The Global Forum Update on Research for Health Volume 3

Global Forum
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HELPING CORRECT THE 10|90 GAP

Global Forum Update on Research for Health Volume 3

Combating disease and promoting health

Edited by **Stephen Matlin**

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Combating disease and promoting health: setting the agenda for health research

Article by Stephen Matlin

The last decade has seen an unprecedented increase in the attention that the world is giving to poverty and to the health problems of poor and marginalized people living in developing countries. Some particularly important elements of this change include:

- The higher priority for development generally, and for health within the overall development agenda, has been reflected in the Millennium Development Goals (MDGs), which committed the world to achieve a set of specific health targets by 2015. This commitment has been further articulated through political arenas such as the G8 summits and European Union and translated into resources through the 2002 International Conference on Financing for Development held in Monterrey (United Nations 2002), in which world leaders pledged to make concrete efforts towards the target of contributing at least 0.7% of their gross national income (GNI) in Official Development Assistance (ODA); debt cancellation for heavily indebted poor countries; and the creation of special funds and initiatives to address specific diseases, such as the GAVI Alliance (formerly known as the Global Alliance for Vaccines and Immunization), the Global Fund to Fight AIDS, Tuberculosis and Malaria, and the President's Emergency Plan for AIDS Relief (PEPFAR).
- A range of new actors are contributing substantially to tackling some of the disease challenges, including new funding sources such as the Bill and Melinda Gates Foundation and the International Financing Facility for Immunization, as well as product development partnerships like the International AIDS Vaccine Initiative, Medicines for Malaria Venture, Institute for One World Health and Drugs For Neglected Diseases Initiative, to bring new drugs and vaccines into clinical use.
- The private sector has become increasingly involved in contributing to the availability of drugs for some of the infectious tropical diseases. Since Merck's groundbreaking donation of ivermectin to treat river blindness, many others have followed suit: a recent survey by the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA) identified 126 health partnerships created by the R&D pharmaceutical industry to donate medicines and collaborate in providing health interventions in developing countries (IFPMA 2002).
- Many developing countries are reinforcing their commitment to tackle their own major health challenges, through increased allocations to health budgets, efforts to reduce health inequities through social security schemes and targeting services to the poor and through support for the development of innovation systems that will create new pharmaceutical manufacturing capabilities.

Despite these welcome increases in effort to address the health needs of some of the world's poorest populations, it is evident that much more still needs to be done, both in combating the diseases that affect these populations and, more broadly, in taking a much more comprehensive approach to promoting health. In each of these domains, much can be achieved with existing knowledge and tools, but even where these are available, research is often needed to adapt them to local contexts; and in many cases the knowledge and tools required are inadequate or not available. Consequently there is a continuing need for research, with a key first step being the development of the research agenda for each domain.

Diseases and injuries

In the field of combating disease, old and new agendas now coexist as the transition in health problems takes place in many developing countries. Thus, five communicable diseases are to be found among the leading 10 causes of the burden of disease (estimated in disability-adjusted life years, or DALYs) in low- and middle-income countries (LMIC) in 2003 (Table 1). By contrast, apart from road traffic accidents, the leading causes of the burden of disease in high-income countries (HIC) consisted entirely of noncommunicable diseases (NCD) (Mathers & de Francisco 2006).

A number of the infectious diseases endemic in developing countries, including some very neglected diseases, require research and development to create new drugs where no effective treatments exist (Chagas disease), to overcome increasing resistance (malaria, TB) or to shorten treatment times (TB). The major killers targeted in the MDGs (HIV/AIDS, TB, malaria) await preventive vaccines, and for both TB and malaria there is an urgent need for rapid, sensitive and reliable diagnostics that are cheap and easy to use in the field.

