Harmonizing health information systems with information systems in other social and economic sectors

Sarah B. Macfarlane[1]

Abstract Efforts to strengthen health information systems in low- and middle-income countries should include forging links with systems in other social and economic sectors. Governments are seeking comprehensive socioeconomic data on the basis of which to implement strategies for poverty reduction and to monitor achievement of the Millennium Development Goals. The health sector is looking to take action on the social factors that determine health outcomes. But there are duplications and inconsistencies between sectors in the collection, reporting, storage and analysis of socioeconomic data. National offices of statistics give higher priority to collection and analysis of economic than to social statistics.

The Report of the Commission for Africa has estimated that an additional US$ 60 million a year is needed to improve systems to collect and analyse statistics in Africa. Some donors recognize that such systems have been weakened by numerous international demands for indicators, and have pledged support for national initiatives to strengthen statistical systems, as well as sectoral information systems such as those in health and education.

Many governments are working to coordinate information systems to monitor and evaluate poverty reduction strategies. There is therefore an opportunity for the health sector to collaborate with other sectors to lever international resources to rationalize definition and measurement of indicators common to several sectors; streamline the content, frequency and timing of household surveys; and harmonize national and subnational databases that store socioeconomic data.

Without long-term commitment to improve training and build career structures for statisticians and information technicians working in the health and other sectors, improvements in information and statistical systems cannot be sustained.

Introduction

The information needs of health and development policies in low- and middle-income countries could be better served if there were more coordinated management of data across the economic and social sectors. There are currently costly duplications, inefficiencies and inconsistencies between institutions in the collection, reporting, storage and analysis of data, and a ubiquitous shortage of the human resources needed to design and manage information systems. The Report of the Commission for Africa estimated that an additional US$ 60 million per year would be needed "to help Africa improve systems to collect and analyse statistics" (*1*). The Health Metrics Network (HMN), which has a budget of over US$ 50 million for 7 years (*2*), must ensure that health information systems (HIS) interact effectively with other information systems to increase the availability of quality data for the evaluation of interventions to improve health and poverty-related issues.

The 1978 Declaration of Alma Ata (*3*) provided an opportunity to develop HIS to reflect broader development needs. Measurement of the indicators for monitoring progress towards the Global Strategy for Health for All by the year 2000 and evaluation of primary health care necessitated community-owned population-based systems that provided intersectoral information to, and required it from, facility-based administrative information systems (*4*). This would have entailed a

[1] Senior Advisor, Global Health Sciences, Visiting Professor, Department of Epidemiology and Biostatistics, University of California, San Francisco, Suite 285, Box 0443, 3333, California Street, San Francisco, CA 94143-0443, USA (email: macfarlane@globalhealth.ucsf.edu).

radical overhaul of the, then predominantly hospital-based, HIS. Instead, the introduction of selective primary health care (*5*), and the coincidental arrival of desktop computers, drove the development of computer-based systems (*6*) which enabled programme managers to monitor vertical programmes and account to international agencies. In 1989, de Kadt observed that "health information remains locked in the collection of data conventionally demanded, yet seldom properly used, by those responsible for the health services" and that "relatively little is being done to adjust the information systems to this new intersectoral approach" (*7*). Subsequent efforts to promote intersectoral action for health (*8*, *9*) have not succeeded in altering the design of HIS or their links with other information systems.

Intersectoral data requirements for sustainable development

In creating a global partnership for sustainable development, Agenda 21 emphasized the importance of "bridging the data gap" by increasing the relevance and availability of data, improving the cost-effectiveness of data collection and developing capacities for data management and analysis across all sectors (*10*). The plan of action emphasized that "the linkage of health, environmental and socioeconomic improvements requires intersectoral efforts". PARIS21 (Partnership in Statistics for Development in the 21st Century) was set up to help bridge the data gap by advocating the use of statistics, and engaging statisticians and policy-makers in dialogue (*11*).

The Millennium Declaration of eight development goals (MDGs) has intensified international pressure to strengthen information systems to monitor 48 target indicators — 18 of which are health-related (*12*, *13*). The Human Development Report, 2003, stressed the "unprecedented demand, [and] urgent opportunity" provided by the MDGs to strengthen statistical frameworks and build statistical capacity (*14*). According to the United Nations (UN) Millennium Project "Today's ad hoc international statistical efforts are unreliable — often duplicative, inconsistent, and burdensome to national governments" (*15*).

