

## Who Counts? 2



## Civil registration systems and vital statistics: successes and missed opportunities

Prasanta Mahapatra, Kenji Shibuya, Alan D Lopez, Francesca Coullare, Francis C Notzon, Chalapati Rao, Simon Szreter, on behalf of the Monitoring Vital Events (MoVE) writing group\*

Vital statistics generated through civil registration systems are the major source of continuous monitoring of births and deaths over time. The usefulness of vital statistics depends on their quality. In the second paper in this Series we propose a comprehensive and practical framework for assessment of the quality of vital statistics. With use of routine reports to the UN and cause-of-death data reported to WHO, we review the present situation and past trends of vital statistics in the world and note little improvement in worldwide availability of general vital statistics or cause-of-death statistics. Only a few developing countries have been able to improve their civil registration and vital statistics systems in the past 50 years. International efforts to improve comparability of vital statistics seem to be effective, and there is reasonable progress in collection and publication of data. However, worldwide efforts to improve data have been limited to sporadic and short-term measures. We conclude that countries and developmental partners have not recognised that civil registration systems are a priority.

This paper follows on from the arguments presented in the first paper in this Series,<sup>1</sup> and considers the present status of vital statistics derived from civil registration systems, with particular attention to cause-of-death statistics as an important element of vital statistics for public-health policy. Starting with a comprehensive and practical assessment framework for vital statistics, we provide a detailed assessment of the status of vital statistics in the world by using the latest datasets on country-level vital statistics available in international databases. We then review previous international efforts to strengthen these systems in three areas: setting standards to improve international comparability of vital statistics, international collection and publication of data, and strengthening national statistical systems. We conclude that international

efforts have had some success in the first two of these areas. Our collective inability to make or sustain improvements in vital statistics at country level is due to two failures: first, governments have not made civil registration systems a priority, and second, development partners do not yet recognise these systems as key components of development infrastructure.

### Vital statistics for making and testing public-health policy

The first paper in this Series described the importance of civil registration systems, which are the cornerstone of any health information system<sup>1</sup> because they generate comprehensive vital statistics. These systems have many social, political, and economic benefits apart from their public-health importance. The primary function of civil registration systems is to create and maintain legal documents proving the identity of individuals. Since these systems also provide official records of births and deaths, the statistics they produce are essential for understanding public-health status in countries and how it is changing.

Vital statistics can be used in several ways to guide public-health policy and practice. William Farr, the first Superintendent of Statistics in Britain's Office of the Registrar General, computed innovative national and subnational measures of vital statistics and mortality, which affected public-health officials, local government representatives, and public opinion. As early as the 1850s, he devised so-called league tables of unhealthy cities and compared them with healthy districts to generate increased public debate.<sup>2</sup> General vital statistics from small areas are still used to identify mortality differentials within developed countries that have low mortality.<sup>3</sup> Studies on occupational mortality that are based on vital statistics in Great Britain, Canada, and

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\*Members listed at the end of article

Institute of Health Systems, Hyderabad, India (P Mahapatra SD); Measurement and Health Information Systems, WHO, Geneva, Switzerland (K Shibuya MD); School of Population Health, University of Queensland, Brisbane, Australia (Prof A D Lopez PhD, C Rao MD); United Nations Statistics Division, New York, USA (F Coullare MD); National Center for Health Statistics, CDC, Hyattsville, MD, USA (F C Notzon PhD); and History Faculty and St John's College, Cambridge, UK (S Szreter PhD)

Correspondence to: P Mahapatra, Institute of Health Systems, HACA Bhavan, Hyderabad, AP 500004, India pmahapat@ihsnet.org.in

#### Key messages

- Vital statistics derived from civil registration systems are global public goods that governments of developing countries and development partners need for generation of comprehensive and detailed health outcome data, which are a key component of building the evidence base for health improvement
- Worldwide civil registration systems have largely stagnated, during the past five decades, in terms of their vital statistics potential
- Systematic evaluation studies and comprehensive assessments of the state of civil registration systems in various countries and regions of the world are rarely done, but they are essential to guide the use of vital statistics
- Various international efforts and programmes have succeeded in setting standards for comparability and publications for easier access, but such efforts have been largely unsuccessful in the development of civil registration systems for vital statistics at a national level

	General vital statistics	Cause-of-death statistics
<b>Accuracy</b>		
Coverage	% of population living in areas where CRS is functional	% of population covered by medical certification of cause of death
Completeness	% of events contributing to fertility/mortality statistics	% of deaths with medically-certified cause of death
Missing data	% of key variables with response not stated	% of cause-of-death reports for which age/sex data are missing
Use of ill-defined categories		% of deaths classified under various miscellaneous and ill-defined categories
Improbable classifications		Number of deaths assigned to improbable age or sex categories per 100 000 coded deaths
Consistency between cause of death and general mortality		% of cause-of-death data points deviating more than 2 (or 3) SDs from general mortality based predictions
<b>Relevance</b>		
Routine tabulations	By sex and 5-year age groups, based on place of usual residence. Deaths in children under 5 years tabulated by 0 and 1-4 year age-group	By sex, and at least by eight broad age groups—namely, 0, 1-4, 5-14, 15-29, 30-44, 45-59, 60-69, and 70+ years
Small area statistics	Number of general vital statistics tabulation areas per million population	Number of cause-of-death tabulation areas per million population
<b>Comparability</b>		
Over time	Stability of key definitions over time	Consistency of cause specific mortality proportions over consecutive years
Across space	Uniformity of definitions across areas	ICD to certify and code deaths; revision used and code level to which tabulations are published
<b>Timeliness</b>		
Production time	Mean time from end of reference period to publication	Mean time from end of reference period to publication
Regularity	SD of production time	SD of production time
<b>Accessibility</b>		
Media	Number of formats in which data are released	Number of formats in which data are released
Metadata	Availability and quality of documentation	Availability and quality of documentation
User service	Availability and responsiveness of user service	Availability and responsiveness of user service
CRS=civil registration systems. SD= standard deviation.		
<b>Table 1: Assessment framework for vital statistics from civil registration systems</b>		

