

## Health Statistics 1

# Health statistics now: are we making the right investments?

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Increases in international funding for health have been accompanied by accelerating demand for more and better statistics, which are needed to track performance and ensure accountability. Worldwide interest in the monitoring of development, as exemplified in the Millennium Development Goals (MDGs), generates pressure for high-quality and timely data for reporting on country progress. This rapid escalation of demand has exposed major gaps in the supply of health statistics for developing countries but also provides major opportunities to increase the supply and use of sound health statistics. First, the emphasis on monitoring and evaluation is leading to proliferation of indicators and excessive reporting requirements, and needs to be refocused on systematic investments in data generation and analysis. Second, the risk of inadequate or poorly targeted investments can be kept to a minimum by understanding the causes of poor availability of health statistics, including lack of accurate measurement instruments, application of suboptimum methods of data collection, and inadequate use of methods and analyses to produce comparable estimates. Third, the preoccupation with MDGs does not take into account the rapid health transition, which implies that health statistics should systematically include a much wider array of health issues from acute infectious diseases to chronic non-communicable diseases and injuries, disaggregated by socioeconomic position. Fourth, the growing number of national household surveys, which are the main source of most population health statistics, need to be streamlined into cohesive and comprehensive country health survey programmes. Now is the time to accelerate the production and use of accurate, complete, and timely health statistics for decision-making by investing in country health information systems that should be based on an efficient and effective mix of standardised methods of data collection and analysis that meet country and international needs.

The availability and quality of health statistics in developing countries are often not adequate to inform health policies and resource allocation at global, regional, and country levels.<sup>1,2</sup> Health systems need such information to respond adequately to the rapidly changing epidemiological context in which infectious diseases and non-communicable diseases now co-exist. National and subnational statistics are needed to effectively allocate resources based on health needs and system performance. Worldwide interests in the monitoring of development, as exemplified by the Millennium Development Goals (MDGs), generate pressure for high-quality and timely data for country progress. International agencies, such as WHO, UNICEF, and the World Bank, and public-private global health partnerships, such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, use health statistics to sustain worldwide political and financial support for their programmes and to build government commitment to solving health problems in developing countries.

The volume and quality of health statistics are on the rise. Household surveys are now implemented more frequently in most developing countries, and have become the main source of information on population health status, equity and risk factors, and service coverage, although there are concerns about the tendency towards single disease surveys. Less progress has been made in improving the supply of health data from other sources, such as civil registration systems, which can provide age-specific and sex-specific mortality by cause of death<sup>3</sup> or statistics about the health workforce.<sup>4</sup> Decision-making

for health in developing countries has been described as “stumbling around in the dark”, because of the weak evidence base.<sup>5</sup>

Increases in international funding for health are accompanied by greater demand for statistics to track performance and ensure accountability. This escalation in demand has exposed major gaps in the supply of health statistics in developing countries, and made clear that new investments and greater efficiency are urgently needed. At the country level, this demand brings increased risk of fragmentation and duplication of efforts, as well-funded disease-specific initiatives commit resources to meet their need to document progress. At the international level, the pressure to produce up-to-date and comparable statistics could risk leading to an upsurge in production of health statistics without systematic improvements in the country systems to produce and sustain reliable data.

In this paper, the first in a Series of four on health statistics, we describe the status of data sources for health statistics. We also identify key issues that need to be addressed to ensure any adverse effects of efforts to reduce the gap between supply and demand are kept to a minimum. The second paper in the Series further examines the supply-demand gap by taking a critical look at the monitoring of the MDG health indicators, and warns that predicted statistics should not be used for monitoring and assessment purposes.<sup>6</sup> The third paper describes the use and misuse of statistics to market health priorities, and provides guidance to consumers about the interpretation of health statistics.<sup>7</sup> The final

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This is the first in a [Series](#) of four articles about health statistics

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paper takes a closer look at the use of statistics to influence policies and resource allocation at national and worldwide levels, and summarises key issues for health statistics during the next decade.<sup>8</sup>

