statistical Capacity Building Indicators Final Report. PARIS21 Task Team on Statistical Capacity Building Indicators; 2002

¹⁴ Paris 21 (2004) A guide to designing a national strategy for the development of statistics (NSDS), Paris 2004

¹⁵ Health Metrics Network & WHO (2008). Framework and Standards for Country Health Information Systems (2nd ed.). Geneva, World Health Organization. ISBN 978 92 4 159594 0.

¹⁶ Health Information Systems Knowledge Hub, University of Queensland, Brisbane, Australia <http://www.uq.edu.au/hishub/>

¹⁷ USAID. Health Systems 20/20. Available online at: <http://www.healthsystems2020.org/>

remained limited. In 2015, countries and development partners came together at a global summit to construct a common agenda to improve and sustain country measurement and accountability systems for health results in the post-2015 era. The *Roadmap for Health Measurement and Accountability*¹⁸ describes how low- and middle-income countries can harness the information they need to plan, manage, and account for the results of their health policies, to respond to inequities in health, and to measure progress in achieving subnational, national and global health goals. It also shows how the international development community can best support these actions.

It is increasingly apparent that greater and sustained investment in country health information systems will be needed to enable adequate monitoring of the goals and targets of the SDG era and support government commitments to enhancing the health of their peoples. But with the needs of national governments, international organisations and major funders diverging so greatly, it is not easy to pinpoint which investments would best meet the generalised needs for better health statistics. A few things, however, are quite clear:

- More granular (sub-national) data are needed for planning and monitoring health interventions. These tend to be raw data, often drawn from administrative sources and health facilities, and with target population projections they can be turned into rates or ratios.
- Sub-national data can be aggregated nationally into adjusted statistics if quality assurance procedures are in place at each level. Data cannot flow in the opposite direction.
- National adjusted statistics can be modified for comparability to meet international reporting needs.
- Improved feedback is essential between data producers and data users at all levels.
- Mechanisms to ensure data quality review and quality assurance need to be in place with a mandate that ensure objectivity and independence.
- It is essential to develop country capacities for critical data analysis and interpretation as well as estimation processes.

The better the lower-level data are, the better the international level estimates will be (and the less they will be needed by countries): *"When you have good data coming up from the district level, why do we really need global estimates?"* Countries that have developed relatively strong systems have done so by investing first in data collection, then in national adjustment techniques, and only later in more sophisticated model-based estimates (Brazil, Chile, Mexico, Ghana). *"The bottom line is that we should be investing in robust country health information systems that can feed in to better global estimates."*

Broadly speaking, there has recently been some increase in investment in data collection (some of it fragmented or parallel to other national systems) as well as in predictive statistics. Despite guidance from international organisations, there has been very limited investment in institutional capacity strengthening in countries: *"WHO has lots of guidance in how to improve systems in Geneva, but it's not being implemented in countries"*. There has been almost no support for the quality assurance, data adjustment and data reconciliation techniques that are the bread and butter of national health statistics, and very little for locally-relevant analysis skills: *"This kind of investment is chronically lacking"*.

The reason for this is clear: funders want comparable data, and they want it now. They need it most for countries where regular data systems are most chaotic. And in truth, the value of systems-building in countries with unstable or dysfunctional governments is probably limited: *"Some countries in our region are still reporting as though everything was going well, even though you know the government can't even go to some areas."* This raises again the tension between accuracy and local ownership. *"What happens when your counterpart in country is giving you bad data? Is it better to replace it with estimates?"*

¹⁸ USAID, World Bank Group, WHO (2015) Roadmap for Health Measurement and Accountability (2015) <http://ma4health.hsaccess.org>

Country participants also noted that disease-specific programmes and funders demand data with great frequency, often for advocacy purposes. A reduction in the frequency of global estimates might free up resources for investment in national systems.

The need for a coherent and unifying conceptualisation of the health information system has emerged in response to the perceived dysfunctionality and inefficiency of separate and duplicative information systems. These are often driven by the demands of disease-focused programmes, donor reporting requirements and international monitoring and evaluation initiatives focused on specific health topics. However, there is an emerging consensus, exemplified in the *Roadmap* around the insight that the activities of a health information system cannot be limited to particular diseases or confined within specific kinds of data collection.