The World Bank and the International Monetary Fund (IMF) provide concessional lending and debt relief to heavily indebted poor countries on condition that they develop poverty reduction strategy papers (PRSPs) (*16*). The PRSPs analyse which people are poor, where they live and why they are poor. They propose macro-economic, structural and social policies to reduce poverty and its outcomes. Governments are required to review their national monitoring and evaluation systems and identify ways in which they will be modified to monitor the consequences of the PRSPs. A major challenge for poverty reduction is to bring about positive changes in macro-economic trends that are reflected in improvements in socioeconomic development indices that are visible to the public.

A review by WHO of 21 country PRSPs concluded that, although there was widespread acknowledgement of the importance of health, the PRSPs were not fulfilling "their potential to stimulate cross-sectoral action for health" (*17*). The report suggested that the health sector, both national and international, be more proactive in improving "the links between the PRSP and other processes which can help improve the poverty focus of the health component". Health impact assessment, developed to predict the health consequences of large-scale construction

projects, has been proposed as a "way to support these strategies and integrate economic and social activities with health concerns" with the potential to "catalyse intersectoral action for health" (*18*).

Interdependence between the information needs of health and other sectors

Some health programmes depend on information obtained from another sector — for example, prediction of epidemics on the basis of climate data (*19*), prevention of trauma on the basis of transport data (*20*), management of malnutrition on the basis of food security data (*21*), monitoring of chronic diseases through risk factor surveillance (*22*), or planning of public health interventions on the basis of environmental indicators (*23*). The implementation of Community-based Integrated Management of Childhood Illnesses (C-IMCI) is based on multisectoral interaction (*24*) between governmental, nongovernmental, private and civil society groups, which traditionally do not exchange data with each other. The response to human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) brings institutions together to halt the epidemic, and to collate information (*25*) about its impact on, for example, education, employment, production, tourism, trade and governance across cultures.

Where the information interests of the health sector, other sectors and the people they serve coincide is in understanding and addressing the social factors that lead some people to experience poverty and poor health. Sweden's new public health policy, for example, prioritizes strategies to address determinants of ill health rather than the conditions themselves (*26*) and WHO has set up a Global Commission on Social Determinants of Health (*27*).

But social statistics remain the "Cinderellas of statistical systems" when compared to economic statistics traditionally collected through the standard UN System of National Accounts (*28*). Felligi has suggested that their relative underdevelopment may be explained in part by the lack of an overall conceptual framework for data collection and analysis, and the fragmentation of statistical systems in countries where line ministries do not necessarily have the expertise or resources to manage the complex systems required to collect, link, analyse and interpret social statistics (*28*).

Statistical systems

Health practitioners operate HIS as stand-alone systems, but it is important to understand that they function within complex statistical systems (Fig. 1).

National statistical systems

National statistical systems, broadly defined, are networks of governmental institutions charged to collect and disseminate official statistics. They are overseen by a national statistical office (NSO), and guided by legal, administrative and professional standards. In countries with largely centralized statistical systems, such as Armenia, Canada, Indonesia, New Zealand and Sweden, the NSO has legal authority over the production of official statistics even in the line ministries. In countries with largely decentralized statistical systems, such as Cambodia, Philippines, Singapore, Uganda and the United Kingdom, line ministries meet certain legal requirements, but are run independently of the NSO and of each other.

Some centralization of statistical systems is advantageous where technical resources and expertise are in short supply. But many low- and middle-income countries operate decentralized statistical systems so that, in maintaining its management information system, each line ministry (e.g. education, environment, production and labour) is likely to face problems familiar to the health sector. These include unreliable and unrepresentative data, lack of timeliness and inadequate coverage, scarcity of staff with adequate skills to design studies and analyse data, shortages of paper and equipment, and little feedback on or use of the data.

Subnational statistical systems

As a consequence of fiscal decentralization, subnational statistical systems are created at lower levels of administration, for example at the district level. As local governments gain control over resource allocation, newly created district planning offices demand information from sectoral planning offices that are set up to report directly to their national line ministries. A project to build subnational statistical systems in Bulgaria, Romania, the Slovak Republic, Slovenia and Ukraine (29) identified challenges that included the following:

— inconsistencies between sectors in their sources and definitions of similar data, between reporting periods used, and in the database software employed;
— tensions between local data needs and central demands for sometimes obsolete data;
— the need to harmonize administrative reporting units used by different institutions and, at the same time, ensure that data collected centrally could be meaningfully disaggregated;
— a shortage of trained staff to manage the subnational statistical systems;
— difficulties in retaining confidentiality when linking local data between systems; and
— creating incentives for institutions to share information.

