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 The argument that nothing like this has been accomplished in Africa and therefore cannot be expected to work is no longer valid.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.

health would be supported by an ICT-mediated system that builds on Weed's vision (*4*) and ensures that all relevant options known to the health sciences are available for consideration. Specific features of the situation at hand that help discriminate between these options would be taken into account; appropriate associations would be made between the specific features of the situation and the various options; and the right technology would be deployed and local capacity developed to permit access to the knowledge.

The late James Grant declared that 80% of the children who died in Africa during his term as Executive Director of UNICEF could have been saved because the knowledge to save them existed. This knowledge simply was not available when and where it was needed. E-Health can promote ICT-mediated options for all countries of the world, with a view to helping us know what we need to know, ensuring that we all know what others know, and making what we know contribute effectively to improving people's health. A number of WHO programmes are dedicated to achieving these aims; for example, the Health Internetwork Access to Research Initiative (HINARI) provides health professionals in over 1200 institutions in developing countries with free or affordable online access to 2400 of the top scientific journals in the health field.

HINARI and other programmes that support knowledge communities in countries through, for example, communities of practice and collaborative workspaces, are enhanced by ICT. Such ICT underpinning has given impetus to a new area of inquiry called "technology enhanced knowledge translation", which examines the role that ICT can play in the actions of individuals, as well as systemic factors that militate in favour of successful transformation of available information and knowledge into action. It also looks at what e-Health tools need to be devised for capturing and sharing experiential (or tacit) knowledge. E-Health networks can remove distance and time barriers to the flow of information and knowledge for health, and they can help to ensure that collective knowledge is brought to bear effectively on health problems in individual countries, as well as globally.

E-Health systems for all

There is a tendency to imagine that e-Health systems are a tool exclusively for the industrialized world. This is not true, as evidenced by the number of telehealth projects in developing countries (*5*). Average rates of penetration of mobile phones and the Internet in the developing world rival those achieved in the industrialized world five years earlier; as expected, the catch-up process is occurring much faster with newer technologies than with older ones. Investment in such systems by developing countries represents money well spent, both for immediate benefits and for future gains. It is important to focus attention on the use of available knowledge by underserved communities, such as developing country health systems. Monitoring progress in the assimilation of ICT among the disadvantaged will be important as causal pathways are charted between e-Health technology and health outcomes for both the rich and the poor.

Building capacity

Another area in which e-Health systems can help bridge the know–do gap is in building capacity in countries, in terms of both individual expertise and institutional capability. Traditional educational methods are inadequate to meet the needs of the health sector in many countries, particularly in the developing world. At the same time, there is an increasing view among educators and medical practitioners that ICT in general and the Internet in particular have the potential to revolutionize the way medicine is learned by students and health-care professionals (*6*).

Internet-based medical education offers a partial solution to the "brain drain" of health workers from developing countries: because higher-level educational opportunities are not always available locally, training is often undertaken in other countries and trainees do not always return to their own countries. To alleviate this problem, *The world health report 2001* suggested that centres of excellence for training and education should be set up in developing countries (*7*). In the e-Health model, the Internet offers promise as an alternative provider of local training (*8*).

Tracking developments

Despite the significant potential of e-Health systems to improve health, the evidence of the impact of ICT on health is thin. An important task for WHO is to stimulate development of the evidence base worldwide, through a global observatory on e-Health systems. The observatory would also track developments in relevant fields by collecting and analysing data on ICT and health, covering developments in research, industry, policy and practice.

Multilingualism will be an increasing challenge of globalization and the information era. ICT can contribute to promoting knowledge for better health through the creation of specialized e-Health networks to support the development of language-specific knowledge communities, by: building communities of practice around a given language for improved sharing of health information and knowledge, as well as for facilitating the development of new knowledge by removing language barriers to understanding; improving access to the wealth of health-relevant information available in a language and building on the concept of a virtual health library, and promoting the growth of health-relevant transactions in different languages on the Internet.

Developments in ICT have ushered in an era of profound opportunity and potential for worldwide advancement in health and health care, and e-Health systems today constitute a third major pillar on which the health sector is built.[b] E-Health systems are an indispensable aspect of the health system of the future. Without appropriate ICT tools, the world has little hope of bridging the know–do gap in health. E-Health systems are a way of keeping pace with the exponential growth of health-relevant information, and applying more of what we know, individually and collectively, to resolving the health problems of the world. ■

Conflicts of interest: none declared.

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Why is research from developing countries underrepresented in international health literature, and what can be done about it?

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Although the highest burden of disease is concentrated in low- and middle-income countries (LMICs), data from the Institute for Scientific Information show large gaps in scientific production between industrialized and developing settings (*1*). In the fields of medicine and public health, the overwhelming majority of publications originate in the United States and Western Europe. Scientific papers where researchers from developing countries are the sole authors represent a very low proportion of published manuscripts.

Over the past few years, several articles have analysed various aspects related to the underrepresentation in international journals of public health problems and research conducted in LMICs (*2–5*). Complex and interrelated contributing factors have been identified; five are elaborated below.

Poor research production. Scientific production is poor in developing settings, both in terms of quantity and quality, because of a critical lack of continuous support for research and development activities including basic infrastructure from both local governments and international agencies, and lack of incentives for research activities. Furthermore, professional researchers are undervalued and their salaries are low, a situation that reflects the lack of status accorded to scientific production and contributes to a scarcity of full-time researchers ad hoc.

Poor preparation of manuscripts. Even manuscripts exhibiting high-quality research may not meet the requirements of peer-reviewed international public health journals in terms of language and scientific presentation. Although some journals' policies include assistance for writing and language editing, this support does not meet the needs. Language proficiency remains a fundamental barrier for scientists whose mother tongue is not English. Poor presentation may also result from a lack of the skills required to develop coherent arguments. Indeed, unlike developed countries where writing skills are an essential component of higher education, writing abilities in LMICs are usually acquired informally on an ad hoc basis, at a later stage in a professional career.

Poor access to scientific literature. Authors from developing countries are often not adequately prepared to participate in the international scientific debate, as they have limited access to the published literature. Out-dated and insufficient or underresourced library stocks, high journal subscription fees and poor Internet access and computer availability represent serious limitations.

Poor participation in publication-related decision-making processes. Developing country experts are seriously underrepresented on editorial boards and review rosters of international journals. Editorial boards of journals devoted to diseases that mostly occur in developing country settings (e.g. tropical medicine) where local experts are not proportionately represented are an example of this situation. As a result, submissions from poor countries are usually evaluated by experts who may not be knowledgeable about the constraints associated with conducting research in these settings and, therefore, do not have a positive attitude to provide the guidance that may make the work publishable.

Bias of journals. Editors, editorial boards and reviewers of international medical journals may be insufficiently interested in the areas to which most researchers from developing countries devote their work, and may consider them unoriginal or irrelevant for their readership. The existence of a bias against the so-called "diseases of poverty" has also been suggested (*6*). This lack of interest may also reflect the preferences of the readership or the advertisers. In addition, researchers from poor settings have a limited capacity to buy reprints, which constitute a substantial source of income for scientific journals. Finally, international journals are usually more willing to consider papers that originate from prestigious research centres in developed countries than those from lesser-known academic entities, particularly when the authors are exclusively researchers from developing countries.

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