Improving death registration and statistics in developing countries: Lessons from sub-Saharan Africa

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Abstract

Cause of death data from vital records are the principal source for population level assessment of the magnitude and rank order of disease specific mortality. Such assessments provide information for health policy and planning purposes, as well as enable monitoring of existing health programmes. Only about a third of all countries in the world have civil registration systems that produce complete, valid, and timely statistics of this nature. In this article, we examine critical issues that determine the functioning of national mortality registration systems in nine African countries and identify key administrative, technical and societal issues. We propose a priority setting strategy to address such problems, drawing on the recent experience of South Africa in improving vital registration.

African countries should be encouraged to establish expert teams to critically review their national civil registration systems in terms of the legal framework, organisational issues, system design, training needs and quality control issues. Country level expert teams should examine the feasibility of innovative approaches such as sample registration systems and verbal autopsy questionnaires should be used as interim measures to obtain data for policy and planning. Political will is an essential ingredient. The need to revitalise vital registration and statistics must be placed high on the development agenda.

Keywords

Civil registration systems, Africa, death registration, causes of death, mortality statistics

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INTRODUCTION

Mortality statistics are primary inputs as evidence for health policy and planning purposes, for monitoring specific health programmes, and for identifying and prioritising health research activities (Ruzicka and Lopez 1990). Information on child and adult mortality rates and causes of death is clearly important to inform regional and national health policies, and to monitor the impact of interventions and progress towards goals such as the Millennium Development Goals (United Nations Development Programme 2000). Data from complete civil registration systems are the "gold standard" for mortality statistics. Although civil registration systems also monitor other aspects of civil status such as marriage, divorce and migration, vital registration includes the events of birth and death. A complete vital registration system is one in which all births and deaths in the population served are legally registered, with the cause of death being medically certified. These systems serve a dual purpose, namely to establish civil status of resident population for legal and other purposes, and to generate statistics for policy and planning. The registration of cause of death assumes additional significance to establish legally whether the death resulted from natural causes or from foul play. Registration of births is of critical importance for accurate measurement of neonatal and infant mortality. The process of establishing and developing a death registration system requires considerable resources, and in many countries, they have taken more than a century to become efficient.
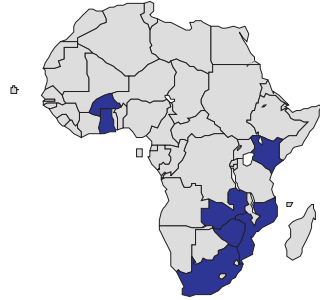
Out of 192 World Health Organization (WHO) member states, there are 115 that have reported annual mortality data for a year more recent than 1995 (Mathers, Inoue, Ma Fat *et al.* 2005). However, only 70 countries have death registration systems that are considered to be essentially complete, and produce timely annual statistics on cause specific mortality. In another 45 countries, registration systems are in advanced stages of development, with reasonably high population coverage. However, the quality of information on causes of death is often doubtful, as many deaths occurring in households do not have the cause of death certified by a medical practitioner, but rely on some form of "lay reporting" by relatives (World Health Organization 1978).

Two large countries, China and India, have established Sample Registration Systems that provide useful data at national level (Registrar General of India 2002; Yang, Zheng and Zeng 1992). However, because they represent only a fraction of the national population, they do not serve the primary purpose of establishing civil status for all national residents. For most other countries,

including many within Africa, there is virtually no information on numbers of births, deaths, and causes of death available from civil registration systems. Available information is chiefly from a few demographic surveillance systems in operation in several countries (The INDEPTH Network (eds) 2002), or from health service based statistics systems (e.g. Botswana). As with sample registration, these systems do not establish civil status of resident population. At the 3rd African Population Conference in 1999, Obonyo and Bauni (1999) and Zanou (1999) concluded that despite the articulated need for civil registration in Africa, little effort had been made to improve the situation.