The control and eradication of these infectious diseases requires more than the creation of these pharmaceutical products. As demonstrated by the onchocerciasis control

Low- and middle-income countries (LMIC)				High-income countries (HIC)			
	Cause	DALYs (millions of years)	% of total DALYs		Cause	DALYs (millions of years)	% of total DALYs
1	Perinatal conditions	95.0	7.0%	1	Unipolar depressive disorders	10.6	9.0%
2	Lower respiratory infections	88.7	6.5%	2	Ischaemic heart disease	7.5	6.3%
3	HIV/AIDS	85.9	6.3%	3	Cerebrovascular disease	5.6	4.7%
4	Diarrhoeal diseases	62.1	4.5%	4	Alcohol use disorders	5.5	4.6%
5	Unipolar depressive disorders	57.5	4.2%	5	Alzheimer and other dementias	4.2	3.5%
6	Ischaemic heart disease	52.3	3.8%	6	Hearing loss, adult onset	4.0	3.4%
7	Cerebrovascular disease	44.0	3.2%	7	Chronic obstructive pulmonary disease	3.9	3.3%
8	Road traffic accidents	36.2	2.7%	8	Trachea, bronchus, lung cancers	3.7	3.1%
9	Malaria	34.3	2.5%	9	Diabetes mellitus	3.3	2.8%
10	Tuberculosis	33.7	2.5%	10	Road traffic accidents	3.1	2.6%

Table 1: Leading causes of burden of disease: comparison between LMIC and HIC, 2003

programme in Africa (African Programme for Onchocerciasis Control) and the trachoma elimination programme (International Trachoma Initiative) in several African and Asian countries, creative partnerships and innovations in public health systems to effectively deliver treatments to the whole population are equally important. As new infectious diseases emerge and some older ones re-emerge as public health threats due to resistance, there is need for a continuous process of research to combat them. Estimates by various groups suggest that billions of dollars of extra R&D funding will be required over the next decade if these diseases are to be eliminated as significant public health problems in developing countries (Burke & de Francisco 2006).

At the same time, it is evident that much greater attention must now be given to the new epidemic of NCD that is spreading in developing countries. Ischaemic heart disease, stroke, cancer, diabetes and mental and neurological conditions have become the major burden of disease in many LMIC, including China and India. Many of these conditions are largely avoidable by changes in diet, physical activity and tobacco consumption. In recent decades, a range of approaches have been developed in HIC for their prevention and treatment. But, to what extent are they relevant to poor populations and in settings where health services and associated diagnostic facilities are inadequate, inaccessible or unaffordable? For the mental and neurological disorders which are currently so poorly treated in many parts of the world, how can research not only contribute to effective and culturally appropriate ways of addressing these chronic conditions, but also help to identify ways to reduce the stigma that often results in the marginalization, neglect and abuse of people with these conditions? Clearly, the research agenda that needs to be formulated in developing responses to the new challenges of epidemic NCD in low- and middle-income countries is a substantial one.

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Similarly, the high rates of injuries that are seen in LMIC require much more attention. Part of the increase stems from growing rates of accidents due to increasing levels of motorized road traffic, with unintentional injuries to children and adolescents being a particular problem. As with NCD, the research challenges include both the adaptation of known prevention and treatment methods developed in HIC and the creation of new approaches suited to specific local contexts.

Health and its determinants

Efforts to contain the HIV/AIDS pandemic have focused attention on behaviour change as a critical factor in limiting the spread of the infection – and have demonstrated that we have a great deal to learn about how to achieve consistent reductions in risk behaviour in different populations and how to sustain these over time. The emerging challenges of NCD have also highlighted the importance of understanding behaviour and what influences people's lifestyle, diet, exercise and the environments in which they live and work.

Combating the spread of HIV/AIDS intersects with other crucial areas of sexual and reproductive health – in particular, the detection and treatment of other sexually transmitted infections and the provision of sexual and reproductive health services to both females and males, including adolescents. There are wide-ranging issues to be addressed across this field, from questions of vertical programming versus integration of sexual and reproductive health services and

There is a growing understanding that many factors in the environments of individuals, over which they exercise little or no effective control, can have profound effects on their health and life expectancy. The significance of factors in society, including education, wealth, status in work and in a range of other social hierarchies, are emerging as key influences

their incorporation within primary health care, to the needs for new products, diagnostic tools and approaches to achieve behaviour change. These are all elements of a global agenda for research on sexual and reproductive health that urgently needs to be defined and implemented.