the USA have identified occupational carcinogens, as well as physical, social, and environmental factors linking some occupations with specific causes of death.<sup>4-8</sup> Routine data from civil registration which showed a substantial increase in deaths from lung cancer in men, led Doll and Hill to identify the causal association between smoking and lung cancer, and subsequently tobacco, as a principal cause of several other diseases of public-health importance.<sup>9,10</sup> Successful public-health campaigns which led to legislation on use of seatbelts and drink driving to curtail deaths from road traffic accidents, have been based on evidence generated from vital statistics.<sup>11</sup>

These examples show how vital statistics derived from civil registration systems have been instrumental in guiding policies and priorities for health development. Vital statistics support a variety of epidemiological research, ranging from ecological studies and methods used in descriptive epidemiology, to analytical investigations based on registration records such as the National Death Index.<sup>12-17</sup>

In an era of increased accountability, the empirical basis for monitoring progress and assessment of public-health programmes is becoming increasingly

important in global health debates.<sup>18</sup> Vital statistics generated through civil registration systems are the only source of data for continuous and comprehensive monitoring of public-health programmes over time. Yet, despite their central role in health development, insufficient priority by governments, donors, and health agencies is given to their development, strengthening, and assessment. Moreover, there is insufficient knowledge about the quality of vital statistics which impedes their use.

### Assessment framework for vital statistics

Most countries have introduced civil registration systems which generate some vital statistics, but their usefulness has been restricted because of many systemic difficulties. Good statistical systems should meet the information needs of their users in an efficient, credible, and objective manner.<sup>19</sup> Previous assessments of the quality of general vital statistics have been done with few criteria, such as the completeness of registration.<sup>20,21</sup> Moreover, comprehensive assessment criteria to evaluate the quality of cause-of-death statistics reported to WHO have been proposed,<sup>22</sup> and expanded to assess data quality in India.<sup>23</sup> These criteria have been organised

**Panel 1: Glossary**

**Coverage of civil registration systems** refers to the extent to which geographical or political units of the country have established these systems. For cause of death, coverage refers to the population living in areas where medical certification of cause of death has been legally mandated

**Completeness** is measured by the percentage of vital events actually recorded in the vital statistics and is estimated by comparison with an independent estimate for the population under consideration, with either direct or indirect methods.<sup>30</sup> For cause-of-death statistics, completeness is the number of cause-of-death reports as a percentage of estimated deaths in the population

**Cross-tabulation** is recording of the event of interest by various characteristics associated with the event—eg, tabulation of births by age of mother and birthweight, etc

**Relevance** is the degree to which cross-tabulation for priority characteristics—from a demographic and public-health perspective—are provided by the data source. The UN principles<sup>30</sup> list relevant characteristics of vital events and discuss their importance. Cross-tabulation of vital events, at least by priority characteristic, would show important relations

**Small areas** denote the smallest population groups or units for which tabulation of vital events are available

**Timeliness** means that statistics are made available to their users on a prompt and regular basis—eg, yearly

**Comparability** means the extent to which a statistic estimates the same thing in the same way over time and across areas<sup>26</sup>

**Accessibility** refers to the ease with which users can access and make sense of the data

**Media** refers to dissemination of data in several formats—ie, print, electronic, internet, etc

**Metadata** refers to information about the data, such as documentation of data elements, their definition, method of collection, manner of presentation, potential for errors, etc. Its purpose is to enhance usability of data for public-health analysis

**User service** refers to dedicated institutional mechanism for distribution of data products, clarification of user queries, and productive engagement with data producers, and also data accessibility

into a framework of four quality concepts—namely, generalisability, reliability, validity, and policy relevance.<sup>24</sup>

The Health Metrics Network (HMN) has developed a method for assessment of country health information systems.<sup>25</sup> The HMN method has been designed to give a broad overview of all components of a health information system. Several of the HMN criteria are based on processes, rather than output, and the core dimensions are not consistent with the key elements of previous quality frameworks for official statistics—namely, accuracy, relevance, timeliness, comparability, and accessibility.<sup>26–29</sup> Table 1 presents an assessment framework for vital statistics derived from civil registration systems that is consistent with quality

dimensions for official statistics. Panel 1 provides a glossary of the ideas and terms used in the table.

### General vital statistics from civil registration systems

Countries which need most to improve their civil registration systems are also those from which obtaining accurate information on the criteria listed in table 1 is difficult. Every year, the UN seeks information from countries about, among other things, their vital statistics. Results are published yearly in the UN Demographic Yearbook and provide a partial picture of the quality of every country's general vital statistics.<sup>31</sup> However, the Demographic Yearbook should be interpreted with caution for several reasons.

	Deaths				Births			
	1965–74	1975–84	1985–94	1995–2004	1965–74	1975–84	1985–94	1995–2004
Total	27%	25%	28%	26%	33%	31%	28%	30%
Africa	2%	4%	2%	7%	7%	7%	9%	5%
Americas	69%	66%	64%	61%	58%	55%	53%	53%
Eastern Mediterranean	17%	21%	15%	1%	21%	25%	17%	42%
Europe	62%	61%	92%	86%	95%	94%	93%	92%
South-East Asia	1%	1%	1%	1%	1%	1%	1%	1%
Western Pacific	12%	11%	10%	13%	12%	14%	13%	18%

Complete means that at least 90% of events (births or deaths) are registered by the system. Figures for 1965–94 from the Demographic Yearbook (historical supplement 1948–1997), UN Statistics Division, New York, 2000. Figures for 1995–2004 are based on the Demographic Yearbook 2004, UN Statistics Division, New York.