### Supply and demand

Basic health statistics can be classified into five main categories: mortality and causes of death, morbidity and health status, risk factors, service provision, and health resources. UN agencies such as WHO and UNICEF publish country mortality statistics every year, which are used to monitor progress towards the health MDGs. However, the availability of data from high mortality countries is poor, and reported figures are generally based on predictions rather than direct measures. The preferred data source for mortality is death registration with medically certified cause, but since 1990, 74% of 152 low-income and middle-income countries had no data, and another 16% were judged to have poor-quality data.<sup>3</sup> In 2005, child mortality rates for low-income countries were estimated from household survey data that on average referred to 1999.<sup>9</sup> The paucity of information on leading causes of child death is striking, with little improvement over recent years.<sup>10</sup> The availability of data for adult mortality is even more constrained.<sup>11</sup>

Accurate data for morbidity are not available for most diseases, including pneumonia, diarrhoeal diseases, malaria, diabetes, mental disorders, and many others. For selected diseases, special efforts are made to obtain complete and accurate data through clinic-based disease notification systems, but selection biases remain. HIV/AIDS prevalence data are reported regularly by more than 80% of 152 countries, but only 36% were deemed to

have a full HIV/AIDS surveillance system.<sup>12</sup> Data for health states are based on individuals' self-report of functionality (eg, mobility, vision, cognition), mostly obtained in household survey interviews,<sup>13</sup> but basic availability, especially for developing countries, and comparability of results between countries and over time are still major challenges.

The availability of data for key risk factors varies widely.<sup>14</sup> For example, 45% of low-income and middle-income countries had at least one data point on national prevalence of low weight-for-age in children for the year 2000 or later, and nearly half had data for tobacco use in adults since 2002. Availability of data for coverage of selected health interventions is better than for key risk factors, especially for maternal and child health. More than 90% of countries reported measles vaccination coverage on a yearly basis and 83% of countries had population data for skilled birth attendance for at least a year since 2000. However, there are issues with the quality of the reported data for coverage, especially where these are entirely based on health facility reports.<sup>15</sup>

Data for health resources, such as numbers of health workers by cadre, are often available (eg, 84% of countries reported data for the number of doctors at least once since 2000), but the quality is poor. The World Health Report 2006 emphasised the dearth of recent quality statistics on the health workforce in many developing countries, including the scarcity of data from the private sector.<sup>4</sup> Financial data are available for the public sector from most countries, but only about 60 countries have done more than one comprehensive national health account exercise. Few countries are able to accurately report on access to health facilities or essential drugs.

	Description	Strengths	Limitations	Trends
Surveys	National population-based surveys are based on a national sample of households and respondents Might include only interviews (health interview survey) or with biomarkers (health examination survey)	Information on the entire population and on a wide range of health issues Vehicle for biological and clinical data collection Data in the public domain with clear standards possible	Reporting biases for several health conditions Low prevalence conditions or rare events need excessive survey sample size High resource requirements to ensure high quality	More frequent household surveys More single-disease surveys Increasing use of biomarkers
Vital registration systems	Population-based systems that record livebirths, deaths, and causes of death based on civil registration system (national) or sample registration system (eg, India)	Yearly data for causes of death by age and sex, by small geographic area, when complete	Incompleteness and poor quality of cause of death recording If no medical certification, reliance on interviews with relatives to ascertain probable cause (verbal autopsy)	Use of local demographic surveillance with verbal autopsy in countries with no civil registration system
Population census	Primary source of information about the population, its geographical distribution, and the social, demographic, and economic characteristics of its people	Covers the whole population; small geographic units; equity information Data for mortality and fertility for small geographic areas	Long intervals between censuses (usually a decade) Only small number of health questions included	Continues on a 10-year basis with few health questions
Service records	Service-generated data derived from facilities and patient-provider interactions covering care offered, quality of care, treatments administered, and morbidity and mortality by cause	Used for service management Yearly data possible Basis for disease surveillance systems to detect outbreaks	Excludes those not reaching the services (selection bias) Incompleteness and data quality Private sector often not included	Use of information technology and focus on minimum set of indicators for local use Special efforts and sentinel clinics to obtain quality data for statistics
Administrative records	Information on financial resources, human resources, health infrastructure	Only source of regular complete data for health resources	Country databases incomplete and out-of-date; private sector not included	Increasing investments in system resources monitoring