The international statistical system

The international statistical system is a structure, led by the United Nations Statistics Division, for reviewing and standardizing national data to produce internationally comparable indicators. Representatives of statistical offices of Member States and international agencies are convened by the United Nations Statistical Commission (UNSC) which "considers special issues of concern in international statistical development, methodological issues, coordination and integration of international statistical programmes, support of technical cooperation activities in statistics and organizational matters" (30).

Problems of coordination between the international agencies with their separate demands for data have a negative impact on the efficiency of national statistical systems. The UNSC recently called on WHO to improve collaboration with the international statistical system, and with national statistical systems, in the collection, production and dissemination of health statistics, and in the development of methodologies, definitions and concepts. WHO's mandate is to work directly with ministries of health, but the Commission emphasized the need for WHO to liaise with NSOs pointing out that this would build statistical capacity in fragmented HIS (31). The Organisation of Economic Co-operation and Development (OECD) has recommended donors to build programme

Fig. 1. **Framework of statistical systems within which health information systems (HIS) function**
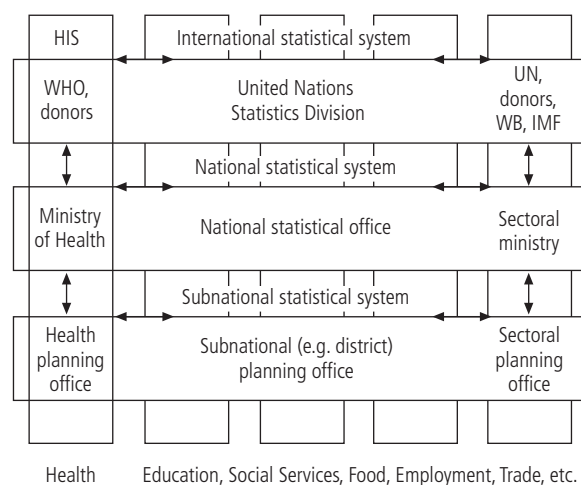
WHO, World Health Organization; UN, United Nations;
WB, World Bank; IMF, International Monetary Fund.

WHO 05.88

evaluations that strengthen and take advantage of country information systems rather than build parallel systems (32). PARIS21 has developed a set of indicators to measure statistical capacity in countries receiving assistance from multilateral and bilateral donors (33).

The 2004 Marrakech Action Plan for Statistics recommended increased resources to support all low- and middle-income countries to prepare national statistical development strategies by 2006 (34). International resources directed towards strengthening national statistical systems include the multi-donor Trust Fund for Statistical Capacity Building (TFSCB) (35), the World Bank's horizontal loan programme (STATCAP) (36), and IMF's General Data Dissemination System (GDDS) (37). Most of these initiatives are directed at NSOs and do not necessarily have an impact on the work of statistical offices in line ministries such as the ministry of health. PARIS21 has proposed a planning framework for these efforts (38) and is working to ensure the involvement of line ministries within it.

Harmonizing technical tools

NSOs are responsible for national population and household censuses, but the major tools used by HIS — surveys, and routine reporting — are common to information systems in other sectors. Surveillance of infectious diseases, risk factors for chronic diseases or demographic events is an activity that is generally unique to the health sector.

Database systems

The availability of powerful computers and of reasonably priced software has led to a proliferation of database systems. Ministries and local governments, with limited information technology skills, struggle to link databases across public, nongovernmental and private institutions to track indicators for MDGs, PRSPs and sector performance. For example, Uganda has proposed a national monitoring and evaluation framework to rationalize at least 15 database systems in different sectors (39). In 2004, DevInfo, developed by the UN Children's Fund (UNICEF), was endorsed as the UN database for monitoring the MDGs.

By the end of that year, training in the use of DevInfo had been provided to at least 117 countries (40). National databases, such as the Tanzania Socio-Economic Database (TSED) (41) based on DevInfo, collate indicators from sectoral information systems to monitor PRSP and MDG indicators.

Geographical information systems

Geographical information systems provide coherent demonstrations of geographical disparities in poverty, social determinants and service delivery. Several systems are in use, for example, DevInfo has a mapping facility within it, and HealthMapper (42) is a WHO system for mapping public health data. The UN has set up a working group to agree standards and achieve some compatibility in core data and geographical boundaries.