**Table 2: Percentage of population living in countries with complete civil registration systems, by WHO region**

For Demographic Yearbook 1997, historical supplement see <http://unstats.un.org/unsd/demographic/products/dyb/dybhst.htm>

For Demographic yearbook 2004 see <http://unstats.un.org/unsd/demographic/products/dyb/dyb2004/table04.xls>

	1961-70 (n=217)	1971-80 (n=222)	1981-90 (n=216)	1991-2000 (n=230)
<b>Cross tabulations for livebirths by:</b>				
Livebirths	154	159	156	156
Mother's age	110	116	121	127
Child's sex and mother's age	59	81	95	94
Birth order and mother's age	92	92	90	94
Birthweight	11	33	57	64
Gestational age	5	28	40	40
Type of births	48	69	76	82
<b>Cross tabulations for deaths by:</b>				
Deaths	148	154	155	176
Sex	137	139	139	152
Sex and age	122	118	117	131
Occupation, sex, and age	37	39	37	32

Data for births from reference 35. Data for deaths from reference 36.

**Table 3: Number of countries reporting at least once selected characteristics of births and deaths, 1961-2000**

First, responses to questionnaires might not show the actual availability and useability of vital statistics within a country. Second, there is no independent validation of responses, and countries might be optimistic when reporting their performance by overestimating the quality of vital statistics from their civil registration systems. Third, the section on data quality is limited, since it seeks information only about whether statistics refer to date of occurrence or date of reporting, and on country impressions about the estimated completeness of registration. Finally, until recently, countries were not required to identify the source of the data they report. Reviews of the Demographic Yearbook system find that there has been little progress in the quality of reporting of vital statistics.<sup>32-36</sup>

Table 2 shows the distribution of world population according to country reports to the UN about completeness of registration of births and deaths, for the past four decades. Roughly 30% of the world's population nowadays live in areas which claim complete (defined as more than 90%) registration of births and deaths. There has been hardly any improvement worldwide over the past four decades. Europe, North America, and Oceania seem to have well developed civil registration systems, whereas Africa and Asia, and to a lesser extent Latin America, do not.

The number of countries with disaggregated data for births (by maternal age, birth order, and birthweight) provides an indication of how well civil registration systems are doing in obtaining these priority characteristics for health policy support (table 3). There has been little change over the past 40 years (from 154 reporting countries in 1961-70 to 156 in 1991-2000), especially if we consider that the total number of countries has increased after dissolution of the Soviet Union in the 1990s. The countries that have improved

are those that were already producing good quality birth statistics 40 years ago.<sup>36</sup>

Similarly, the number of countries reporting deaths has been fairly stable over the past 40 years (table 3). Some variations exist in regions and also in the frequency of reporting. For instance, 89 (39%) countries supplied data for the number of deaths for every year in 1991-2000 and 22 countries have reported yearly data for the number of deaths since 1961.<sup>36</sup> Yet there are countries that have never submitted data for deaths since 1961. Around 60 countries, more than half of them in Africa,<sup>36</sup> have never reported deaths by age and sex since 1961.

Countries such as Ghana, Angola, Mozambique, Madagascar, Bolivia, Honduras, Paraguay, Peru, and the Dominican Republic reported death statistics every year in the 1960s but did not report at all in the 1990s. Conversely, Malaysia and Pakistan have reported most often and with detailed information over the decades.

Over the past four decades, the limited improvement in availability of general vital statistics seems to have come from outside the civil registration systems. For instance, 26 African countries claimed to produce death statistics from complete civil registration systems in 1975-84. Two decades later, the number of such countries was 25. Censuses or surveys, as an alternative source of general vital statistics, did not exist in any African country during 1975-84. Two decades later, 28 African countries reported general vital statistics solely on the basis of census or surveys.<sup>32</sup>

### Cause-of-death statistics from civil registration systems

Country reports to the WHO (WHO Statistical Information Systems [WHOSIS]) are the major source of international cause-of-death statistics from civil registration systems. WHO published two volumes containing the annual epidemiological and vital statistics for 1939-46 and 1947-49.<sup>37</sup> These reports were a continuation of the annual epidemiological reports formerly published by the League of Nations Health Organization. The WHO Mortality Database<sup>38</sup> in the WHOSIS, however, contains data from 1950. We analysed the quality of data in WHOSIS by applying the framework proposed in table 1.

As of June, 2007, only 125 of 193 member countries, representing 76% of the world's population, had reported cause-of-death statistics to WHO at least once since 1950 (table 4). For 1996-2005, the number of countries reporting fell to 118 but the percentage of world population living in countries that do report remained at 75%. Reporting countries, on average, have sent cause-of-death data to WHO for 29 of 55 years since 1950. Countries with large populations such as India and China have rarely sent reports on cause of death to WHO.

During the 55-year lifespan of this database, countries have needed an average of 5 years per reporting cycle to provide data to WHO, with lag time ranging from 3 years in European countries to 11 years in African countries.

