- Invest in improving the working conditions of health professionals.
- Vigorously pursue policies that give priority to the development of science and technology research.
- Enter into bilateral agreements with receiving countries in an attempt to control the flow and derive some compensation for the loss of professionals.

Suggested national strategies for developed countries

- Make a genuine commitment to train more health professionals. Canada and the United Kingdom have both decided to do this, and Australia has gone a step further by explicitly tying the increase in numbers of medical students to rural requirements, and providing financial incentives for rural practice.
- Develop and implement a national code of conduct for ethical recruitment. The guidelines for ethical international recruitment, published by the United Kingdom Department of Health, are a clear example.
- Take a unilateral, principled decision to limit recruitment from countries with very clear staffing shortages; do not advertise job openings in the journals of such countries.
- Issue non-extendable visas, specifically geared to the acquisition of skills for the benefit of the source country.
- Pay some compensation to source countries through bilateral arrangements. This could take a variety of forms including financial help, the expansion of infrastructure (buildings and equipment), the expansion of communication and information technologies, improved access to library information, the creation of research grants targeted specifically to developing countries, and the development of a system of exchange of health professionals designed to enhance the quality of the source institutions affected by departures.
- Implement policies that facilitate the re-entry of skilled professionals into the host country after a period of stay in their countries of origin.

Suggested internationally binding regulations

For the above measures to yield measurable results, strict international rules are required to govern the recruitment of health workers. Formulation and adoption of an international code requires the active participation and cooperation of all the major players: major developed countries, major developing countries, international organizations such as the International Labour Organization and WHO, and representatives of the health professions. Experience with the *Code of practice for the international recruitment of health workers* adopted by the Commonwealth health ministers will provide a good starting point.

The main objectives of such a code will be to:
- link international migration to the health policy goals of individual countries;
- identify countries from which recruitment may be less harmful;
- regulate the international movement of health workers in a way that allows a sending country to produce the extra manpower needed to meet the demands of a receiving country, without injuring its own health system;
- safeguard the rights of recruits in the host country;
- set appropriate guidelines for bilateral agreements on compensation between source and receiving countries. There is little doubt that the international administration of such a compensation policy is likely to be quite complicated; it is nevertheless necessary if we are to uphold the principles of fairness.

An important consideration in this effort will be the need to improve the underlying data on migration. The work of Carrington & Detragiache (*3*) has amply illustrated the weaknesses of existing databases. Very little documentary evidence exists on the sending countries. We need to understand the scope, magnitude and direction of the migratory flows, within and outside the country, as well as the characteristics and skill of the migrants. Such data are necessary if a clear distinction is to be made between local production shortage, internal brain drain to other sectors of the same economy, and international brain drain. The development of a core of standardized data collection instruments will be an essential step in ensuring international comparability. ■

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Rebuilding the ship as we sail: knowledge management in antiretroviral treatment scale-up

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In a recent film about the Napoleonic wars, a frigate suffers heavy damage and loss of life after a withering canon barrage from a faster and more heavily armed privateer. Listing with a damaged hull and broken mast, the crew assumes they will return to port to rebuild. In the captain's mind, however, his duty is clear and their options are singular: they must rebuild as they sail.

In meeting the challenge of providing equitable care to the 40 million people in the world living with human im-

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munodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), the course of the disease makes the goal doubly demanding, as it has become increasingly clear that the future path of this pandemic will run through the poorest and most densely populated areas of the world — areas that are the least well equipped to respond. Africa is home to 10% of the world's population but accounts for almost two-thirds of global HIV infections, so the greatest burden will be borne by countries with already weakened and in some cases failed health systems. Without proper health systems in place, is an effective strategy for scaling-up antiretroviral treatment (ART) possible? There is only one answer to this question: we must rebuild health systems as we confront the epidemic.