The evident connections between behaviour and health are raising important and complex questions about responsibility. There are widely differing views about how much it should be left to individuals to make "choices" that may have beneficial or adverse effects on their health. At one end of the spectrum, it can be argued that healthy behaviour is a personal responsibility and it is the right of individuals to exercise full freedom of choice. However, individuals rarely have all the information and expertise necessary to make fully informed choices that take account of all the risks, benefits and uncertainties involved. There are also issues of collective good involved in areas of public health (e.g. limiting the spread of infections through sanitation, vaccinations or behaviour changes) and medicine (who pays for expensive treatments for "self-inflicted" conditions) that require state intervention. But, how much responsibility should the state take to prevent or penalize unhealthy behaviours?

There is a growing understanding that many factors in the environments of individuals, over which they exercise little or no effective control, can have profound effects on their health and life expectancy. The significance of factors in society, including education, wealth, status in work and in a range of other social hierarchies, are emerging as key influences. The Commission on the Social Determinants of Health, established by the WHO in 2005, is now engaged in global studies to define and better understand these root causes (WHO Commission on the Social Determinants of Health).

Building country capacities for health research

For more than 15 years it has been recognized that health research has vital roles to play in development and that every country needs to build and use a capacity to conduct essential health research (Commission on Health Research for Development 1999). Much effort has been expended in strengthening capacities of individuals and institutions to conduct research and increasing attention has focused on how to improve the research-to-policy interface to ensure that research results are translated into practice. Nonetheless, as a recent review highlights (Nuyens 2005), much more systematic attention is required to the development, resourcing, prioritization and effective use of research capacity for health at country level. It is vital that these elements be linked if the investment in national capacity for research is to impact on policy, practice and, ultimately, health, pointing to the need to ensure effective functioning of a health research system (Sadana & Pang 2003).

In a world that is constantly changing due to the forces of globalization, urbanization and climate change, and with rapid industrialization in countries like China and India, there is an ever-growing list of factors being recognized that are impacting on the health of populations in developing countries and that urgently require investigation.

Research for health: setting the new agenda

The WHO has defined health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Nevertheless, efforts in the 20th century to improve health, particularly in developing countries mainly focused on the treatment of diseases and the "Health for All" movement launched in Alma Ata in 1978 became narrowly channelled into a selective version of primary health care. However, attention to the wider aspects of health has been growing and 2005 saw two important events – the 6th Global Conference on Health Promotion in Bangkok continued the efforts begun in Ottawa in 1987 to bring health, rather than disease, into the centre of attention; and the WHO Commission on the Social Determinants of Health was constituted and began a global, multi-year effort to identify the knowledge available in this field.

With the growing appreciation of the range and complexity of factors beyond the health sector that impact on health, the widening scope of the research agenda required is becoming evident. Increasingly, this agenda is being described as "research for health" rather than "health research", a term that resonates with the decision by Finland to make promotion of the principle of "Health in All Policies" a core part of its EU presidency in 2006 (EU 2006).

Conclusion

The mission of the Global Forum for Health Research is to draw attention to priority gaps in health research for development and to advocate for increases in financial, human and institutional resources to close those gaps. With the growing number of actors and funding mechanisms now engaged in the field and with the widening of health challenges that countries everywhere now face, the need for greater coherence in national and international responses is greater than ever. Not only are greater resources important, but it is vital that the priority research agendas be mapped in order to guide the directions in which these resources are invested to combat disease and promote health. ❑

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References

African Programme for Onchocerciasis Control, see: www.apoc.bf/en

Burke MA & de Francisco A 2006, 'Monitoring financial flows for health research 2005: behind the global numbers', Global Forum for Health Research, Geneva.

Commission on Health Research for Development 1990, 'Health research: essential link to equity in development', Oxford University Press, New York, available from: www.cohred.org

EU 2006, see: http://www.eu2006.fi/eu_and_policy_areas/policy_areas/en_GB/employment/

International Federation of Pharmaceutical Manufacturers & Associations 8 March 2006, press release: 'IFPMA survey of pharmaceutical sector's contribution to developing world is conservative, experts say', IFPMA, Geneva, available at: http://www.ifpma.org/News/NewsReleaseDetail.aspx?nID=4467

International Trachoma Initiative, see: www.trachoma.org

Mathers C & de Francisco A 2006, 'Trends and patterns of morbidity and mortality', in Burke MA, de Francisco A, Matlin SA (eds), *Monitoring financial flows for health research 2006: the changing landscape of health research for development*, Global Forum for Health Research, Geneva, Chapter 3.