During the last few years, WHO has undertaken a major effort to collect cause-specific mortality data from vital registration systems in member states (Mathers, Stein, Ma Fat *et al.* 2002). All 46 member states in sub-Saharan Africa were contacted to provide such information. Nine countries provided data on deaths by age, sex and cause, as shown in Figure 1. Reported age specific death rates could be tested for completeness of registration using standard demographic methods (Preston 1984). For this review, the extent of registration is described as a coverage estimate, expressed as the percentage of reported deaths to the WHO estimate of deaths for that country year (Mathers, Inoue, Ma Fat *et al.* 2005). There is substantial variation in the estimated coverage for different countries in Figure 1, but only the two small Island countries demonstrate good coverage of death registration. The coverage estimate for South Africa was debatable, with the official figure from Statistics South

Figure 1 Death registration systems in Africa: Latest available data and estimated coverage rates, 2003

Country	Year of data	Coverage estimate (per cent)
Botswana	1998	25
Ghana	2001	25
Kenya	2001	60
Mauritius	2000	90
Mozambique	2000	5
Seychelle	1998	99
South Africa	1996	67
Zambia	2000	16
Zimbabwe	1995	40

Africa in 1996 at 67 per cent (2000), while other researchers consider the figure is closer to 80 per cent (Bradshaw, Schneider, Dorrington *et al.* 2002). In addition, there was variation in the statistical formats used to report the data, in terms of cause-of-death codes.

A workshop was organised by WHO in February 2003, to examine the vital registration systems in nine African countries (Botswana, Ethiopia, Ghana, Kenya, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe) (Kowal, Rao and Mathers 2003). This paper reviews the issues that emerged from the discussions in the workshop. While specific criteria are available to critically evaluate quality and usability of national mortality statistics in terms of adequacy of content and timeliness of data (Mahapatra and Rao 2001; Rao, Gonghuan, Lopez *et al.* 2004), this article focuses on the determinants of a satisfactory civil registration system for generating these statistics, in terms of its structure and organisation. The framework proposed by Powell is used to identify and prioritise critical problems (Linder and Moriyama 1984). This is based on consideration of the administrative aspects, the technical issues and societal issues and facilitates the identification of strategies for improving death registration to produce useful information on levels and causes of death within the foreseeable future.

ADMINISTRATIVE ASPECTS OF MORTALITY REGISTRATION
Several events involving multiple institutions are necessary between the event of a death and the production of cause-specific mortality tabulations at the national level. Generally, more than one government department is involved and the compliance of the general public, the civil registration authorities, the health system, and the statistical office are crucial for adequate performance of the system. The legal framework and structural organisation for death registration are basic administrative pillars that determine functioning of the system. Understanding these aspects at country level are an important first step in addressing improvements, and we describe a few salient characteristics of these aspects below.

Legal framework
A sound and comprehensive legal framework is fundamental to the establishment of a well-functioning death registration system. A national Registration Act, and an associated set of Rules and Regulations, should provide the following:

· adequate definition of duties and responsibilities of the citizen as well as the government;
· a complete set of forms and instructions on use of the forms;
· a clear administrative hierarchy for the collection and submission of data;
· nomination of responsible individuals at each level in the hierarchy, with adequate delineation of responsibilities;
· responsibilities of central agencies for collation, analysis, and publication of vital statistics; and
· provisions for public access to individual records, as stipulated in the law.

Table 1 Summary of national death registration laws and procedures in African countries

Country	First VR laws/ Latest update	Nationwide compulsory registration	ICD certificate/ version for tabulation	Latest year of statistics	Coverage
Botswana (1983)	1968/1983	Not specified in act or rules	Yes/ICD-9 BTL	1998	26%
Ethiopia (1960)	First draft laws under legislative process	Current system voluntary	Not known/ICD-6	Not available at national level	Unknown
Ghana (1965; 1970)	1965/1968	1968	Not known/ICD-9	2001	25%
Kenya (1972)	1928/1971	1971	Yes/ICD-10 (for institutional deaths only)	2001	60%
Mozambique (Dgedge 2003)	1975/1988	No law about compulsory national registration	Yes/ICD-7–8 (for institutional deaths only)	Not available at national level	60% urban, 10% rural
Tanzania (1989)	1923/1989	Not specified in act or rules	No	Not available at national level	Unknown
South Africa (Bradshaw and Schneider 1995)	1959/1998	1978	Yes/ICD-9 bridged to ICD-10	1996	Estimates vary from 67–80%
Zambia (Kamwengo 2003)	1898/1973	In law, but driven by individual interest	Yes/ICD codes not used	2000	16%, only in urban areas
Zimbabwe (1994)	1986/1994	1986	Yes/ICD-9 3 character	1995	40%

The legal frameworks of the nine African countries are summarised in Table 1. All countries have official laws for registration, except Ethiopia, where draft laws are currently in the legislative process. Previously, the Ethiopian Civil Code (Ethiopia 1960) did contain some clauses for death registration, which are followed to some extent in urban areas. The extension of registration to cover all regions or communities within some countries has taken nearly half a century. Reviewing the legal framework to update the organisational structure and incorporate current data standards demonstrates political will and conveys governmental interest in this issue. South Africa enacted the Births and Deaths Registration Act in 1992 (Republic of South Africa 1992) with detailed provisions for notification and registration of births and deaths.