Surveillance

Disease and risk factor surveillance, major components of HIS activities, use passive and active reporting systems, targeted surveys and case–control studies. The epidemic of severe acute respiratory syndrome (SARS) has demonstrated the efficiency with which institutions and government sectors can share information nationally and internationally when faced with a common and immediate threat, and laid foundations for greater future cooperation (43). Demographic and health surveillance — continual oversight of demographic and health events in a defined catchment population — provides estimates, for example, of life expectancy and of distributions of disease burdens at sentinel sites. The International Network of field sites with continuous Demographic Evaluations of Populations and Their Health in developing countries (INDEPTH) coordinates 33 sites in 18 countries, some of which are collaborating in research on the social determinants of health disparities (44).

Household surveys

Because of inadequate coverage of systems for the routine collection of data there is increasing reliance on household surveys to provide comprehensive socioeconomic indicators — for example the World Health, Demographic and Health, Multiple Indicator Cluster, Labour Force, Household Budget, Core Welfare Indicators, and Income Expenditure surveys. Few ministries, and even NSOs, in low- and middle-income countries have sufficient statistical expertise to design and analyse large-scale surveys, and often rely on external consultants. Different household surveys have overlaps in their content and there are inconsistencies in timing, sampling schemes and data definitions. To address this problem, the United Republic of Tanzania, for example, has scheduled a sequence of one national survey (or census) each year over a 10-year cycle rather than creating a new survey tool to monitor poverty reduction targets (45). The International Household Survey Network (IHSN) (46), created by way of follow-up to the Marrakech Plan of Action for Statistics, seeks efficient approaches to household surveys, for example, by harmonizing survey design, developing a minimum programme of household surveys across sectors and agencies, and creating a survey archive.

Human resources

The acute shortage of human capacity to operate statistical and information systems has not been addressed. Lehohla, Statistician General for South Africa, drew attention to the scale of this problem, emphasizing the need to train statisticians as "custodians of democratic principles of transparency

in measurement and accuracy, and therefore of accountability" (47). He estimated that South Africa needed to train at least 2000 people a year in basic statistical skills to satisfy the increased demands for information, particularly in municipalities. This level of demand for training is reflected in many African countries, particularly those undergoing fiscal decentralization. Uganda, for example, has plans to employ at least one statistician in each of its 56 district and 13 municipality planning units; the United Republic of Tanzania plans to train statistical staff to work in planning offices in 121 districts. The two major suppliers of statistical training for English-speaking African countries are the East African Statistical Training Centre, United Republic of Tanzania, and the Institute of Statistics and Applied Economics at Makerere University, Uganda, but as Lehohla has pointed out these two institutions are unable to meet the escalating demand.

Despite the overriding international concern about shortfalls in the health workforce, little attention is being given to the career structures of people who work within HIS. Some have professional training in medical records, medical statistics, demography, epidemiology or database management, and others may or may not have received some short-course training. In-service training is often project-related, for example in the use of specific software or in data collection for a specific type of survey. There is little professional connection to the NSO, where there are usually more opportunities for professional development.

Challenges and opportunities

In 1989, de Kadt wrote "WHO proclaims the importance of intersectoral action for health, but obviously underestimates the inertia of HIS and the true revolution needed in these systems to provide the data necessary for the monitoring of intersectoral action for health, and for feedback" (7). Eleven years after the Declaration of Alma Ata, he was optimistic about adapting HIS to the "new intersectoral awareness". Why, after a further 16 years of inertia, can we expect change and how can change be effected? Previous calls for intersectoral action were led by the health sector and targeted at health outcomes. Today, there is widespread understanding that the achievement of development goals depends on the ability of low- and middle-income countries to measure indicators of progress and that more efforts are required to build that capacity (34).

The willingness of international agencies to coordinate their efforts is demonstrated by promotion of DevInfo as the MDG database, creation of the IHSN, the 2010 World Programme on Population and Housing Censuses (48), and the publication of the OECD guidelines for harmonizing donor practices (32), but international collegiality will not necessarily meet country agendas. The HMN must address a familiar tension: the desire to quench, or even whet, the international community's appetite for proposing new "metrics" as opposed to making available the resources for low- and middle-income countries to strengthen their own information systems so that they can propose and measure "metrics" of national and international relevance. International commitment to strengthening information systems in low- and middle-income countries does, however, offer opportunities to the following bodies:

Health ministries, to harness the technical and financial resources of the HMN, STATCAP and the TFSCB to strengthen national and subnational links with NSOs and the information offices of other ministries, local governments, nongovernmental

and civil society organizations, and private practitioners. Outcomes could include:

— conformity of definitions and sources of data, and of reporting frequency and reporting units for indicators common to each sector, MDG, PRSP and local government performance monitoring;
— rationalization and sharing of software, geographical boundaries and maps used for database and geographical information systems;
— agreement on minimum health-related requirements for household surveys: including data collection, timing of the surveys and means of analysis, desegregation and dissemination of the data; and
— coordination with nongovernmental information systems, facilitating increased accountability between subnational statistical systems (including health) and cross-sectoral community-based information systems.