Some participants, while acknowledging the progress in the conceptualization of country health information systems in recent years, nonetheless expressed concern that the regular availability of new series of international estimates could act as a disincentive to countries to strengthen their own data systems. However, others reported that discrepancies with international estimates led them to strengthen their national efforts (Brazil, Thailand, Turkey, Iran).

The disincentive to invest is marked at the level of the large funders of global health whose time horizons and reporting requirements do not favour the systemic investments needed by countries. At the same time, it is important to acknowledge that strengthening country systems and capacities requires high-level policy commitment and investment of country resources. Countries cannot expect development partners to shoulder all the costs of country health information system strengthening.

The reluctance to invest in local skills and systems (and the opportunity cost of large investments in estimates which substitute for better empirical data that would be more useful for countries) has a trickle-up effect: *"Once data collection systems are working well, technical support tends to evaporate. But we don't necessarily have the analytic capacity we need to criticise our own procedures, to keep improving."* And no matter how much is invested in methods and processing power, without decent input data, all models will produce dubious results.

Improving data communication and use

Participants in the meeting from both countries and WHO regional offices stressed the need for more investment and skills building around the estimation processes and communication of data and its use. These discussions subsumed two quite different concerns. The first, broadly defined as "communication", revolved largely around a lack of communication between producers of international estimates and the supposed consumers of those estimates. In other words, it was a rephrasing of the earlier calls for a more inclusive, communicative process. *"Increasing communication is not enough. You need to build a process of trust, to think about how the information will be accepted, how it fits into other people's world view."*

The second concern focused on helping governments at the national and sub-national level to analyse their data and contextualise it in ways that are actionable. For countries with the weakest local capacities, this may mean producing simple national briefing papers explaining and interpreting the internationally-made estimates for that country. For those with more capacity, it might mean mentoring around the development of sub-national health plans based on the results of new health surveys.

While sub-national estimates of the burden of disease made at the national level can prove useful for provinces or districts, they will rarely be produced at those levels. Several participants stressed the need for relatively simple tools for use by provincial and district level health planners.

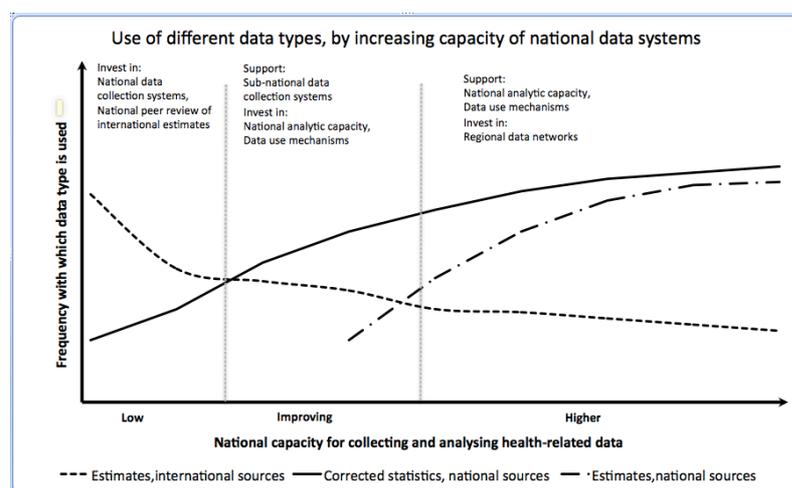
A phased approach to strengthening country health statistics

One clear conclusion of the discussions was that appropriate investments will differ according to a country's existing level of capacity. In countries with **very poor national data systems**, many decisions about health policy are data-free, others are made with reference to estimates made at the global level. Support to these countries should focus on improving the ability to interpret and use whatever data are available and on strengthening national data collection systems.

As a **nation's data system improves**, internationally-made estimates become relatively less important. Here, investment should focus on improving data adjustment and correction techniques and developing analytic capacity.