Table 1: Description of key data sources

	Number of indicators	Comment	Source
HIV/AIDS	142	57 general indicators for national programmes and six monitoring and evaluation guides for specific components	UNAIDS. National AIDS programmes: a guide to monitoring and evaluation (2000)
Tuberculosis	57		WHO. Compendium of indicators for monitoring and evaluating national tuberculosis programs (2004)
Malaria	29		Roll Back Malaria. Framework for monitoring progress and evaluating outcomes and impact (2000)
Reproductive health	148	Includes short list of 17 indicators; another compilation gives 250 indicators	WHO. Monitoring reproductive health: selecting a short list of national and global indicators (1997)
Adolescent reproductive health programmes	292		FOCUS on Young Adults. A guide to monitoring and evaluating adolescent reproductive health programs (2000)
Child health	102		USAID/MEASURE Evaluation. A guide for monitoring and evaluating child health programs (2005)
Essential drugs	98	Focusing on input, process, output of programmes	WHO. Indicators for monitoring national drug policies (1999)
Decentralisation process	83	Range of suggested indications cover input, output, and outcomes	PHR plus and MEASURE Evaluation. Monitoring and evaluation of decentralization reforms in developing country health sectors (2004)

**Table 2: Number of indicators proposed for monitoring and evaluation of selected health and disease programmes**

The methods of data collection vary for different categories of statistics. Health data sources can be classified into those that generate population-based data (including household surveys, death registration, and census) and those that depend on clinical and administrative records. Table 1 summarises the features, strengths and limitations, and current trends. National household surveys, such as Demographic and Health Surveys (DHS), are the main data source for most health statistics. National surveys can be costly, and substantial investments have to be made to ensure data quality. Yet a comparative analysis of different sources of health data showed that household survey costs per capita are often lower than other health data sources.<sup>16</sup> The main limitations of surveys include the inability to disaggregate at local level and to provide information at short time intervals. Household surveys also can be misused to obtain information on topics for which there are no valid and reliable questions or tests.

The increase in demand provides a major opportunity to increase the supply of sound health statistics in developing countries. There is, however, the potential for several unintended adverse consequences, and this risk would need to be minimised. The risks include: the proliferation of indicators or indices for monitoring and evaluation and excessive reporting requirements; inadequate or poorly targeted investments to improve the availability and quality of health statistics; failure to take into account the continuing health transition because of preoccupation with the MDGs and specific infectious diseases; fragmented and duplicative investments in data collection in surveys; and poor convergence of international and country needs, an issue that will be discussed in the fourth paper in this Series.

### Refocusing monitoring and evaluation

Monitoring and evaluation has multiple dimensions, including monitoring of worldwide goals and initiatives, programme and project monitoring focused on processes and immediate outputs, and assessment of the effects of large programmes. The dimensions are overlapping and need an integrated approach at the country level.

The goal of the Health for All by the Year 2000 initiative was adopted by all WHO Member States at the 1977 World Health Assembly, and adoption of the goal was followed by the selection of 20 indicators by which to monitor progress, including 14 with targets for which there was restricted investment in data collection.<sup>17</sup> Monitoring of progress towards the MDGs for 2015 is based on 48 indicators, including 17 health indicators.<sup>18</sup> Intensive country reporting requirements are set by UN agencies. Worldwide initiatives rarely make the necessary systematic investments in data generation and often rely on poor data collection methods such as key informant surveys to monitor progress (eg, monitoring of the UNGASS goals on HIV/AIDS). An exception was UNICEF's World Summit for Children. 46 indicators were selected to monitor progress towards its goals during the 1990s and an international survey programme—Multiple Indicator Cluster Surveys—became operational in tens of countries in the middle of the decade and again at the end of the decade. Its successor, A World Fit for Children, expanded the set of indicators to a less manageable number (101), but the investment in a multicountry survey programme continues.