The HMN, WHO, researchers, ministries of health and donors, to explore systems through which information activities of health sector-initiated projects could be: either made available to other sectors, for example, demographic surveillance sites could invite non-health sectors to pilot intersectoral information systems to jointly manage data on social determinants; or enhanced by linking information from other sectors, for example, by creating intersectoral information systems for community-based health projects such as C-IMCI.

Health ministries, other line ministries, local governments and NSOs, to harness the technical expertise of the HMN, WHO, other international agencies and donors to conduct collaborative projects for example:

— to build vital registration systems — a priority of WHO (*49, 50*) and of UNICEF;
— to develop coordinating frameworks for collecting and collating socioeconomic data from censuses, surveys, and routine databases and to ensure that the data can be disaggregated and disseminated for use at the local level; or
— to assess common training needs for statisticians and information technicians working in HIS, NSOs and information systems in other sectors, and to invest in national and regional training institutions to provide that training.

Health ministries, NSOs, UNSC, WHO, PARIS21, HMN and the international community, to advocate support for: countries to harmonize HIS within the broader framework of national statistical development strategies, and development of coordinated training programmes and career structures for statisticians and information technicians. ■

Résumé

Harmonisation des systèmes d'information sanitaire avec les systèmes d'information d'autres secteurs sociaux et économiques

Pour renforcer les systèmes d'information sanitaire dans les pays à revenus faibles et moyens, il convient de créer des liens avec les systèmes d'information d'autres secteurs sociaux et économiques. Les gouvernements souhaitent disposer de données socioéconomiques détaillées leur permettant de mettre en œuvre les stratégies de réduction de la pauvreté et de surveiller la réalisation des Objectifs de développement pour le Millénaire. Le secteur de la santé envisage de prendre des mesures pour agir sur les facteurs sociaux conditionnant les résultats sanitaires. En matière de collecte, de notification, de stockage et d'analyse des données socioéconomiques, les différents secteurs ont parfois des activités redondantes ou incohérentes. Les bureaux des statistiques nationaux recueillent et analysent en priorité les statistiques économiques, avant les données sociales.

Le Rapport pour la Commission pour l'Afrique estime que US $ 60 millions supplémentaires sont nécessaires pour améliorer les systèmes de collecte et d'analyse des données statistiques en Afrique. Certains donateurs reconnaissent que les systèmes ont été affaiblis par de multiples demandes internationales d'indicateurs et se sont engagés à soutenir des initiatives nationales pour renforcer les systèmes de statistiques, ainsi que les systèmes d'information sectoriels tels que ceux de la santé et de l'éducation.

De nombreux gouvernements œuvrent à la coordination des systèmes d'information destinés à suivre et évaluer les stratégies de réduction de la pauvreté. Il est possible que le secteur de la santé collabore avec d'autres secteurs pour lever des ressources au niveau international afin de :
1) Rationaliser les définitions et les mesures des indicateurs communs à plusieurs secteurs,
2) Réorganiser le contenu, la fréquence et le calendrier des enquêtes auprès des ménages, et
3) Harmoniser les bases de données nationales et sub-nationales qui reçoivent les données socio-économiques.

En l'absence d'engagement à long terme pour améliorer la formation des statisticiens et des techniciens de l'information travaillant dans le secteur sanitaire ou autre, et pour mettre sur pied à leur intention des structures de carrière, on ne pourra obtenir d'améliorations durables des systèmes d'information et de statistiques.

Resumen

Armonización de los sistemas de información sanitaria con los sistemas de información de otros sectores sociales y económicos

Una de las actividades de refuerzo de los sistemas de información sanitaria en los países de ingresos bajos y medios debería ser la de forjar vínculos con los sistemas de otros sectores sociales y económicos. Los gobiernos están interesados en obtener datos socioeconómicos detallados que les permitan implementar estrategias de reducción de la pobreza y vigilar los avances hacia los Objetivos de Desarrollo del Milenio. El sector de la salud pretende incidir en los factores sociales que determinan los resultados sanitarios, pero se dan duplicaciones e incoherencias entre los sectores en lo que respecta al acopio, notificación, almacenamiento y análisis de los datos socioeconómicos. Las oficinas nacionales de estadística priorizan la recogida y el análisis de datos económicos más que sociales.