	Number of member states in every region	At least one report during 1950–2005				At least one report during 1996–2005			
		Number of member states	% of regional population	Average number of years by country	Average time since last report (years)	Number of countries	% of regional population	Average number of years by country	Average time since last report (years)
Africa	46	6	8%	16	11	3	6%	9	2
The Americas	35	34	99%	36	5	32	98%	7	4
Eastern Mediterranean	21	10	39%	12	5	10	39%	4	5
Europe	53	52	100%	33	3	51	100%	8	3
South-East Asia	11	5	75%	18	6	5	75%	3	6
Western Pacific	27	18	94%	19	7	17	94%	6	5
All	193	125	76%	29	5	118	75%	7	4

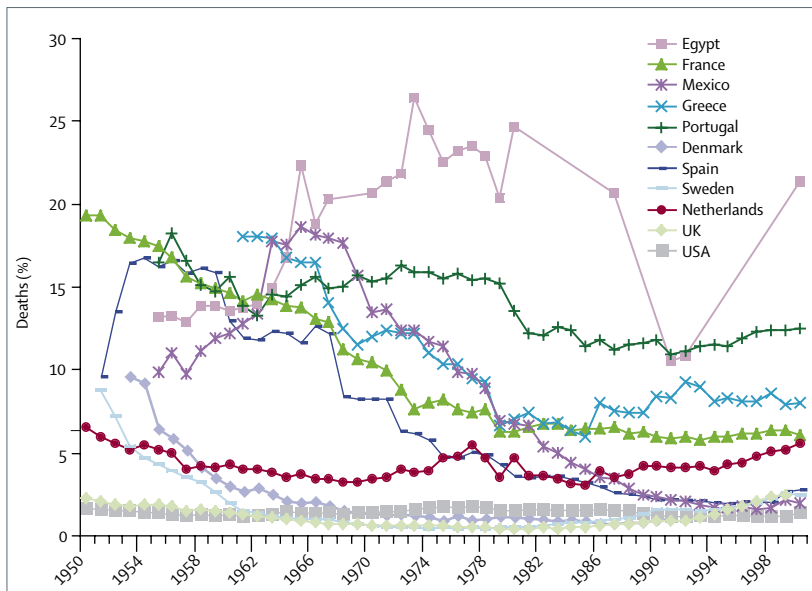
Data from reference 38.

**Table 4: Reporting of cause-of-death statistics from WHO member states, 1950–2005**

Criteria	WHO member states¶				% Total population	List of member states, by descending order of the size of the population	
	ICD*	Code level†	Completeness‡	Ill-defined codes§			
High quality	Recent	3–4	90–100%	0–10%	31	13%	USA, Japan, Mexico, UK, Canada, Venezuela, Uzbekistan, Romania, Australia, Chile, Cuba, Hungary, Sweden, Austria, Israel, Slovakia, Finland, Costa Rica, Singapore, Ireland, New Zealand, Moldova, Lithuania, Kuwait, Latvia, Estonia, Trinidad and Tobago, Malta, Bahamas, Iceland, Saint Vincent and the Grenadines
Medium-high quality	Recent	3–4	70–100%	0–15%	24	7%	Philippines, Germany, Italy, South Korea, Colombia, Spain, Netherlands, Belgium, Czech Republic, Switzerland, Denmark, Kyrgyzstan, Norway, Croatia, Georgia, Panama, Former Yugoslav Republic of Macedonia, Slovenia, Mauritius, Barbados, Belize, Antigua and Barbuda, Dominica, Niue
Medium-low quality	Recent or Recent	3–4 2–1	70–100% 70–100%	15–20% 0–20%	26	8%	Brazil, Russia, France, Ukraine, Kazakhstan, Guatemala, Ecuador, Portugal, Serbia and Montenegro**, Belarus, Azerbaijan, Bulgaria, Turkmenistan, Bosnia and Herzegovina, Uruguay, Mongolia, Oman, Luxembourg, Suriname, Brunei, Saint Lucia, Grenada, Seychelles, Saint Kitts and Nevis, San Marino, Cook Islands
Low quality	Old ICD or alternate list or ill-defined codes >20%		50–70% or		26	7%	Egypt, Iran, Thailand, South Africa, Argentina, Poland, Peru, Syria, Sri Lanka, Greece, El Salvador, Tajikistan, Paraguay, Jordan, Nicaragua, Albania, Armenia, Cyprus, Qatar, Fiji, Bahrain, Guyana, Maldives, Tonga, Kiribati, Tuvalu
Limited use	Data before 1996 or data in non-standard format or data of partial coverage		<50% or		17	41%	China, India, Turkey, Burma, Morocco, Malaysia, Zimbabwe, Dominican Republic, Haiti, Honduras, Papua New Guinea, Lebanon, Jamaica, Cape Verde, Sao Tome and Principe, Monaco, Nauru
No report	No cause-of-death data received by WHO				68	24%	Indonesia, Pakistan, Bangladesh, Nigeria, Vietnam, Ethiopia, Democratic Republic of the Congo, Tanzania, Sudan, Kenya, Algeria, Uganda, Iraq, Nepal, Afghanistan, Saudi Arabia, North Korea, Ghana, Yemen, Mozambique, Madagascar, Côte d'Ivoire, Cameroon, Angola, Burkina Faso, Cambodia, Niger, Malawi, Senegal, Mali, Zambia, Chad, Tunisia, Rwanda, Bolivia, Guinea, Benin, Somalia, Burundi, Togo, Libyan Arab Jamahiriya, Sierra Leone, Laos, Eritrea, United Arab Emirates, Central African Republic, Congo, Liberia, Mauritania, Namibia, Lesotho, Botswana, The Gambia, Guinea-Bissau, Gabon, East Timor, Swaziland, Comoros, Djibouti, Bhutan, Equatorial Guinea, Solomon Islands, Vanuatu, Samoa, Micronesia, Andorra, Marshall Islands, Palau
Total					192	100%	