The proliferation of indicators in specific health and disease programme areas has been even more striking. Table 2 shows the large and growing numbers of indicators for selected areas that have been proposed by mostly UN agencies and US government-sponsored projects. For instance, monitoring and evaluation in

HIV/AIDS started off with ten priority prevention indicators in 1994, which grew into a list of 57 indicators for national programmes in 2000. Since then, at least six separate publications, each with a dozen indicators, have been published to guide monitoring and evaluation in specific components of HIV/AIDS programmes. The assumption is that indicators are useful for advocacy and help to improve programme management and accountability. But data availability and quality are a major constraint. Even if data are available, interpretation of rates, trends, and differentials of statistics for such large numbers of indicators is beyond the capacity of most programmes.

Evaluation of programme and health effects is chronically under-funded.<sup>19</sup> But despite the financial and technical constraints, there is an increasing demand for statistics to show how many lives have been saved or infections averted by specific interventions, to assess the associated costs, and to compare these measures in alternative interventions. The main obstacle to meeting these demands is the scarcity of accurate and up-to-date information.

The case of malaria provides an example of this measurement challenge. Almost all countries with endemic malaria have no death registration systems and must rely on household surveys to identify mortality rates. Furthermore, the identification of the probable cause (through an interview with the relatives of the deceased called a verbal autopsy) has low sensitivity and low specificity for malaria.<sup>20</sup> Calculation of the lives saved from this method will therefore have substantial uncertainty and trends will be difficult to detect. Attributing changes in malaria-specific death rates is further complicated by the difficulty of documenting the exposure to either population-based or individually targeted interventions to reduce disease. The challenge of documenting the effectiveness of programmes to control or treat HIV/AIDS and other diseases might be even more complex. For all of these disease-specific programmes and for strengthening of health systems, there is a need to strengthen and simplify measurement strategies and

methods, and to refrain from contributing to the proliferation of indicators and reporting requirements.

### Making the right kinds of investment

To efficiently address deficiencies in health statistics, the underlying causes need to be understood. The context will define whether investments are needed mainly to increase the volume of data, to develop a better mix of data sources, or to strengthen analysis and use of existing information. In addition to general underinvestment in health data collection, inadequate availability and quality of health statistics can have three underlying causes: poor measurement instruments, insufficient or suboptimum methods for data collection, and lack of analysis and methods to produce comparable estimates.

Measurement instruments include population and clinical registers, interview questions, and biological and clinical tests. All are imperfect to varying degrees. Some methods, such as HIV antibody tests to measure the prevalence of HIV infection and questions to female respondents about the place of delivery of the most recent child, have high reliability and validity. For many health outcomes, however, the so-called diagnostic test is not satisfactory. Questions on sexual behaviour to measure new partner acquisition rates<sup>21</sup> or self-reported morbidity data,<sup>13</sup> for example, yield information that is fraught with problems of validity and reliability, especially across cultures and locations. Even though an increasing number of biological and clinical tests can be used in surveys,<sup>22</sup> many major disorders and risk factors still do not have an appropriate test that can be used in surveys to establish population prevalence.

Investing in the right data source for key statistics is also essential. The preferred data source for mortality is death registration with medically certified cause. Where there is no death registration, household surveys and censuses can provide information on rates and trends of mortality. This method has been more successful for child mortality, through a birth history obtained from the mother, than for adult mortality. About a third of countries without registration systems have done a national survey with a full birth history during the past 5 years. Figure 1 shows that household surveys are the leading source for child mortality statistics in 57 low-income countries. But little progress has been made in the area of death registration systems, which would not only provide more frequent and detailed child mortality statistics, but also provide adult mortality statistics and causes of death.