Once a **national system is robust**, countries generate most of their own data needs, and make a significant contribution to international data needs also. At this stage, international supporters can help countries use more sophisticated analytic techniques that reveal sub-national differences and pay greater attention to the social dimensions of health and measures of service quality.

This progression is shown schematically below:



The possible contribution of different international actors to this sort of phased approach was discussed, based on a proposal from Thailand. The WHO is mandated to provide technical guidance on health statistics for all countries. That mandate comes with a responsibility, too, to develop robust processes that help countries to develop their own capacities. The organization is thus well positioned to help countries in the first and second phases of system development. In recent years discrepancies in statistics produced at the national and international levels have been most pronounced in countries undergoing very rapid social and economic transitions. The meeting recommended that the WHO should provide extra support to these countries, concentrating especially on developing robust and inclusive processes that lead to consensus around data quality.

Because of the differing needs of countries and international users of health statistics, however, more advanced countries are also well placed to provide advice and guidance to those who are at an earlier phase. Countries with strong national capacities can help those with low-level and improving systems to develop robust correction and adjustment factors for their reported statistics, for example.

The more academically-oriented producers of estimates are well-placed to help countries with higher capacities develop their own national skills for more complex analysis of existing health data.

Recommendations for good practices in health estimation

Based on the inputs to the meeting and discussions, a number of good practice recommendations emerged, with relevance to data users and producers in countries, donors, international agencies and academia:

Good practices in countries

- Country policy-makers invest in health information and statistical systems in order to improve the efficiency of data collection, metadata preparation, storage, access, management and dissemination of health data.
- Standards are defined to improve data management, permit quality control, improve interoperability and data exchange between programmes and with country-level and international databases.
- A mechanism to be established, or an existing one strengthened, in order to promote objective data quality assessment and analytical review.
- Capacity-development activities are conducted, in collaboration with countries academic institutions and technical experts, in order to develop analytical skills to analyze and, where necessary, adjust reported data to correct for known biases. Skills are enhanced to critically assess and evaluate the relevance and utility of indicator estimates produced by external agencies.

Good practices for producers of estimates

- Producers of estimates invest more heavily in processes that yield estimates that are technically sound but also developed by way of participatory, inclusive and transparent processes..
- The *GATHER* principles are applied in the preparation and dissemination of estimates. Sufficient detail beyond what is available in routine academic literature is provided to show what methods and assumptions have been applied to adjust data.
- Mechanisms for more effective country involvement in the estimation process and consultation around estimates are set up that both take account of country inputs while at the same time maintaining standards with regard to data quality and methods for adjusting available data a necessary when available empirical data are incomplete or biased.
- Concerted efforts are made to convey to policy makers and users of statistics, the sources of uncertainty in statistical estimates and how they could be minimized in order to provide a more solid foundation for decision-making.
- Investments are made in capacity development in countries in order to enhance the understanding, critical review and contextualization of global estimates.

Good practices for publishers of health-related statistics

- All published statistics are accompanied by clear differentiation between raw numbers, unadjusted

data, corrected and predicted statistics or estimates.

- The UN agencies including WHO, are transparent about data gaps and weaknesses and provide information on the sources, methods and degree of uncertainty associated with individual data points.
- Where imputations are made to fill data gaps or methods for statistical fitting are used, such imputations and adjustments are clearly documented in a footnote or annex, as well as providing the values of the raw data or unadjusted indicator. Alternatively, it may be necessary to omit the reported values until the data quality can be improved.

Good practices for development partners, donors, funds and foundations

- Resources allocated to agencies, academics and researchers for the production of statistical estimates are matched by funding directed towards a phased approach for building national capacities for producing, analyzing and using health statistics.
- The varying needs of different users and uses of data are taken into account in the planning and issuance of estimates.
- Resources are directed to support for inter-sectoral and cross-country learning, especially around statistical adjustments and data use.

Next steps

Meeting participants recommended that the WHO take active measures to incorporate the perspectives of different data users in developing and disseminating estimates of health indicators. WHO should proactively engage in capacity development for countries to enhance capacities to produce and use locally-relevant health statistics, using a phased approach. The Organization should also encourage and support cross-country learning, especially around statistical adjustments and data use.