Organisational issues

Civil registration is the responsibility of the Ministry of Home Affairs in most African countries. Responsibilities for registration are devolved through an administrative hierarchy to primary units, which are typically municipal or city councils in urban areas, and village councils/headmen in rural areas. The process of registration is usually initiated in the health sector with a medical practitioner certifying the cause of death. This information is then submitted through mortuary and undertaker services to the Home Affairs office for

Figure 2 General structure of national death registration systems
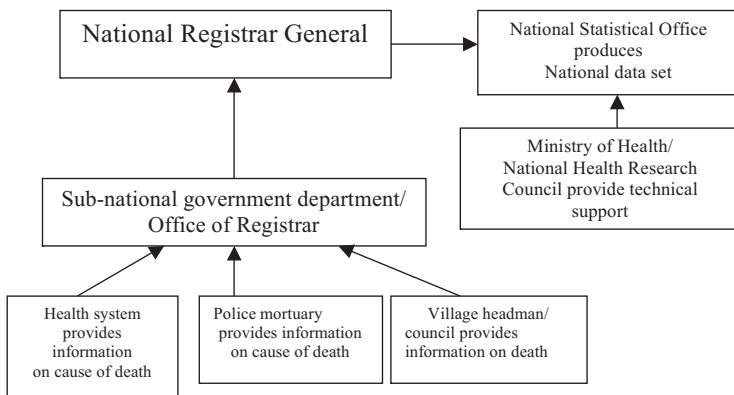
registration. Where there are no health practitioners, as in rural areas, deaths are registered by village headmen with a 'lay' opinion on the cause of death. The Ministry of Health and/or the national statistical office may then become involved again to coordinate coding of cause of death, and to process and tabulate summary data. Figure 2 summarises the process of registration, the administrative relationships between different responsible organisations, and the flow of data till their final publication as statistical tabulations.

The collaboration and compliance of hospitals, health practitioners, coroners and pathologists is essential for proper cause of death attribution at the time of death registration. Overlapping responsibilities and poor collaboration between different sectors have been cited as major impediments to system development in Kenya and Zambia (Kowal, Rao and Mathers 2003). In Ghana, there were shifts in the responsibility in overseeing civil registration from the Ministry of Local Government in 1966, to the Ministry of Finance in 1972, to the Ministry of National Statistics in 1981, which has delayed the complete implementation of civil registration laws in the country. For instance, in 2001, hospitals from only the eastern region of Ghana were reporting causes of death. In Botswana, national statistics are based on data from health information systems for urban areas only, not from civil registration records.

The first step in analysing an existing registration system is to examine the structure of the system. Such an investigation in Cape Town (Bradshaw and Schneider 1995) led to an analysis of problems at national level in South Africa, and a national technical committee was established with representatives from the Ministries of Home Affairs, Health and Statistics. When advising structural changes to the system, it is useful to bring together data producers and data users to effectively plan the reforms.

System design
Comparability of data across populations and over time demands standard data definitions, design of forms, procedures for cause of death certification, coding systems and formats for summary tabulations. While all these issues are subtly related, the latter two are more technical and are dealt with in the next section.

Standard data definitions are especially important for issues related to births and infant mortality. For instance, internationally prescribed guidelines for registering and reporting live births by duration of gestation/birth weight

should be adhered to. Regarding stillbirths, clear definition of these parameters for registration should be provided. In the case of adult deaths, proper definitions and guidelines are required for determining whether a specific event requires official investigation as to the cause of death, as a medico-legal case. The WHO prescribes an international form of medical certificate of cause of death to be used uniformly in all member states (World Health Organization 1993). This is not widely used in the African countries reviewed. As shown in Table 1, the WHO cause-of-death certification format is used for deaths certified by medical practitioners in several countries, but not for deaths outside medical institutions. In Kenya, for example, the death registration form for deaths in rural areas contains a list of 12 causes, and the registrar selects one from information obtained through 'lay reporting'. However, national statistics lump together data from rural areas along with data from urban areas collected on WHO death certificates, and these dissimilar formats result in difficulties in data compilation and comparability.