The shortcomings of data generated by health facilities are well known, and they have been of little value for public-health planning and monitoring in resource-poor countries. Yet donors and countries have unsuccessfully invested in the development of such systems for decades. This limitation, however, does not mean that facility data are not useful. Investments in specific sentinel clinic sites can provide data that allow estimation of incidence or prevalence among whole populations by use of

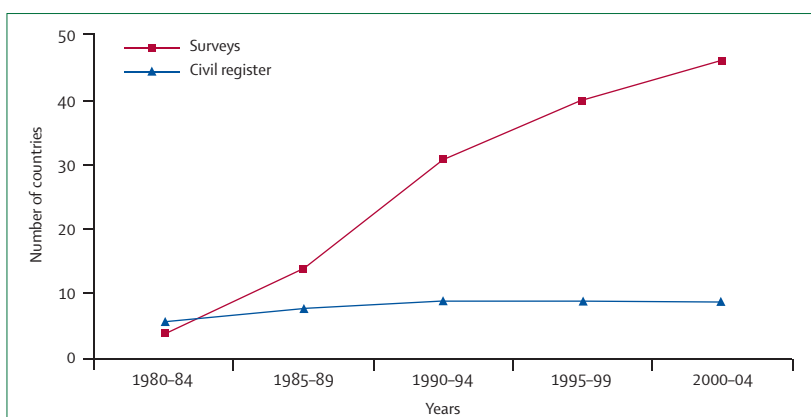


Figure 1: Mortality data collection and reporting by source in 57 low-income countries, 1980-2004

information from population-based sources to correct for biases. Although the absence of a clear denominator makes facility-based data less useful for public-health planning and management, these data can be used successfully to improve management and quality of care within individual institutions.

There is a general lack of investment in analysis of data, particularly at the country level. Substantial progress has been made in analytical methods during the past decade, allowing correction for known biases and prediction of statistics in time (when no data are available) and in space (when country data are incomplete or lacking). Distinction between the different types of analysis used to produce the statistics is crucial, and will be addressed in the second paper in this Series. Estimation methods for disease incidence, prevalence, and mortality are available for several diseases, although much work still needs to be done to improve methods and communicate results to different consumers, as discussed in the third paper in the Series.

Several health statistics can be obtained from multiple data sources, and reconciliation of data from different sources is needed to obtain the best estimate of rates and trends. Population-based surveys generally do not generate yearly data or provide information for small geographic areas. Health facility data, provided special investments are made to ascertain the quality and completeness of the data, can provide frequent data for small populations but are limited to clinic users. Population-based survey results need to be used to adjust rates and trends seen in health facilities. One example is the major adjustments made to the size of the AIDS epidemic in sub-Saharan Africa, after 19 national household surveys with HIV testing (panel).<sup>23–25</sup>

### Expanding beyond the MDGs

Developing countries are in the process of a rapid health transition, which includes demographic,<sup>26</sup> epidemiological,<sup>27,28</sup> nutritional,<sup>29</sup> and sociobehavioural risk transitions.<sup>30</sup> Although the original transition theories assume gradual one-directional changes, the actual picture is much more complex.<sup>31</sup> The starting point and pace of health changes varies between and within societies and counter transitions could take place, which has been referred to as epidemiological polarisation.<sup>32</sup> Such widening disparities might be transient in the long term but need to be monitored closely because there are immediate implications for health policymaking and programmes. Country health systems and the international public-health community often fail to respond adequately to the great heterogeneity caused by this complex health transition. Accurate and timely health statistics, disaggregated by relevant socioeconomic and demographic characteristics, are a main requirement for the development of an effective response.

Communicable and non-communicable diseases affect the poor and rich in unequal ways at different times

during the transition. Within countries, increasing inequality in health has been seen between the rich and the poor, whereas public health interventions and programmes might disproportionately reach the better off.<sup>33,34</sup> Globalisation could increase the prevalence of risk factors for non-communicable diseases, such as obesity