El Informe de la Comisión para África ha calculado que se necesitan US$ 60 millones adicionales al año para mejorar los sistemas de recopilación y análisis de datos en África. Algunos donantes reconocen que esos sistemas se han visto debilitados por numerosas demandas internacionales de indicadores y han prometido apoyar las iniciativas nacionales para fortalecer sus sistemas estadísticos, al igual que los sistemas de información sectorial, como los de la salud y la educación.

Muchos gobiernos están trabajando para coordinar los sistemas de información a fin de vigilar y evaluar las estrategias de reducción de la pobreza. El sector de la salud tiene por tanto la oportunidad de colaborar con otros sectores y reunir recursos internacionales que permitan racionalizar la definición y medición de indicadores comunes a varios sectores; simplificar el contenido, la frecuencia y el calendario de las encuestas de hogares; y armonizar las bases de datos nacionales y subnacionales que alberguen información socioeconómica. Sin un compromiso a largo plazo para mejorar la capacitación y crear perspectivas profesionales para los estadísticos y los técnicos de información que trabajan en el campo de la salud y en otros sectores, será imposible mantener las mejoras de los sistemas de información y estadísticas.

ملخص

التوفيق بين نُظُم المعلومات الصحية والنُظُم الصحية في القطاعات الاجتماعية والاقتصادية

ينبغي أن تتضمَّن الجهود المبذولة لتعزيز نُظُم المعلومات الصحية في البلدان المنخفضة والمتوسطة الدخل روابط متينة مع النُظُم الأخرى في القطاعات الاجتماعية والاقتصادية الأخرى. وتلتمس الحكومات المعطيات الاجتماعية والاقتصادية التي تتَّسم بالشمولية والتي تبني على أسسها استراتيجيات ترمي لتخفيف وطأة الفقر ولمراقبة ورصد مدى الإنجاز الــمُحْرَز لبلوغ المرامي الإنمائية للألفية. ويتطلع القطاع الصحي إلى العمل على العوامل الاجتماعية التي تحدد الحصائل الصحية، ولكن هناك ازدواجية وعدم اتِّساق بين القطاعات في مجالات جمع وخزن وتحليل المعطيات الاقتصادية والاجتماعية والإبلاغ عنها. وتولي المكاتب الوطنية للإحصاء أولوية قصوى لجمع وتحليل الإحصائيات الاقتصادية أكثر مما تولي الإحصائيات الاجتماعية.

وقد قدَّر التقرير الذي قدَّمته اللجنة الأفريقية أن هناك حاجة سنوية إضافية لستين مليون دولار أمريكي لتحسين نُظُم جمع وتحليل الإحصائيات في أفريقيا. وتدرك بعض الوكالات المانحة أن مثل هذه النُظُم قد شابها الضعف بسبب تعدُّد الاحتياجات للمؤشِّرات على الصعيد الدولي، وتلتزم بتقديم الدعم للمبادرات الوطنية لتعزيز النُظُم الإحصائية وتعزيز نُظُم المعلومات في القطاعات الأخرى أيضاً، مثل نُظُم المعلومات الصحية والتعليمية.

ويعمل الكثير من الحكومات على تنسيق نُظُم المعلومات لرصد وتقييم استراتيجيات تخفيف وطأة الفقر. ومن هنا فإن الفرصة سانحة أمام القطاع الصحي للتعاون مع القطاعات الأخرى لاستحلاب الموارد الدولية التي تضمن التعريف الرشيد والقياس للمؤشِّرات الشائعة في العديد من القطاعات، والاتِّساق في المضمون وفي التوقيت وفي تكرار إجراء المسوحات السكانية واتِّساق قواعد المعطيات الوطنية ودون الوطنية التي تُختزن فيها المعطيات الاقتصادية والاجتماعية.

ولا يمكن ضمان استمرار التحسُّن في نُظُم المعلومات والإحصاء دون التزام طويل الأمد بتحسُّن التدريب وبدون بناء بــنَى هيكلية للوظائف التي تضمن المستقبل المهني للعاملين في الإحصاء وفي تكنُولوجيا المعلومات في القطاع الصحي وفي غيره من القطاعات.