Officials in South Africa undertook a consultative process to redesign their mortality registration form. The Cape Town study had identified that the death notification form needed revision to permit the functions of registration, certification, burial and health information in one form and to bring the cause of death section into line with international standards (Bradshaw, Kielowski and Sitas 1998). At the same time, a national law commission investigating the implications of HIV/AIDS and issues of confidentiality resulted in the separation of health information, including the cause of death, from the rest of the form so as to facilitate confidential handling of these data (Dhai, Dada, Kirk *et al*. 2001). This would also provide certifying physicians the freedom to express their professional opinion about the presumptive cause of death, since these data are to be used only for statistical and planning purposes. The new form was introduced in 1998 through legislation (Republic of South Africa 1998). However, the use of a different form for completion by a village headman, in the absence of a medical certifier, was also re-introduced in 1998.

TECHNICAL ISSUES

The use of standard methods for compiling cause-specific mortality statistics for international comparison is an area of technical expertise that cuts across the disciplines of demography, epidemiology and statistics. Capacity needs to be built in these disciplines by academics with practical experience in such data

collection and management, who can transfer technical expertise and teaching skills to local personnel to sustain capacity development for expanding registration systems. Specific technical aspects include the coding of causes of death, various elements of capacity building, and quality control measures.

Data standards for coding and statistical tabulations

Underlying causes of death should be coded according to the current tenth revision of the International Classification of Diseases and Injuries (ICD) (World Health Organization 1993). The WHO recommends national level statistical tabulations at the ICD-10 three-character level. These can be presented at various different age groupings, depending on level of detail at which data are available, but it is advisable to use standard five-year age groups up to age 85 and above (World Health Organization 1993).

No African country is fully using ICD-10 (Table 1), although South Africa did bridge coding in 1996 using ICD-9 and ICD-10 at three-character level, but reported statistics only according to ICD-9. Zambia, Kenya and Mozambique publish statistics using only disease labels without corresponding codes. This limits both the understanding and the usability of the data. Ethiopia uses ICD-6 for official cause of death statistics in some municipalities. In Tanzania, due to lack of data from the national death registration system, information from the Adult Morbidity and Mortality Project (AMMP) (Ministry of Health and AMMP Team 1997) is used for health policy and planning purposes, which is compiled using non-ICD labels and codes.

Insufficient technical and human resources hamper the coding process in most countries. Despite the extensive improvements to the South African system, there remains a lag in the production of statistical tabulations, available only up to 1996. In general, a time lag of up to two years might be considered reasonable, considering the need to collect, collate, validate and then publish cause of death statistics.

Capacity building requirements

A newly designed or restructured registration system will require trained administrative and technical personnel. The importance of physician training for cause of death certification cannot be overemphasised. Simple training programmes using locally available resources (for example, hospital case records and completed cause-of-death certificates providing correct and incorrect examples) can be drawn up and conducted periodically. Training on

cause-of-death certification, and on the uses of such information, should be included in medical training curricula and in continuing professional training.

Capacity building is also required for administrative personnel. In Kenya, lack of training and feedback has been mentioned as a cause of apathy and lack of motivation in staff (Kowal, Rao and Mathers 2003). Coupled with this is the lack of capacity to analyse data at the local level, with the resultant non-utilisation of data at local levels leading to further inattention to the system. Training in ICD coding is central to the production of useful statistics on causes of death. Support in ICD coding and data analysis will be needed at country level, with support from WHO on a regional basis. At central levels, training is required for personnel involved in data transfer, processing, analysis, tabulations, data validation and dissemination. Computerisation, with proper training, can greatly improve speed and accuracy of data processing and analysis. However, the capacity to assess the quality of data and to interpret them is also essential to ensure that the data can be used optimally to inform policy.

Quality control aspects
The coverage of civil registration systems and the quality of cause of death information are two important aspects that need to be monitored. The experience of South Africa in this regard serves as a useful example. Table 2 shows that the coverage of registration of deaths for adults has increased since 1990.

This increase was influenced by several specific government initiatives:
· provincial task teams involving all key players, including representatives from undertaker agencies, developed a strategy to enhance registration, while facilitating introduction of the new death notification form;
· death certification and ICD code manuals were distributed to hospitals, academic and health professional organisations for training of personnel;
· letters were dispatched to all registered doctors, informing them of the revised procedures for death certification and relevant guidelines.