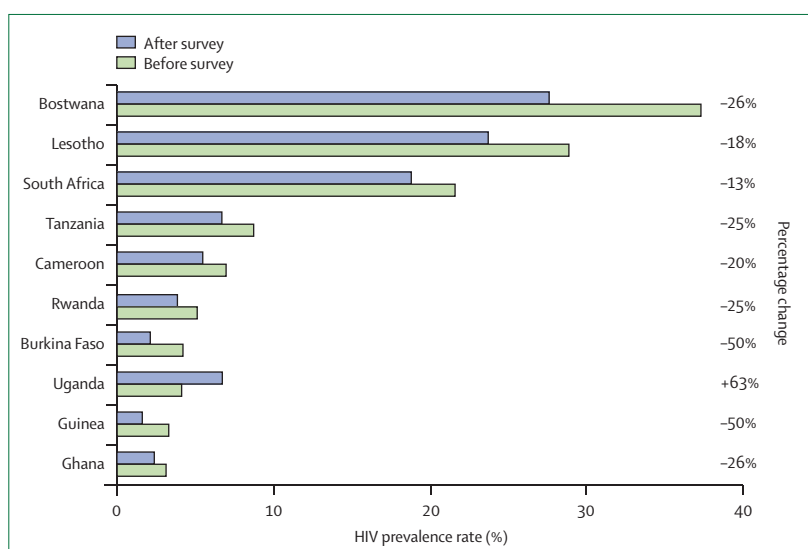
#### Panel: The effect of population-based data for HIV estimates

The joint UN Programme on HIV/AIDS (UNAIDS) and WHO provide updates every 2 years of estimated HIV prevalence by country. Estimates for previous years are also adjusted as better data become available. This analysis allows a comparison of the effect of the introduction of HIV testing in population-based surveys on national estimates.

Previous estimates for most countries in sub-Saharan Africa were solely based on data generated by surveillance systems that focus on pregnant women attending a selected number of sentinel antenatal clinics. UNAIDS and WHO, in collaboration with individual countries, use a six-step method to estimate HIV-1 prevalence in adults, and an increasing number of countries have adopted these methods to obtain national estimates.<sup>23</sup>

HIV testing was included in an increasing number of national Demographic and Health Surveys and other national health surveys after positive experiences in Mali and Zambia in 2001–02. Survey-based estimates, however, could have substantial uncertainty because of individuals' refusal to participate or their absence from the household.<sup>24</sup> In general, however, national population-based surveys represent a much wider proportion of the population than do antenatal clinics, since such surveys include men and non-pregnant women, and are done over a large geographical area.

Figure 2 compares the old (before the survey) and new (taking into account the survey) estimates for the year 2003, as published in the UNAIDS report on the worldwide AIDS epidemic.<sup>25</sup> Figure 2 shows that, after incorporating survey results in the estimation model, HIV prevalence in adults 15–49 years of age was on average a quarter lower than previous estimates based on only antenatal clinic data (ranging from 13–50%) in all countries except Uganda. Only in Uganda was the estimated HIV prevalence rate in 15–49-year-olds for 2003 higher after the survey (6.7%) than before the survey (4.1%). Overall, HIV prevalence in adults 15–49 years in sub-Saharan Africa for 2003 was adjusted downward from 7.5% to 6.2%.



**Figure 2: HIV prevalence rate in adults 15–49 years of age for 2003**  
UNAIDS/WHO estimates done before (2004) and after (2006) a household survey in selected countries in sub-Saharan Africa.

and tobacco-related illness, and might simultaneously either increase or decrease the risk factors for communicable diseases. Some risk factors for cardiovascular diseases happen at a much earlier stage of economic development and in much more complex socioepidemiological patterns than predicted from the transition theory.<sup>35</sup>

This complex transition is strikingly illustrated with an epidemiological snapshot of South Africa. A provincial health examination survey in 1998 showed that the mortality rate for children younger than 5 years was 80 per 1000 livebirths, with threefold differences between rural and urban areas. The prevalence of hypertension and obesity were 20% and 29%, respectively, in women older than 15 years.<sup>36</sup> The surveillance system reported HIV prevalence in pregnant women to be about 20%, with large differences by socioeconomic and demographic characteristics. According to the death registration system, HIV/AIDS was the leading cause of premature mortality burden (28% of all years of life lost), whereas homicide and violence ranked joint fourth and road traffic accidents ranked sixth.<sup>37</sup>

The health transition implies that health statistics should go beyond the infectious disease and nutrition focus of the MDGs,<sup>18</sup> and include chronic non-communicable diseases and injuries and their associated risk factors. Disaggregation of health statistics by socioeconomic and demographic characteristics is essential to be able to address inequities, which implies that population-based data are needed. Furthermore, summary measures of health, such as disability-adjusted life years (DALYs), that combine information on mortality and non-fatal outcomes, need to be used to guide resource allocation based on the burden of disease. Comprehensive epidemiological information on population health and on the relative costs and health benefits of different interventions are needed.