Data from reference 38. Categories are mutually exclusive. ICD=International statistical classification of diseases and related health problems. \*Recent ICD=ICD 10 or 9. Old ICD=ICD 8 or earlier. Alternate classification includes all national or local classifications that are not consistent with ICD. †Code level: 4=ICD four-digit code. 3=ICD three-digit code. 2=ICD tabulation list. 1=ICD Chapter or other list not consistent with code levels 2–4. ‡Completeness of statistics on cause of death is the ratio of number of deaths for which cause of death is registered to the civil registration system, to the estimated total number of deaths in the population; the latter includes all deaths registered to the civil registration system (whether cause of death is mentioned or not) as well as those not registered to the civil registration system. Completeness here refers only to deaths in people older than 5 years. §Percentage of deaths coded to symptoms, signs, and ill-defined conditions (ICD-9 codes 780–799 and ICD-10 codes R00–R99), injury deaths with undetermined intent (ICD-9 codes E980–989 and ICD-10 codes Y10–Y34 and Y872), secondary neoplasms and neoplasms of unspecified sites (ICD-9 codes 195, 199 and ICD-10 codes C76, C80, C97), and ill-defined cardiovascular causes (ICD-9 codes 427.1, 427.4, 427.5, 428, 429.0, 429.1, 429.2, 429.9, 440.9 and ICD-10 codes I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9, I70.9). ¶WHO member states represent 99.8% of the world population. ||Population estimates are for the year 2007. \*\*On June 3, 2006, the Permanent Representative of the Republic of Serbia to the UN and other international organisations in Geneva informed the Acting Director-General of the WHO that "the membership of the state union Serbia and Montenegro in the United Nations, including all organs and the organizations of the United Nations system, is continued by the Republic of Serbia on the basis of Article 60 of the Constitutional Charter of Serbia and Montenegro, activated by the Declaration of Independence adopted by the National Assembly of Montenegro on 3 June 2006".<sup>38</sup> Certain factual elements used cover a period of time preceding that communication.

**Table 5: Classification of WHO member states based on quality of cause-of-death statistics reported to the WHO**



**Figure:** Trends in percentage of deaths assigned ill-defined codes according to the ICD classification in selected countries, 1950–2000

Data points for Egypt between 1980–86 and 1988–90 are not available. Data from reference 38.

We then classified member states into six categories according to the quality of cause-of-death data received by WHO (table 5). 31 countries, representing 13% of the world population, were assessed to high-quality data. These are countries which use a recent revision of the International Statistical Classification of Diseases and Related Health Problems (ICD), provide 3 or 4 digit ICD codes, where more than 90% of deaths are medically certified with a cause of death, and where less than 10% of deaths are coded to ill-defined categories. Another 24 countries were assessed to medium-high-quality data. These countries, after excluding those in high category, still use a recent ICD revision and provide 3 or 4 digit codes, but the completeness of cause-of-death reports could be lower at 70–100%, and up to 15% of deaths are coded to ill-defined categories.<sup>38</sup> In another 26 countries (with quality classified as low-medium), 70–100% of deaths are medically certified in a recent ICD, then either assignment to ill-defined categories is 15–20% and 3 or 4 digit codes are used, or assignment to ill-defined categories is 0–20% and ICD codes less detailed than 3 or 4 digits are used. There are 85 countries, representing 66% of the world population, for which data are of little use or not reported at all to WHO (table 5).

In terms of progress, the number of countries reporting causes of death to WHO has tripled between 1950 and 2000 (from 36 to 115). Furthermore, there has also been a general decrease in the proportion of deaths assigned to ill-defined categories (figure).

The initial rise in the proportions of deaths in Mexico, Egypt, and Spain was because of expansion of civil registration in these countries after the second world war, with adequate recording of the event of death only. In

every case, this expansion of civil registration systems was probably followed by increased attention to the correct identification of the cause of death, resulting in an improvement in data quality. However, physicians and coders, in attempting to assign well-defined categories, could exhibit bias and arbitrariness in selection of the underlying cause of death.

Two points stand out from table 5—first, the absence of data reported to WHO from sub-Saharan African countries and second, the mixed quality of cause-of-death reporting from Europe, Asia, and Latin America. In particular, not all developed countries seem to have high-quality data.

From a global perspective, the performance of civil registration systems as the source of cause-of-death data is not ideal. Challenges exist in all regions of the world, ranging from systems that do not generate data at all, to malfunctioning systems that produce poor-quality data. Countries are not always aware of the extent of data difficulties with their systems or how they might be corrected to improve health-policy needs. Countries need to periodically assess the data generated from their civil registration system.<sup>23,24,39,40</sup> Such assessments are designed to identify structural weaknesses in the system, provide an empirical basis to correct observed biases in the data it generates, and plan improvements.

### International efforts to improve vital statistics and strengthen civil registration systems

Over the past 60 years, many efforts by international agencies and others have been made to improve the availability of usable vital statistics for public health. These fall into three categories: (1) setting standards to improve comparability of vital statistics, (2) international collection and publication of data, and (3) strengthening national statistical systems.<sup>41</sup>

### Setting standards to improve comparability of vital statistics

One of the core functions of the UN system is to set norms and standards to ensure consistency and comparability of statistics across countries and over time. In 1953, the UN Statistics Division published the Principles and Recommendations for a Vital Statistics System (revised in 1973 and 2001) to bring about uniformity of data acquisition through civil registration systems and comparability of notions for vital statistics. Such principles have successfully improved the comparability of vital statistics by standardising fundamental ideas in vital statistics, including date and place of events.<sup>20,30</sup> WHO has also been instrumental in clearly defining livebirth and fetal death<sup>41</sup> to improve comparability of infant mortality and stillbirth rates.