The proportion of deaths assigned to the ICD codes for "symptoms, signs, and ill-defined conditions" (ICD-9 codes 780–799; ICD-10 codes R00–R99) is one indicator of the quality of coding for the death registration system. The sudden expansion of death registration in the early 1990s resulted in a rise in this proportion (see Figure 3), followed by a fall after additional training in cause attribution. A sample of 16 000 death certificates was evaluated, and

feedback on quality of certification was provided to medical practitioners, which helped improve data quality.

Table 2 Annual registered adult deaths and estimated levels of completeness of registration, South Africa, 1989–2000

Year	Number of adult deaths registered	Estimated completeness (per cent)
1989	141 876	60
1990	129 256	54
1991	145 587	59
1992	152 485	61
1993	168 489	57
1994	205 266	73
1995	231 932	79
1996	258 220	85
1997/98+	295 483	87
1998/99+	326 761	87
1999/2000+	366 790	89

Source: Dorrington, Bourne, Bradshaw *et al*. 2001

Figure 3 Trend in proportion of deaths assigned ill-defined codes, South Africa, 1981–1996
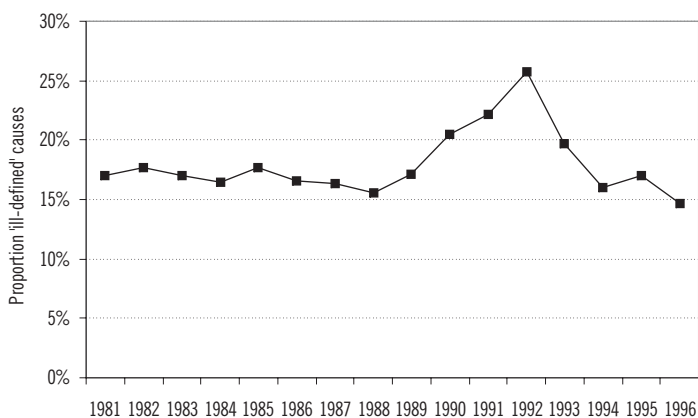
Source: Bradshaw 2003

There are several other aspects in which reported cause of death statistics need to be evaluated for assessing their usability for health policy and monitoring (Mahapatra and Rao 2001), and such assessments should be built into regular quality control mechanisms in the death registration system.

SOCIETAL ISSUES
Political will

Strong political support is essential for establishing collaboration between different agencies and personnel involved in the registration system. It was political commitment that resulted in the progress achieved in the South African vital registration system, following the development of a strategy for improving it (Bradshaw and Schneider 1995). In Ethiopia, absence of a legal framework has hampered the development of the civil registration system. However, current political support has led to establishment of the Vital Statistics Registration Study team, which has the responsibility of overseeing the development of draft Civil Registration Laws, and their subsequent implementation (Hagos and Geressu 2003).

Improvements in death registration data require a concerted demand for valid and reliable mortality data from policy-makers, bureaucrats, social scientists, and health professionals. Short capacity-building programmes on the importance and uses of data from vital registration systems should be organised for policy-makers and other government staff. Such programmes can generate the political and administrative support required to devise and implement reforms in national registration systems, and subsequently monitor performance, and improve accuracy.

Public awareness

Active public participation is essential in the process of civil registration. This can be increased by public awareness of the basic purposes of civil registration, and the responsibilities of the citizen and the government towards it. Linking individual records of civil status to basic citizen's rights can help increase awareness, e.g. school enrolment, property transfer mechanisms, and survivor or dependency benefits. Public cooperation can be actively solicited through linking vital records to respect for human rights. At the same time, the State has an obligation to provide the necessary organisational structure, sound legal framework, and adequately trained staff.

Innovative approaches are available for enhancing public awareness. In

Zimbabwe, mobile registration campaigns are conducted occasionally, waiving certain fee liabilities for delayed birth and death registration. In South Africa, there have been attempts to develop an unofficial notifier system involving midwives, nurses, graveyard attendants, schoolteachers and religious officials, which would increase community participation through increasing awareness and enabling people to become part of the registration process. In many countries, mass media campaigns use newspapers, radio and television to promote public awareness of citizens' rights and responsibilities towards registration of births and deaths.

STRATEGIES FOR IMPROVEMENT IN REGISTRATION

At the workshop, several strategies to improve cause-of-death registration were highlighted. The South Africa experience demonstrated the importance of assessing the problems in the functioning of vital registration, described by Powell as follows (Linder and Moriyama 1984):

· *Relatively intractable problems:* such as widely dispersed populations, lack of adequate infrastructure to provide services, illiteracy and low public compliance.
· *Solvable problems requiring large amounts of funding:* Staff development, office space, record storage/retrieval facilities, essential forms and supplies require significant capital and running investments, and these may be substantial enough to deter the attempt to set up a comprehensive vital registration system.
· *Solvable problems, with small financial inputs:* Adequate legislation, procedural problems that can be solved by planned intersectoral collaboration, targeted training requirements for specific weak elements in the system, etc. It is likely that many problems within the South African system would fall into this category.