### Streamlining surveys

Currently, most additional investments in health data collection are directed towards population-based surveys, since surveys are usually externally funded and produce quick and comparable results. Household surveys are the preferred source of many health statistics on population health outcomes, risk factors, and service use, and allow disaggregation of the results by socioeconomic position, sex, and other key equity variables.

The predominance of disease-specific initiatives is affecting data collection in developing countries. Single-disease surveys, such as for AIDS, malaria, or tuberculosis, are becoming more common, often accompanied by biological and clinical data collection. This situation will undoubtedly lead to increased data availability for the disease of interest, but misses an opportunity to obtain information on a broader range of health issues at little marginal cost.

In theory, one survey could include all priority health topics for which data are needed for decision making, from acute infectious to chronic non-communicable diseases. Limiting factors, however, are the complexity of the survey (training, logistics, analysis), the length of the interview, and funding challenges.

The advantages of an integrated approach are most compelling for biological and clinical data collection in health examination surveys. Technological advances have made the inclusion of biomarkers in population-based surveys in developed and developing countries possible.<sup>22</sup> The array of possible and relevant biomarkers is rapidly expanding, and most tests can be done simply with a finger stick and blood spotted filter paper. Currently, experience with biological and clinical markers in surveys includes a range of diseases and conditions, such as infectious diseases (eg, HIV, sexually transmitted diseases, vaccine-preventable diseases, malaria), nutritional disorders (eg, a range of micronutrient deficiencies, undernutrition, obesity), external causes (eg, functional disabilities), intoxication and environmental exposure (eg, lead, tobacco), non-communicable diseases (eg, diabetes, hypertension, hyperlipidaemia), and even genetic markers.<sup>38</sup>

To streamline survey planning and implementation, a national 10-year survey plan that addresses all health priorities needs to be established. Such a plan should assess national health surveys at regular 2-year intervals with variable survey contents and also incorporate economic surveys, to which a few health questions or a module could be added. International survey programmes, such as Demographic and Health Surveys, UNICEF Multiple Indicator Cluster Surveys, and World Health Survey, as well as donors and disease programmes should buy into such a national health survey programme. The contents of each round of the survey should be established by country and international data needs, and by considerations of expected changes and ability to detect significant differences between survey results. For instance, data for immunisation coverage can change more rapidly than mortality rates and need to be obtained more frequently. A suite of survey modules that meet international standards and only include valid interview questions and biological tests should form the basis of the survey contents. The set of modules would include the whole array of priority health issues, non-communicable and communicable diseases, acute and chronic conditions, and children, adults, and the older population. Table 3 presents a core list of modules with a proposed frequency of application.

### Conclusion

Health statistics is a complex topic with multiple categories, data sources, measurement techniques and analytical methods, and a wide array of users. The demand for health statistics has increased, especially in the context of worldwide health initiatives. The supply situation has improved only partly during the past