International efforts to develop a uniform nomenclature and classification of cause of death, which is essential for comparability, began as early as 1851.<sup>41</sup> WHO continued this work, adopting the sixth revision of the ICD in 1948,

and it has guided all subsequent revisions. The ICD is a major achievement in enhancing the comparability of medically-certified causes of death and is one of the

**Panel 2: Achieving consistency in classification of medically certified causes of death**

The need for uniform nomenclature and classification of diseases as a prerequisite for the international comparability of medical statistics was discussed during the first international statistical congress held in Brussels in 1853. At the second congress, in 1855, William Farr from the General Register Office, London, proposed classification under five groups—namely, (1) epidemic diseases, (2) constitutional diseases, (3) local diseases arranged according to anatomical site, (4) developmental diseases, and (5) injury. Marc d'Espine, from the General Register Office, Geneva, proposed a classification on the basis of the clinical, pathological, and aetiological basis of diseases. The congress adopted a compromise list of 139 rubrics.

In 1891, Dr Jacques Bertillon, head of the statistical services of Paris, was appointed as chair of a committee to prepare the first revision of the international list of diseases. The Bertillon classification, adopted in 1893, was based on the classification of causes of death used by Paris, which represented a synthesis of English, German, and Swiss classifications. Three lists were drawn up for its application: a detailed list, an intermediate list, and an abridged list, containing 161, 99, and 44 titles, respectively. The purpose of these lists was to maintain comparability between countries with different statistical systems.

After a proposal by the American Public Health Association for decennial revision of the classification, revisions of the ICD were made in 1900, 1910, and 1920. In 1924, the Health Organization of the League of Nations took up responsibility for the ICD. Fourth and fifth revisions of the ICD were made in 1929 and 1938, respectively. Preparatory work for the sixth revision had been entrusted to the US Government, which was investigating rules for selection of joint causes of death. In 1947, WHO took over the work of preparing the sixth revision. The sixth revision of ICD was adopted by the First World Health Assembly, in 1948, and an International Form of Medical Certification of Cause of Death and Rules for classification were also approved at this time. The form and the rules were based on the notion of the underlying cause of death, in view of its public-health importance.

The seventh and eighth revisions were adopted in 1955 and 1965, respectively. For the ninth revision, countries with well developed statistical systems asked for more detail, whereas developing country statisticians sought simpler classifications. The ninth revision, adopted in 1975, added four digit subcategories, but retained the three digit categories for simpler tabulations. A dagger and asterisk system was introduced to allow for recording of both the underlying cause and its manifestation in a specific organ or site. The tenth revision of the ICD, currently in use, was adopted by the WHO in 1990.<sup>41–45</sup>

earliest examples of an international classification for statistical use (panel 2).

Another important achievement towards comparability of cause-of-death statistics has been the development of the International Form of Medical Certification of cause of death and a set of rules for classification in the ICD, including the notion of underlying cause of death. However, only about 80 member countries, representing 27% of the world's population, have reported useable cause-of-death data to WHO in the past decade.

Another major difficulty in achieving comparable results for certified causes of death is the scarcity of interest from the medical profession, especially in developing countries where doctors do not attend most deaths and have no professional incentive to ascertain their cause. Physicians in developed and developing countries should be provided with training in the proper completion of the medical certification form. Without this training, cause of death statistics cannot improve. Detailed training for coders is also essential, partly because of the complexities of the ICD.

More than half of the world's population live in countries where medical attention at death, or medical certification of its cause, is rare. Many of these countries use verbal autopsy to ascertain cause of death. But verbal autopsy questionnaires, operating procedures, cause-of-death lists, and coding practices vary substantially.<sup>46</sup> Efforts to improve the comparability of causes of death from verbal autopsy have only recently begun, led by WHO.<sup>47</sup>

**International collection and publication of data**

The UN Statistics Division is the primary agency responsible at the international level for collecting, compiling, and disseminating official national data for fertility and mortality. WHO is mandated through its constitution to collect, compile, and publish relevant vital statistics including causes of death. Such information is essentially a public good since there is no incentive for one country to compile and publish international vital statistics.

Over the past two decades, access to these data has been substantially improved through regular publications and web-based databases, which has enabled users to undertake comparative studies on vital statistics that are relevant for policymaking.<sup>48–50</sup> Vital statistics compiled by international bodies are completely dependent on official reporting from countries, and the latest data that are potentially available in countries are often not forwarded to WHO. For example, although the Registrar General of India has published yearly reports on medically certified causes of death since 1973,<sup>51</sup> the WHO mortality database contains data only for 2001.<sup>38</sup> The reasons for this are two-fold. First, all reports from the Medical Certification of Cause of Death scheme do not reach the WHO. Second, received reports are not incorporated into the database because the formats do not match.

The procedure for the international collection, publication, and dissemination of vital statistics can in itself have a strong and continuous effect on the improvement of national statistics.<sup>52</sup> The requested formats for reporting data, including definitions, classifications, and cross-tabulations sent by international organisations, can be used as models by national offices and have great effect in improving quality and comparability of national statistics. The experience from the standards set for censuses in the Americas in 1950 suggests that setting such minimum standards can serve as a powerful stimulus to countries which otherwise might not have taken a census at all.<sup>53</sup>

Since local data are important,<sup>54</sup> an obvious problem in officially reported statistics is the absence of external validation and correction of known bias. Since 2000, WHO has published estimates of levels and causes of mortality by adjusting for known biases and using disease models and extrapolations to make estimates.<sup>55</sup> The primary reason was to ensure internal consistency of statistics and their comparability across countries over time. Unadjusted vital statistics are subject to bias because of lack of representativeness (eg, low completeness) and misclassification of causes of death (eg, ill-defined codes). These concerns restrict the comparability of international vital statistics across countries and over time and could render them unsuitable for monitoring progress and assessing health programmes at both national and international level.<sup>58</sup> The most recent online publication on health statistics by WHO, *World Health Statistics 2007*, includes the classification of selected vital statistics according to whether they were unadjusted or corrected for known biases.<sup>56</sup> Such initiatives have substantially improved the comparability and quality of international vital statistics.