Nuyens Y 2005, *No development without research: a challenge for research capacity strengthening*, Global Forum for Health Research, Geneva.

Sadana R & Pang T 2003, 'Health research systems: a framework for the future', *Bulletin of the World Health Organization,* vol. 81, no. 3, p. 159.

World Health Organization: Commission on Social Determinants of Health, see: www.who.int/social_determinants/en

United Nations 2002, Report of the International Conference on Financing for Development Monterrey, Mexico, 18-22 March 2002, United Nations, New York, available at: http://www.un.org/esa/ffd/aconf198-11.pdf

Global Forum for Health Research

The Global Forum for Health Research is an independent international foundation established since 1998 in Geneva, Switzerland. It works to promote more health research to combat the neglected diseases and conditions that are major sources of ill-health in developing countries.

Health research encompasses a wide spectrum of activities that generate new knowledge and technologies – ranging from biomedical research that creates new drugs, vaccines and diagnostics, to health systems and policy research which ensures that health systems are better informed and managed, to social science and operational research to improve access and uptake and to help us better understand what affects the health and the choices of people in the community.

The Global Forum works to encourage all these aspects of health research to focus more on the health needs of poor, marginalized and disadvantaged people everywhere. It does this through advocacy, brokerage and catalytic roles and by serving as a generator and incubator of ideas and initiatives. This can be achieved by creating a platform for debate and by acting as a convenor of individuals and groups representing all types of interest in health research and its benefits.

The annual Forum meeting has become a key gathering on the agenda of those who direct, prioritize, fund and carry out research. The meetings have proved successful in stimulating and facilitating dialogue and exchange between a very wide range of actors from all parts of the world, providing the opportunity for groups to come together to explore how best to increase research into a particular problem area.

Many of the themes that feature in the annual Forum are also pursued as elements of the annual work programme of the Global Forum and through its collaborations with partners. Key areas of work include priority setting, equity, gender, poverty, research capacity strengthening and studying resource flows for health research and the relationship between resource flows and burden of disease. ❑

Publications of the Global Forum for Health Research

Current

10/90 REPORTS

The 1990 Report of the Commission on Health Research for Development and the 1996 report of the WHO Ad Hoc Committee on Health Research concluded that the central problem in health research was what has now become widely recognized and quoted as the "10/90 gap" (less than 10% of global spending on health research being applied to 90% of the world's health problems). The expression continues to serve as a symbol of imbalance in the allocation of global health research resources, and the Global Forum's biennial report describes the progress made towards correcting it by focusing on research activities and initiatives that address problems of middle and lower income countries and generating funds to support these initiatives.

RESOURCE FLOWS

[NEW] Monitoring financial flows for health research 2006: the changing landscape of health research for development

This report provides an update on the global figures published in 2004.

Monitoring financial flows for health research 2005: behind the global numbers

February 2006

In response to the need for disaggregated data, this study identifies how much is being spent on research on individual diseases (both infectious and chronic) and determinants and health problems of specific geographical regions and population groups. It also draws attention to precise cases where more investment in research is needed.

Monitoring financial flows for health research 2004

October 2004

This report responds to widespread interest on the part of those who fund research, manage and set priorities in different institutions and use our results to try to improve the health of populations around the world. The study presents a new estimate of global spending on health R&D for 2001 but also exposes major gaps in the availability of good quality data from all sectors, disease-specific information and the measure of complex determinants such as poverty, inequity and gender.

PRIORITY SETTING

The Combined Approach Matrix: a priority-setting tool for health research

June 2004

The Combined Approach Matrix (CAM) publication describes a tool used for the purpose of priority selection in health research: the matrix enables the collection, organization and analysis of the mass of information needed to help set priorities. It incorporates criteria and principles from earlier methods and links them into a matrix with the actors and factors that play a key role in the health status of a population. The method aims at helping institutions at national, regional and global levels to set their priorities in health research. National uptake of the CAM has been widespread, including countries such as Argentina and Malaysia, among others.