	Method	Frequency†	Indicators	Comment
<b>Mortality</b>				
Child mortality	Birth history	5	Child mortality rates	Death registration preferred source if complete
Adult mortality	Sibling survival; recent deaths	5	Adult mortality rates	Death registration preferred source if complete
Causes of death	Verbal autopsy	5	Main cause distribution	Death registration with medical certification preferred source
<b>Morbidity and health states</b>				
Health states (adults)	Self-reported health for specific domains	5	Summary and specific measures for domains	No other sources
Chronic disease	Algorithm; recall diagnosis; biological test	3–5*	Prevalence of chronic conditions	Recall data often result in poor validity; clinical reports and disease surveillance are complementary sources
Acute disease (mostly children)	Recall symptoms in the previous 2 weeks	3–5*	Incidence of frequent conditions	As for chronic diseases
<b>Service coverage</b>				
Maternal and child health preventive interventions	Health card review; recall	2	Coverage immunisation; maternity care, etc	Clinical reports are complementary source
Maternal and child health treatment interventions	Facility use for recent disorders	2	Rates of treatment use by those in need	Clinical reports are complementary source
Chronic conditions	Recall treatment use	3–5*	Rates of treatment use by those in need	Clinical reports are complementary source
<b>Risk factors</b>				
Risk factors (child)	Proxy reporting and biomarkers	3–5	Water and sanitation; nutritional status and feeding patterns	No other data source
Risk factors (adult)	Self-reporting and biomarkers	3–5*	Nutritional status; indoor air pollution; smoking, alcohol, etc; sexual behaviour	No other data source
<b>Health resources</b>				
Health expenditure	Self-reported health expenditure and economic status	5	Catastrophic health expenditure and impoverishment; out-of-pocket payment; insurance	No other data source
Responsiveness of the health system	Self-reported perception of interaction with health services	5	Summary and specific measures for domains	Health facility client exit surveys are complementary source

\*Depending on the expected rate of change. †Interval in years.

Table 3: Survey modules for key health statistics with proposed frequency of application and additional data sources

decades and is still weak. Efforts to reduce the demand-supply gap are preoccupied with the importance of monitoring and evaluation, more investment in data collection, and regular production of health statistics at the international level. This paper has identified four areas that need special attention.

First, the emphasis on monitoring and evaluation of the scale-up of health programmes has disproportionately focused on the creation of large numbers of indicators and reporting requirements, which has led to fragmentation and duplication of data collection and poor quality of statistics. There is a need to refocus monitoring and assessment on the investments in data collection and analysis, and aim for the development of a coherent system of data collection, analysis, and use.

Second, to make the most efficient and effective investments, the different causes of the demand-supply gap need to be taken into account. The paucity of cause-specific mortality data is not overcome by more household surveys, but needs investment in demographic surveillance and civil registration systems. The poor quality of coverage statistics based on health facility reports can be addressed by investments in facility reporting systems, but also needs more frequent population-based surveys and

improved country capacity to analyse data from both sources to monitor rates and trends. The scarcity of reliable and valid questions to obtain certain risk factor data cannot be overcome by including more questions in surveys, but needs methodological work including validation studies. The absence of a biological or clinical test to diagnose a disease in household surveys and assess disease prevalence or incidence cannot be overcome by more data collection, but needs investments in basic research to develop appropriate tests.

Third, the MDGs and related worldwide health initiatives are driving the efforts to close the demand-supply gap in health statistics, focusing on the unfinished agenda of infectious diseases and perinatal and nutritional disorders. There is, however, increasing evidence that developing countries are rapidly transiting into a situation in which the unfinished agenda co-exists with chronic non-communicable diseases and affects the poor disproportionately. Health statistics are urgently needed on non-fatal health outcomes to assess the size of the burden due to morbidity and disability, especially in adults. Data collection strategies have been too slow to adapt to these new challenges, resulting in poorly informed health decision-making.

Fourth, national health interview and examination surveys will have to be done regularly, but ad-hoc surveys to inform specific initiatives or particular diseases should be avoided. National health surveys should be done at regular intervals as part of a 10-year survey plan using standardised modules to address priority questions that will drive action and is well-integrated with planning cycles.

There is an unprecedented opportunity to reduce the supply-demand gap in health statistics in developing countries. International agencies and organisations, global health partnerships, academic institutions, country health and statistical constituencies, and others should join forces in international and national platforms to efficiently direct financial and technical resources for health statistics. Now is the time to accelerate the production and use of accurate, complete, and timely health statistics for decision-making by investing in country health information systems that should be based on an efficient and effective mix of standardised methods of data collection and analysis that meet country and international needs.

#### Contributors

Both authors devised the paper, developed the arguments and examples, participated in writing the manuscript, and approved the final version for publication.

#### Conflict of interest statement

We declare that we have no conflict of interest.

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