Specific priorities for next steps suggested by participants included the following:

Country consultation

- The consultation process should be strengthened, paying more attention to inclusivity and participation, involving a broader range of country focal points, and allowing for multiple opportunities to actively review individual country estimates.
- More attention needs to be given to countries in transition, many of which are working to rapidly strengthen data sources to meet the demand for monitoring.
- In addition, WHO should invest more in facilitation of bridging from evidence to policy, for example as initiated by the EVIPNET network.

Capacity strengthening

- Participants agreed that the model for the development of estimates used by UNAIDS and partners was a good one but that it would be resource intensive and implied the availability of considerable skills and resources in WHO at global, regional and country levels.
- WHO should seek to mobilize collaboration among partners to develop training materials and tools for data review and statistical analysis. This should involve WHO, but also IHME and other agencies and academic partners. The methods of data adjustment were identified as a particular area requiring capacity development to improve understanding.

Communication and dissemination

- WHO should present both country reported statistics with WHO estimates in its reporting.
- WHO should produce both technical reports and short reports designed for non technical readers in countries explaining how the estimates were developed and the main differences for discrepancies with country reported values.
- WHO and partners should produce policy briefs targeting senior decision makers explain the findings and policy implications of estimates.

Publication

- A special publication of a scientific journal will be useful to disseminate the evidence of what works and what does not work and why. This publication will include a few cross cutting technical papers and a range of country case studies.

WHO HQ and Regional Offices agreed to meet later in 2015 to discuss such processes more concretely; the WHO Regional Offices for Europe offered to host the event in the Region.

Annex 1: Agenda

Day 1: 24 June 2015

Time	Topic		Moderator
9:00	Session 1 – Setting the scene		Ties Boerma
	Welcome and introductions		
	Context & meeting objectives	Ties Boerma	
	General issues	Carla Abouzahr	
09:50	Session 2 – Country case studies on production, use and communicating of estimates		Carla Abouzahr
	Brazil	Fatima Marinho	
	Thailand	Kanitta Bundhamcharoen	
<i>10:30</i>	<i>Coffee / tea break</i>		
11:00	South Africa	Debbie Bradshaw	
	Iran	Ardesh Khosravi	
	Ghana	Frank Nyonator	
	Discussion		
<i>12:30</i>	<i>Lunch break</i>		
14:00	Session 3 – Global and regional perspectives		Don de Savigny
	WHO – global	Colin Mathers	
	IHME	Ali Mokdad	
	Regional perspectives (max. 10 minutes)	Arash Rashidian	
	EMRO	Mohamed Ali	
	EURO	Claudia Stein	
	AFRO	Derege Kebede	
	Discussion		
<i>15:30</i>	<i>Coffee / tea break</i>		
16:00	Session 4 – Country case studies: continued		Elizabeth Pisani
	Mexico	Hector Gomez	
	Turkey	Berrak Basara	
	Multiple country experiences	Maarten Kok	
	Discussion		
<i>19:00</i>	<i>Reception at hotel bar</i>		

Day 2, 25 June 2015

Time	Topic		Moderator
09:00	Session 5 – Country case studies: continued		Colin Mathers
	Chile	Ximena Aguilera	
	Indonesia	Soewarto Kosen	
	HIV case study: South Africa	Rob Dorrington	
	HIV case study: global	Mary Mahy	
	Discussion		
<i>10:45</i>	<i>Coffee / tea break</i>		
11:15	Session 6 - Global and regional perspectives		Mohamed Ali
	Family planning estimates	Ann Biddlecom	
	Program specific case studies on use of estimates: malaria example	Richard Cibulskis	
	Causes of death	Bob Black	
	Discussion		
<i>12:30</i>	<i>Lunch break</i>		
14:00	Session 6 – Outline of best practice principles		Ties Boerma
	GATHER	Gretchen Stevens	
	Insights from the presentations & discussions	Elizabeth Pisani Carla Abouzahr	
<i>15:30</i>	<i>Coffee / tea break</i>		
	Discussion & way forward		
17:00	END		

Annex 2: List of participants

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