EQUITY

[NEW] The BIAS FREE Framework: a practical tool for identifying and eliminating social biases in health research

by Mary Anne Burke and Margrit Eichler

This volume introduces a user-friendly rights-based framework as an integrative approach to explore and remove the compounding layers of bias (sexism, racism, ableism, classism, casteism, ageism etc.) that derive from any social hierarchy. The BIAS FREE Framework applies to any sector, not just health, and not only to research but also to legislation, policies, programmes and practices for getting at the roots of social inequalities and effecting real social change.

RealHealthNews

[NEW printed issue] Quarterly

Real health for the poorest, most disadvantaged communities of the world - that's the focus of RealHealthNews, an independent e-magazine targeted at policy-makers of all levels, including those in health and finance ministries, about real evidence, real research and real interventions that can change people's lives for the better. Edited by Robert Walgate (former news editor of *New Scientist, Nature and The Bulletin of WHO*), and supported by the Global Forum for Health Research and The Special Programme for Research and Training in Tropical Diseases, the RealHealthNews page can be found at: www.globalforumhealth.org

[NEW] The Global Forum Update on Research for Health, volume 3

Co-published for Forum 10 by the Global Forum for Health Research and Pro-Brook Publishing, this report focuses on the importance of mapping priority research agendas to guide the directions in which resources are invested to combat disease and promote health. It contains 27 articles written by a selection of health ministers and other policy-makers, representatives of international and bilateral development agencies, the funders, controllers and users of research, and senior research leaders from around the world.

SYNTHESES

[NEW] Application of burden of disease analyses in developing countries: implication for policy, planning and management of health systems

by Adnan A Hyder, Li Liu, Richard H Morrow and Abdul Ghaffar

Methods to measure the burden of disease (BOD) on populations have been applied for decades, but have only received increasing attention in the past 20 years. During this period, a number of concerns have been raised with the use of summary measures of population health. This report summarizes the lessons learned from seven BOD studies funded by the Global Forum for Health Research.

No development without research: a challenge for research capacity strengthening

by Yvo Nuyens

August 2005

This publication reviews the literature and surveys the successes and failures of research capacity strengthening in the health field, in the context of its potential to contribute to health, development and equity. It points very clearly to the need for all stakeholders in the field – funders, producers, users and beneficiaries of health research – to be organized into a health research system in which the resources, drivers and priorities are aligned to produce results that are needed, valued and utilized.

AVAILABLE ON CD-ROM

- **Publications of the Global Forum for Health Research 2000-2005**
- **The 10/90 Report on Health Research 2003-2004**

Forthcoming

- **The 10/90 Report on Health Research 2006: overcoming barriers to health**
- **Forum 10 Report – Combating disease and promoting health: setting the agenda for health research**
- **The Combined Approach Matrix: a priority-setting tool for health research, 2nd edition**
- **On CD: Forum 10 Report and final documentation; Publications of the Global Forum 2000 - 2006**

NOTE

The full texts of our reports are available (as pdf files) on the website www.globalforumhealth.org where publications can also be ordered, free of charge. In addition, we encourage you to register on the website to receive regular information on all Global Forum activities.

Combating infectious and chronic disease

Community participation in the prevention and control of dengue fever: a case study in Cambodia

Article by Sokrin Khun

One day in March 2003, I walked into a small village in the eastern province of Kampong Cham, Cambodia. This province and village had experienced the highest prevalence of dengue fever of the last three years and health workers had come to the village to put Abate (temephos) in villagers' water containers to control Aedes mosquito larvae. The village was green, with trees and vegetables growing in backyards. Almost every house had coconut trees. Coconut shells, cans, bottles and plastic packing bags were discarded in every backyard. Some of these discarded items contained larvae. The villagers had varied needs and health problems and were busy farming for food and survival.

This situation is not uncommon in any village in Cambodia, where dengue fever (DF) is still among the top 10 causes of hospitalization, and its fatal forms – dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) – are among the top causes of death in hospital (Cambodia DSP 2004a; 2004b; 2005). Dengue fever is a tropical human viral disease transmitted by mosquitoes. In other tropical and subtropical regions of the world, too, dengue fever has re-emerged as a major health problem, its spread creating both economic and social consequences (Lloyd 1991).