However, there are several issues when estimates are published that need to be carefully considered. First, there are discrepancies between figures reported by countries and estimates produced by WHO.<sup>57</sup> For example, the under-5 mortality rates for Uzbekistan in 2005 reported from the civil registration system and estimated by the UN agencies were 21 and 68 per 1000 livebirths, respectively. One potential way to add transparency is to make the original data, including metadata, and adjustment processes publicly available. The continuous international appraisal of data and the resulting correspondence with countries can show key areas where improvements or clarifications are needed, and stimulate the national agencies to make these changes.<sup>52</sup> Second, are the data real or modelled? Users often assume that estimates and trends are based on observed events, but this assumption is not necessarily the case.<sup>57</sup> Better empirical data support better modelling and vice versa.

#### **Strengthening national statistical systems**

As early as 1958, WHO set itself an agenda for development of national capacities in health statistics.

National committees for vital and health statistics (NCVHS) were recommended as a coordinating body.<sup>58</sup> By 1969, some 50 countries had national committees.<sup>59</sup> However, the idea was not picked up by developing countries and was discontinued after the second conference of NCVHS, which was held in Copenhagen in 1973.<sup>58</sup> Although regional advisors in health statistics were appointed by WHO to help in the development of country level health statistics, their numbers did not reflect regional need.

For the past 50 years, WHO and the UN have endeavoured to assist countries in developing national capacities for health statistics. During the 1970s–80s in particular, the UN Fund for Population Activities (UNFPA) invested substantially in about 20 developing countries to enhance the civil registration systems and vital statistics.<sup>60</sup> Although short-term and medium-term objectives were often achieved, in most cases the improvements to existing systems were not self sustainable, so when external resources came to an end, the new systems collapsed. In 1991, the UN adopted the International Program for Accelerating the Improvement of Vital Statistics and Civil Registration Systems to assist countries to achieve complete civil registration systems. However, the effect has so far been partial. The HMN was established in 2005, and has focused on civil registration systems as a priority, but with little funding.

Although there are several agencies within the UN system that have a broad mandate in population and development, and which also share common interests as end users of vital statistics (eg, UNFPA, WHO, UNICEF, World Bank), there is little cohesion or synergy in their efforts to strengthen these systems nationally. For example, the projects supported by UNFPA paid little attention to strengthening the interministerial and interagency linkages. Broader capacity-building potential and its usefulness to other official agencies were missed. A review of these projects suggested that support for civil registration systems should be built into projects and activities funded by various international agencies such as WHO and UNICEF.<sup>60</sup>

Similarly, UNICEF actively promotes birth registration as a human right and has supported national initiatives on this matter,<sup>61</sup> but it does not accord similar priority to the registration of early childhood deaths. Instead, UNICEF relies on the indirect children ever born and surviving method, on the basis of data from their Multiple Indicator Cluster Surveys (MICS), which were conducted periodically in developing countries.<sup>62</sup> In addition to several limitations of indirect methods,<sup>63</sup> they do not provide measures of important indicators to improve child survival, such as perinatal and neonatal mortality rates. WHO, on its part, could support the systematic introduction and implementation of the international medical certificate of cause of death in many countries in Africa and Asia, from where cause-of-death data are either not reported or are of limited use.

The World Bank has consistently supported international descriptive epidemiology reports over the past two decades,<sup>64-66</sup> but has done little to address the paucity of mortality data from several regions in the world. For example, the health systems development projects and health sector reforms financed by the Bank hardly have any provision for development of vital statistics. The World Bank's latest strategy document on health and nutrition notes paucity of impact data and weak focus by the Bank on monitoring and evaluation aspects.<sup>67</sup>

A major constraint on the efforts by WHO and the UN (Statistics Division) is that they are basically technical agencies, which can offer information and advice but cannot substantively affect how national governments allocate financial and human resources. Countries that have recognised the importance of vital statistics, and allocated resources accordingly, have gone on to develop their civil registration systems and medical certification process. Improvement of these systems, the vital statistics they generate, and the publication thereof, needs substantial human and material resources that cannot be sustained through philanthropy. A fundamental requirement for the development of civil registration systems is for countries to own and invest in their vital statistics infrastructure.

The widespread neglect of vital statistics by national and international bodies continues. The International Monetary Fund established a Trust Fund for Statistical Capacity Building in 2000, but the development of civil registration systems and vital statistics seems to have been a low priority. Most of the country projects financed up to now have focused on poverty measurement and economic statistics. The Marrakech Action Plan for Statistics, developed at the second roundtable of development bankers, set a target for all low-income countries to establish national strategies for the development of statistics (NSDS).<sup>68</sup> Also, the PARTnership In Statistics for development in the 21st century (PARIS21), hosted by the Organisation for Economic Cooperation and Development secretariat, has developed guidelines for NSDS. However, these efforts do not address civil registration systems and what is needed to develop and sustain them.

## Conclusions

Worldwide civil registration systems have largely stagnated during the past five decades, which has severely restricted their potential as a source of vital statistics on the health of populations. Yet at a time when accountability and rational allocation of resources for health development have become an increasing concern, the need for reliable national statistics for births, deaths, and causes of death has never been greater.

UN initiatives have largely succeeded in making vital statistics internationally comparable, at least for vital statistics notions for civil registration systems and medically certified cause of death. Data collection,

archival, and dissemination systems have made substantive progress, but they are largely geared towards developed countries. As a result, the few data gathered by developing countries do not always enter the international databases.