From an information science perspective, this is a two-fold problem. First, we do not have the information base and infrastructure to manage treatment and prevention and measure their impact. Second, which is more important, we have no mechanisms to recognize effective practice and disseminate this knowledge on a continent-wide scale. Simply put, expansion of treatment delivery has never before been accomplished on such a scale in such limited resource settings, and we do not know how to do it.

The maxim "learning by doing" has been adopted by WHO to capture the essence of the challenge ahead. It is clear that traditional approaches to operational research, though still necessary and vital, are not sufficient to respond with the speed and urgency that the global crisis demands. Classic double-blind peer-reviewed trials are, in many cases, too expensive and time consuming and may or may not have relevance or exposure to caregivers in clinics and hospitals in the developing world. In addition, information systems that have been proposed for Africa are often driven and owned by donor governments and international organizations and offered without local control or ownership of the information. This could have the unintended effect of undermining already weakened health systems in the countries most severely in need of assistance.

A new approach is needed

The world health report 2004 focused on the global challenge of HIV/AIDS and called for the application of knowledge management principles and techniques that can accelerate expansion of ART delivery as one way of meeting the historic challenge of delivering care to millions of patients in the most resource-challenged settings (*1*). WHO believes that effective delivery of care reduces stigma and offers individuals hope and incentives for prevention as well. But how can this be accomplished in practice?

WHO is advocating a new and ambitious holistic knowledge strategy to the historic challenge of ART scale-up in Africa. Combining the structures and techniques of knowledge sharing and management with information technology appropriately adapted to existing infrastructure and information-gathering practices, a vision of a system integrated throughout Africa is emerging that will capture, test and disseminate effective practice and innovation in HIV/AIDS treatment. The knowledge within this system will be locally generated, owned and applied but also shared across boundaries, with multiple benefits.

- HIV treatment centres will have instant access to patient information within their clinic or hospital as well as immediate, preformatted reports of area treatment information, from catchment area to district level and countrywide analysis.

- District-level analysis and resource allocation will be based on real patient care needs and data directly impacting on every aspect of care, from making available diagnostic tools to preventing stocks of ARVs from running out.
- Country-level policy-making will be based on locally generated information, thus adding a broad and relevant evidence base as a supplement to information gathered from guidelines supplied by international organizations.
- International organizations and research institutes will be able to identify evidence-based patterns and trends that could form the basis for better constructed hypotheses to help ensure relevance and success of classic research studies and trials, making them more problem-solving in focus and more cost-efficient.

All these aims will be accomplished with two basic tools used in an integrated way. The first is quantitative, with an electronic medical records (EMR) system designed specifically for low bandwidth settings with core data fields essential to monitoring and evaluation across borders, but flexible enough to add data fields to test out information that is of local urgency and relevance. The second tool is qualitative, a collaborative web space serving local networks of people through which knowledge can be shared across clinical settings; as new observations on treatment are made, testing strategies will be formulated to evaluate quickly and efficiently the promise of the emerging practices.

Although the driving urgency is the HIV/AIDS epidemic and the challenge of scaling-up ART, this system will be applicable to all of primary care from the first level of treatment to the making and implementation of effective policies. The end result will not only accelerate the pace and effectiveness of the expansion of ART in Africa, but will also strengthen health systems from the clinic to the global research community.

Is this approach realistic in Africa?

Four major categories of criticism have been levelled at this approach: information and computer technologies and human resource infrastructure are weak; there are cultural obstacles; nothing similar has been accomplished in Africa; and international organizations are unable to coordinate with each other let alone with local governments and organizations. These points are dealt with below.

Technology and infrastructure. It is true that general statistics on Internet connectivity have not improved much in Africa, rising from 1% to 2% of the general population in the last five years. In terms of total numbers, however, it is a dramatic increase, with 1 in 160 Africans now using the Internet (*2*). Regarding the weak human resources infrastructure, it is also true that the situation is bleak, often with no doctor present in the treatment centre. Paper information systems do seem to be in place, however, and are followed appropriately. As long as the electronic system is based on what is already being done effectively at the local level by the caregiver, professional or not, it should be easily learnt and will have an impact on the efficiency of workflow and will improve treatment.