In order to alleviate these burdens, a sustainable programme for the prevention and control of the disease, with the participation of local residents in health activities, is needed. For many years, community participation has been rather superficial, often limited to the involvement of community members in their own health care (Krogstat & Ruebush 1996). Passive acceptance of health programmes imposed from outside the community, such as vaccination or mass drug distribution for malaria treatment or prevention, was considered to be an example of community participation transferred to dengue control. More recently, emphasis has been placed on the difference between passive acceptance and real involvement in the choice, design, implementation and evaluation of disease control activities (ibid). In order to discuss community participation in health, it is crucial to discuss meanings of community in health.

Meanings of community in health

The meaning of community is not clearly defined in health or development literature, even though it is the core of community participation. It ranges from an unspecified number of people who are affected by a health problem (Hawe 1994) to a heterogeneous settlement with different class, ethnic, social, cultural and political factors which may affect the implementation and sustainability of a community participation programme (Manderson 1992; Morgan 2001). Community members may have different health problems and wealth status, and therefore they are likely to have different interests and needs. For example, the needs of one group may be for adequate food or clean water, while the needs of another group may be dengue prevention. These different needs are very important in community-based dengue control programmes, as the programme requires community members who perceive different health needs to understand their shared risks of DF and to work together to control mosquito breeding sites and larval habitats in their village. If any household ignores this responsibility, then mosquito breeding sites and larval habitats continue to exist, with an increased chance of occurrence of DF if there are infected people in the village. Moreover, emphasis on locale for disease control programmes is not enough. Control programmes need to consider and integrate other influencing factors prevailing in a community, including cultural and sociopolitical structure; inequalities of health, wealth and education status; and different needs, experiences and political beliefs (Midgley, Hardiman & Narine 1986; Oakley 1991; Whiteford & Manderson 2000). In Cambodia, mothers with children affected by DF were more interested in DF health education messages than their local counterparts with children without dengue infection. Similarly, mothers of small children were more influenced than mothers of older children because the latter believed that DF was unlikely to affect older children. Villagers had different experiences of typhoid fever, pain in the thorax, heart problems, cough or cold, so they were likely to talk about how to solve these problems. Other villagers had difficulties in earning money for their survival and paying back high interest loans to fellow villagers. Moreover, political pluralism in Cambodia also affects community solidarity and participation.

Community participation

Community participation is often conceptualized as a means by which residents can participate in activities that have a positive impact on their collective health (Zakus & Lysack

1998). The approach to community participation has been adopted within tropical disease control programmes to achieve the ultimate goal of disease control (Espino, Koops & Manderson 2004). This approach is used by governments or other programme providers to establish participation in terms of contributions of labour, cash or materials, or in relation to organizations involved in formulating structures necessary for participation (Woelk 1992). The overall outcome of this approach is that collective action involves both community members and outsiders such as programme providers (Espino, Koops & Manderson 2004). Whether in well-resourced or under-resourced communities, community participation remains a favoured paradigm for tropical disease control, and its success depends on ongoing cooperation between programme providers and communities to realize their needs and survival.

Health planners have used two approaches to community participation in health care (Rifkin 1996). The first approach is one in which health providers define the objectives, strategies and activities of a health programme and then attempt to convince community members to accept and participate in programme implementation. This first approach is in use in the dengue control programme in Cambodia where the National Dengue Control Program (NDCP) has defined Abate distribution as one of its dengue control activities. The health workers employed by NDCP go to villages to put Abate in villagers' water containers and convince residents that Abate is safe and effective against Aedes larvae. However, insecticide resistance is a concern (Polson et al. 2001; Braga et al. 2004) and villagers pay less attention to other larval source reduction activities when using Abate. Health education materials such as posters, leaflets, and television and radio spots are also used, however, with the ultimate goal of gaining residents' involvement in these activities.

The second approach is one in which community members are encouraged to take decisions about resource allocations and priorities, and then invite health providers to respond to these decisions (Rifkin 1996). This approach results from the argument that the reasons for poor health in a community are in part due to inequalities of resource distribution. This framework sees community participation as the result of community members gaining information, access to resources and control over their lives, and is often referred to as the "bottom-up" approach or the empowerment framework. This approach rarely occurs, however, because health programmes are conducted by health departments or units and are rarely based on community initiatives (Manderson 1992). Moreover, most programmes work with selected community members to undertake defined tasks and do not seek broader community involvement (ibid).