Categorisation of problems using this classification can help plan measures to improve efficiency of national vital registration systems. Additionally, two interim strategies – use of sampling and verbal autopsy – may help towards the production of useful and representative information on causes of death.

Sampling

A Sample Registration System (SRS) has been developed in India and the Disease Surveillance Points (DSP) system in China to produce nationally representative statistics, since it is considered not feasible to establish complete

civil registration systems to cover the entire population in the near future. SRS is based on continuous enumeration of births and deaths within a nationally representative set of population clusters, or primary sampling units. Sample registration systems may be useful interim measures towards developing complete civil registration systems and provide lower cost but representative national statistics for health policy and monitoring. While they do not fulfil the State's obligation to provide civil registration services to all citizens, they can be used as pilot ventures towards the establishment of complete systems.

SRS could potentially be applied in a country such as Kenya, which has an established civil registration data collection system but no systematic collection of the statistics (Mbuvi 2003). A selected number of sample units, ideally randomly selected, could be set up for the compilation of statistics. Alternatively, SRS may be restricted to sub-national regions under-served by civil registration. For example, in South Africa, there is near complete urban registration, and sample sites in rural areas could be a useful supplementary source of data. In Tanzania, four major districts are covered by complete registration under the Adult Morbidity and Mortality Project (Ministry of Health and AMMP Team 1997), and it would be useful to have sample units in other districts in order to obtain national data.

Verbal autopsy

Medical certificates on cause of death are ideally required to provide good cause of death statistics. However, in rural areas or in the case of home deaths, a verbal autopsy interview may be the most suitable method to obtain information on the cause. If the deceased had visited a health facility, it is possible that members of the household could possess some information regarding the illness before death. Verbal autopsy questionnaires have been developed to include these items, as well as an open narrative section to record information about the signs and symptoms experienced by the deceased prior to their death (National Sentinel Surveillance System 2001). While these methods have been extensively used for evaluating causes of childhood and maternal mortality (Hussain, Bhuiyan, Haque *et al.* 2002; Snow, Armstrong, Forster *et al.* 1992), there are several issues related to their use for adult deaths (Chandramohan, Maude, Rodrigues *et al.* 1994). The implementation of verbal autopsy approach to supplement cause of death statistics has been mooted as an option to obtain cause of death information to supplement death registration by village headmen in rural areas of South Africa. For population level cause-of-death assessment,

verbal autopsy methods are best implemented in a demographic surveillance system, with mortality events linked to a well-defined resident population, preferably a representative sample of the national population. Training in administering the interview, as well as reviewing questionnaires to ascertain cause of death, are critical for an efficient verbal autopsy system. Use of these methods in different settings should be accompanied by studies to measure their reliability and validity for specific causes of death.

CONCLUSIONS

Strengthening civil registration systems in Africa is a critical step for obtaining mortality statistics for health policy and evaluation purposes and should form part of the development agenda. Countries should be encouraged to establish expert teams to critically review their national civil registration systems in terms of the legal framework, organisational issues, system design, training needs and quality control issues. Practical strategies to improve the systems should be developed by identifying the problems that are solvable and the level of funding required to overcome them. Priorities should be set for intervention, with specific targets to monitor progress.

Country level expert teams should examine the feasibility of innovative approaches such as sample registration systems and verbal autopsy questionnaires as interim measures to obtain data for policy and planning. Universities with public health, anthropology and social sciences departments should be encouraged to undertake specific areas of research on verbal autopsy procedures, with a view to incorporating such methods within the framework of sample/civil registration systems, as necessary.

It must be recognised that political will is an essential ingredient and the need to revitalise vital registration and statistics must be placed high on the development agenda. In 2004 the WHO launched the Health Metrics Network, a broad partnership including other international organisations, bilateral agencies, ministries of health and civil society organisations. One of the key focuses of the Health Metrics Network will be to improve the completeness and quality of information on causes of death in populations. International recognition of the need to invest in the health of Africa to promote development and the funding opportunities that arise from this should be harnessed to build the infrastructure needed to monitor causes of death in the region.

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