References

1. Commission for Africa. *Our common interest. Report of the Commission for Africa.* London: Commission for Africa; 2005.
2. World Health Organization. *Health Metrics Network.* Geneva: WHO. Available from: URL: http://www.who.int/healthmetrics/about/history/en/
3. World Health Organization. *Primary Health Care: Report of the International Conference on Primary health care, Alma Ata.* Geneva: WHO; 1978.
4. World Health Organization. *Development of indicators for monitoring progress towards health for all by the year 2000.* Geneva: WHO; 1981.
5. Walsh J, Warren K. Selective primary health care: An interim strategy for disease control in developing countries. *New England Journal of Medicine* 1979;301:967-74.
6. Sandiford P, Annett H, Cibulskis R. What can information systems do for primary health care? An international perspective. *Social Science and Medicine* 1992;43:1077-87.
7. de Kadt E. Making health policy management intersectoral: Issues of information analysis and use in less developed countries. *Social Science and Medicine* 1989;4:503-14.
8. Kreisel W, von Schirnding Y. Intersectoral action for health: a cornerstone for health-for-all in the twenty-first century. *World Health Statistics Quarterly* 1998;51:75-8.
9. World Health Organization. *Ottawa Charter for Health Promotion.* Ottawa: International Conference on Health Promotion;1986. WHO document WHO/HPR/HEP/95.1.
10. United Nations Division for Sustainable Development. *Agenda 21. The Rio Declaration on Environment and Development.* United Nations: New York; 1992.
11. Willoughby C, Thomson A, Charoy X, Munoz J. *An Evaluation of PARIS21. An initiative to improve the contribution of statistical services to development.* Oxford: Oxford Policy Management Group; 2003. Available from: URL: http://www.paris21.org/documents/65.pdf
12. Fifty-Fifth Session of the General Assembly. *United Nations Millennium Declaration.* New York: United Nations; 2000. UN document A/RES/55/2. Available from: URL: http://www.un.org/millennium/

13. Wagstaff A, Claeson M. *The Millennium Development Goals for Health. Rising to the challenges.* Washington: World Bank; 2004.

14. United Nations Development Programme. *Human development report.* New York: Oxford University Press; 2003.

15. Millennium Project. *Investing in development. A practical plan to achieve the Millennium Development Goals. Report to the UN Secretary-General.* London: Earthscan; 2005.

16. Verheul E, Rowson M. Poverty reduction strategy papers. *BMJ* 2001; 323:120-21.

17. World Health Organization. *Poverty reduction strategy papers: their significance for health: second synthesis report.* Geneva: WHO; 2004. WHO document WHO/HDP/PRSP/04.1.

18. Banken R. Health impact assessment — how to start the process and make it last. *Bulletin of the World Health Organization* 2003;81:389.

19. Grover-Kopec E, Kawano M, Klaver RW, Blumenthal B, Ceccato P, Connor SJ. An online operational rainfall-monitoring resource for epidemic malaria early warning systems in Africa. *Malaria Journal* 2005;4:6.

20. Pilkington P, Kinra S. Effectiveness of speed cameras in preventing road traffic collisions and related casualties: systematic review. *BMJ* 2005;330:331-4.

21. Food and Agriculture Organization of the United Nations. *Handbook for defining and setting up a food security information and early warning system.* Rome: FAO; 2000. Available from: URL: ftp://ftp.fao.org/docrep/fao/003/X8622e/X8622e00.pdf

22. World Health Organization. *The Surf Report 1. Surveillance of risk factors related to non-communicable disease. Current status of global data.* Geneva: WHO; 2005.

23. World Health Organization. *Environmental health indicators for Europe. A pilot indicator based report.* Copenhagen: WHO Regional Office for Europe; 2004. Available from: URL: http://www.euro.who.int/document/E82938.pdf

24. Bessenecker C, Walker L. *Reaching communities for child health: advancing health outcomes through multi-sectoral approaches.* Washington: Core Group; 2004.

25. Ginn D. The AIDS information crisis: confluence of the roles of information creator, seeker and provider. *Bulletin of the Medical Library Association* 1987;75:333-41.

26. Ågren G. *Sweden's new public health policy.* Sandviken: Swedish National Institute of Public Health; 2003. Available from: URL: http://www.fhi.se/shop/material_pdf/newpublic0401.pdf

27. Marmot M. Social determinants of health inequalities. *Lancet* 2005; 365:1099-104.

28. Felligi IP. Official statistics — pressures and challenges. *International Statistical Review* 2004;72:139-55.

29. Yilmaz S, Hegedus J, Bell M, editors. *Subnational data requirements for fiscal decentralization. Case studies from Central and Eastern Europe.* Washington, DC: World Bank; 2003.