International efforts to improve vital statistics infrastructure in developing countries have been too limited in size and scope. Firstly, there has been a general lack of vision by the worldwide health community in according health statistical development a similar priority to health systems development and health interventions. Substantial investments have been made over the past few decades to develop and roll out disease control programmes, especially for childhood diseases, and more recently to prevent injuries and population exposure to hazards such as tobacco. Yet very little effort has been invested into simultaneously strengthening vital statistics systems in these countries to reliably measure progress with such strategies, and to guide the prioritisation and focus of health development initiatives. WHO, in particular, has made little progress beyond the collection and dissemination of vital statistics for developed countries to meet the needs of countries and the global health community for reliable information about the health of populations. The interest shown by WHO in the development and application of methods such as verbal autopsy, which can help meet the information gap in most developing countries, is laudable but it needs greater urgency, support, and promotion in these countries.

Furthermore, countries have not given sufficient priority to the development of civil registration systems to support their own national health plans, perhaps because they are affected by international inertia. International assessments of vital statistics systems have focused on processes rather than outcomes. Very little effort by national or international partners has been invested into assessment of the strengths and weaknesses of civil registration systems, the quality of the data it produces, and the plausibility of the information about the health of the population that can be derived from them. The assessments have relied on questionnaires sent to countries, but national direct assessments have not been done, except in some developed countries. As a result, country-specific plans for developing vital statistics have been meagre, at best.

Our collective inability to make or sustain improvements in vital statistics is due to two principal failures; first, national governments have not made civil registration systems a priority, and second, development partners do not yet recognise such systems as crucially important in the development infrastructure. Over the past half century, the world has become healthier, despite the absence of development of vital statistics. But surely that development would have been widespread and much more equitable if people had access to health intelligence about regional and local differences in

disease burden? Sustainable civil registration systems that yield reliable information about the state of a population's health should be a key development goal for all countries. It is unacceptable for us to be as ignorant about the state of a nation's health in 50 years' time as we are today.

#### MoVE writing group

In addition to the authors of this article are: Carla AbouZahr (Health Metrics Network, WHO, Geneva, Switzerland); Robert N Anderson (National Center for Health Statistics, Centers for Disease Control and Prevention, Hyattsville, MD, USA); Ayaga A Bawah (INDEPTH Network, Accra, Ghana); Ana Pilar Betrán (Department of Making Pregnancy Safer, WHO, Geneva, Switzerland); Fred Binka (INDEPTH Network, Accra, Ghana); Kanitta Bundhamcharoen (International Health Policy Program, Bangkok, Thailand); Rene Castro (Ministry of Health, Chile); John Cleland (London School of Hygiene and Tropical Medicine, London, UK); Timothy Evans (Information, Evidence and Research, WHO, Geneva, Switzerland); Ximena Carrasco Figueroa (Department of Health Statistics and Information, Ministry of Health, Chile); Chakkalackal Korah George (Institute of Health Systems, Hyderabad, India); Laragh Gollgoly (Department of Knowledge Management and Sharing, WHO, Geneva, Switzerland); Rogelio Gonzalez (Ministry of Health, Chile, and Center for Perinatal Diagnosis, Hospital Dr Sotero del Rio, Pontificia Universidad Catolica de Chile, Santiago, Chile); Danuta Rajs Grzebien (Department of Health Statistics and Information, Ministry of Health, Chile); Kenneth Hill (Harvard Center for Population and Development Studies, Cambridge, MA, USA); Zhengjing Huang (National Center for Chronic and Non-communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China); Terence H Hull (Australian Demographic and Social Research Institute, Australian National University, Canberra, Australia); Mie Inoue (Department of Measurement and Health Information Systems, WHO, Geneva, Switzerland); Robert Jakob (Department of Measurement and Health Information Systems, WHO, Geneva, Switzerland); Prabhat Jha (Centre for Global Health Research, St Michael's Hospital, University of Toronto, Canada); Yong Jiang (National Center for Chronic and Non-communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China); Ruy Laurenti (Department of Epidemiology, School of Public Health, University of Sao Paulo, Brazil); Xiaoyan Li (National Center for Chronic and Non-communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China); Denise Lievesley (International Statistical Institute, London, UK); Doris Ma Fat (Department of Measurement and Health Information Systems, WHO, Geneva, Switzerland); Sarah Macfarlane (Global Health Sciences, University of California, San Francisco, USA); Mario Meriardi (Department of Making Pregnancy Safer, WHO, Geneva, Switzerland); Lene Mikkelsen (Health Metrics Network, Brisbane, Queensland, Australia); Jyh Kae Nien (Center for Perinatal Diagnosis, Hospital Dr Sotero del Rio, Pontificia Universidad Catolica de Chile, Santiago, Chile); Keqin Rao (Center for Health Statistics Information, Ministry of Health, Beijing, China); Osman Sankoh (INDEPTH Network, Accra, Ghana); Philip W Setel (MEASURE Evaluation, Carolina Population Center and Departments of Epidemiology and Anthropology, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA); Nadia Soleman (Health Action in Crises, WHO, Geneva, Switzerland); Susan Stout (Results Secretariat, World Bank, Washington DC, USA); Viroj Tangcharoensathien (International Health Policy Program, Bangkok, Thailand); Paul J van der Maas (Erasmus University Medical Center, Rotterdam, The Netherlands); Fan Wu (National Center for Chronic and Non-communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China); Gonghuan Yang (Chinese Center for Disease Control and Prevention, Beijing, China); Siwei Zhang (National Center for Cancer Registry, Beijing, China); Maigeng Zhou (Chinese Center for Disease Control and Prevention, Beijing, China).

#### Conflict of interest statement

We declare that we have no conflict of interest. The opinions in this paper are those of the authors and not necessarily those of the institutions they represent.

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