Culture. Africa has been described as an information "gate-keeping" culture, with few traditions of information sharing or collaboration across organizations or communities. However, Africa also possesses an equally strong indigenous tradition of

storytelling and knowledge sharing "under the palaver tree" (*3*). Capturing knowledge through informal networks, better to inform decision-making in more formal administrative structures, is at the heart of knowledge management. From this perspective, Africa may prove to be a more effective setting than others for this form of knowledge transfer.

Previous experience. An effective EMR system is in place in western Kenya and has already had a positive impact on health care in rural clinics (*4*). The argument that nothing like this has been accomplished in Africa and therefore cannot be expected to work is no longer valid.

Coordination. Given the ever shifting political landscape experienced by many organizations working in Africa, either foreign or indigenous, effective coordination is always a challenge. WHO's special relationship with ministries of health, its convening power, and its reputation as an "honest broker" will be crucial in aligning the locally operating partners that are essential to this strategy's success.

The proposed integrated information strategy is practical, scalable, locally relevant and realistically achievable. Within its framework, all members of the HIV/AIDS treatment community — from the nonprofessional clinical caregiver to district-level resource managers, health ministers and researchers in medical institutes — will do their part in rebuilding the ship as we sail. ■

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What e-Health can offer

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"In a world rich with resources and knowledge, closing the gap between unnecessary human suffering and the potential for good health is one of the foremost health challenges of our times." This quote from the Rockefeller Foundation's Equity Initiative captures the spirit behind the increasing attention paid to reducing the chasm between what is known and what we do in health, the so-called "know–do gap". How do we go about bridging this gulf, and what can e-Health do to help?

E-Health is an all-encompassing term for the combined use in the health sector of electronic information and communication technology (ICT) for clinical, educational, research and administrative purposes, both at the local site and at a distance (*1*). It lies at the intersection of medical informatics, public health and business. Some definitions associate e-Health strictly with the Internet, focusing on the growing importance of this medium in health transactions. There are over 100 000 web sites worldwide, proffering health information of varying quality, that are used by both professionals and laypersons. In 2001, 86% of all adults in the United States with access to the Internet had consulted it for health-related information, and 55% of primary care physicians in Germany and 90% in the United States had made use of it (*2*).

ICT can also make significant contributions to public health, as demonstrated by the role of telemetry data in onchocerciasis control in West Africa and the use of the Internet in the control of the SARS outbreak. But what can e-Health offer in the specific context of the know–do gap?

ICT has become indispensable to health workers, as the volume and complexity of knowledge and information have outstripped the ability of health professionals to function optimally without the support of information management tools. In the area of health research, for example, the volume of new information is enough to stretch even ICT-assisted decision-making systems: on an average day, there are 55 new clinical trials taking place, 1260 articles indexed in MEDLINE, and 5000 papers published in the biomedical sciences. In 2002, the world produced five exabytes[a] of new information, 90% of it on magnetic media, and the annual growth rate is 30% (*3*).

There is an urgent need for ICT tools that can aggregate information from multiple sources, to give an overall understanding of the healthy human or to provide a clearer picture at the systems level.

The know–do bridge

E-Health systems can improve access to information, thus increasing awareness of what is known in the health sciences, while selective dissemination by electronic means can facilitate targeting of information on those who either request it or are most likely to use it. The most effective way of building the know–do bridge, however, is to provide just-in-time, high quality, relevant information to health professionals and, increasingly, to laypersons.

At the level of individual practice, ICT systems can support the mind's limited capacity to sift through large quantities of health facts and identify those items that bear directly on a given situation. Doing the right thing, in the right place, at the right time, the right way — as LEE Jong-Wook, Director-General of WHO, exhorted the staff when taking office — can be greatly facilitated through e-Health. All decision-making in

[a] 1 exabyte = 1 billion gigabytes, the equivalent of 37 000 new US Libraries of Congress.