30. United Nations Statistics Division. *Home page.* New York: United Nations Statistics Division; 2005. Available at: URL: http://unstats.un.org/unsd/statcom/commission.htm

31. United Nations Statistics Division — Statistical Commission. Thirty-fifth session of the Statistical Commission. *Report of the friends of the chair on health statistics.* New York: United Nations Economic and Social Council; 2004. UN document E/CN.3/2004/4. Available from: URL: http://unstats.un.org/unsd/statcom/doc04/2004-4e.pdf

32. Organisation of Economic Co-operation and Development. *Harmonising donor practices for effective aid delivery.* Paris: OECD; 2003. DAC Guidelines and Reference Series;.

33. Laliberté L. *Statistical capacity building indicators. Final report.* Paris: PARIS21 Task team on Statistical Capacity Building Indicators; 2002. Available from: URL: http://www.paris21.org/pages/task-teams/teams/introduction/index.asp?id_team=6&tab=doc

34. Second International Roundtable on Managing for Development Results. *Marrakech Action Plan for Statistics. Better data for better results. An action plan for improving development statistics.* Marrakech: 2004. Available from: URL: http://unstats.un.org/unsd/statcom/doc04/marrakech.pdf

35. Thomson A, Willoughby C, Chander R. *The World Bank Trust Fund for Statistical Capacity Building. An evaluation.* Oxford: Oxford Policy Management Group; 2003. Available from: URL: http://www.opml.co.uk/docs/World_Bank_Trust_Fund_Final_Report.pdf

36. World Bank Group. *STATCAP.* Washington, DC: World Bank; 2005. Available from: URL: http://www4.worldbank.org/afr/stats/statcap.cfm

37. International Monetary Fund. *General data dissemination system.* Washington, DC: International Monetary Fund; 2005. Available from: URL: http://dsbb.imf.org/Applications/web/gdds/gddshome/

38. Partnership in Statistics for Development in the 21st Century Secretariat. *A guide to designing a national strategy for the development of statistics.* Paris: PARIS21; 2004. Available from: URL: http://www.paris21.org/pages/designing-nsds/NSDS-reference-paper/index.asp?tab=doc

39. National Integrated Monitoring and Evaluation Strategy Task Force. *Draft national integrated monitoring and evaluation strategy.* Kampala: Office of the Prime Minister; 2004. Available from: URL: http://www.ihsd.org/prsps/PRSPdocs/NIMES.pdf

40. DevInfo. *Capacity building.* New York: DevInfo; 2004. Update No. 2. Available from: URL: http://www.devinfo.org/articles.htm#2a

41. Tanzanian National Bureau of Statistics. *Tanzanian Socio-Economic Database.* Dar es Salaam: National Bureau of Statistics; 2005. Available from: URL: http://www.tsed.org/

42. World Health Organization. *HealthMapper.* Geneva: WHO. Available from: URL: http://www.who.int/csr/mapping/tools/healthmapper/healthmapper/en/

43. World Health Organization. *The world health report 2004 — Changing history.* Geneva: WHO; 2004.

44. INDEPTH Network. *Population and health in developing countries. Volume 1, Population, health, and survival at INDEPTH sites.* Ottawa: International Development Research Centre; 2002.

45. United Republic of Tanzania; *Poverty monitoring master plan.* Dar es Salaam: United Republic of Tanzania; 2001. Available from: URL: http://www.tanzania.go.tz

46. World Bank. *International Household Survey Network.* Washington, DC: World Bank. Available from: URL: http://www.internationalsurveynetwork.org/home/

47. Lehohla P. *Inside statistics: need for statistics will increase as democracy deepens.* South Africa: Business Report & Independent Online (Pty) Ltd.; 2004. Available from: URL: http://www.statssa.gov.za/news_archive/05aug2004_1.asp

48. Demographic and Social Statistics Branch, United Nations Statistics Division. *United Nations 2010 World Programme on Population and Housing Censuses and related Surveys. A proposal for active involvement of Member States.* New York: United Nations Secretariat; 2004. UN document ESA/STAT/AC.97/2. Available from: URL: http://unstats.un.org/unsd/demographic/meetings/egm/Symposium04/docs/AC97_2.pdf

49. Lee JW. Global health improvement and WHO: shaping the future. *Lancet* 2003; 362:2083-88.

50. Mathers CD, Fat DM, Inoue M, Rao C, Lopez A. Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bulletin of the World Health Organization* 2005;83:171:77.