Community-based dengue control programmes

Many people living in communities that benefited from vertical dengue control programmes view dengue control as the responsibility of the health authority (Winch, Kendall & Gubler 1992; Toledo-Romani et al. 2006). The current worldwide spread and epidemics of DF place more emphasis on new approaches to prevention and control of DF. The emphasis on the transfer from a vertical or top-down programme to a community-based programme has been advocated with the hope of greater effectiveness and sustainability. In addition, the success of public health strategies depends on the level of community involvement, especially for communicable diseases for which there are no vaccines and for which the only strategy is prevention. A community participation-based Aedes aegypti control programme aimed at source reduction provides the hope for decreasing the incidence of DF and reducing mortality (Lloyd et al. 1992; Gubler & Clark 1996; Fernandez et al. 1998; Winch et al. 2002; Renganathan et al. 2003).

The objectives of community participation in dengue prevention and control rely on several factors. First, it is crucial to extend coverage of the programme to communities by creating community awareness through health education. Second, coordinating local resources and activities and forming community organizations to define problems, solutions and strategies for actions is very important to make the programme more effective and efficient. Third, it is important to promote equity through serving people in greatest need and at greatest risk and finally, to promote self-reliance and capacity to control their own health and lives. However, a successful community-based dengue control programme with community involvement is not easy to achieve because it needs to consider various factors affecting communities and community participation.

The review of a number of community-based dengue control programmes illustrates that most health problems are identified, and strategies and prevention and control activities set, by programme providers. Programme providers convince community members to comply and collaborate. Community members have a limited opportunity to take part in assessing their health needs, identifying solutions, and developing plans and strategies for implementation or project monitoring and evaluation. Social, economic, political and cultural factors have not been well considered. As a result, the sustainability of these immediately successful projects remains questionable.

In Cuba, with strong political guidance, community members value the importance of community participation in solving any problem, especially dengue control. In one study, (Sanchez et al. 2004), the surveyed population indicated the value of working together as a team in developing the community. Some of those surveyed also indicated the need to reward – with more than just words of thanks – residents who regularly serve the community (ibid). A project in Colima, Mexico, reported by Gomez, Suarez & Cardenas in 2002, was particularly successful because it involved community members, health authorities and academics in identifying and solving health problems. It also proved that in DF, health education and source reduction by community members were more effective than any other control methods. Moreover, the long-term cooperation between the programme providers and community members was crucial to the sustainability of the programme. The educational campaign of this project had greater impact than the

project in Merida, also in Mexico (Lloyd et al. 1992; 1994), because in the former, the investigators spent a much longer time (eight years) in implementation than in the latter. Such pilot projects with intensive involvement cannot be replicated nationally.

Biological control methods with the use of larvicidal fish and copepods in Laos (Jennings et al. 1995), Chiapas, Mexico (Martínez-Ibarra et al. 2002) and Hanoi, Vietnam (Nam et al. 1998; Kay & Nam 2005), respectively, illustrate the potential for community-based dengue control programmes with community involvement and the use of local resources, such as fish for food and income generation. These projects proved immediately successful to control the disease. However, the control of discarded containers is still needed to complement the use of the fish and copepods to control the larvae in domestic water containers. Projects such as these need also, if they are to remain sustainable and of large scale, to consider other factors affecting the community and people's perceptions towards control agents.

A project in Sarawak, Malaysia (Crabtree, Wong & Mas'ud 2001) involved community members in the identification and management of health problems and solutions. This project proved successful, but at the time of publication, was still too recently developed to reach conclusions about its sustainability. The limited success of the dengue project in the Dominican Republic disclosed problems with the dissemination of health messages that communities could not understand; lack of community team spirit; and lack of political will of the government (Service 1993; Whiteford 1997). Moreover, Dominican residents already had a poor partnership with the government that reflected past disappointments and expectations of failure. The dengue partnership, borne from past failure, predicted its own unsuccessful outcome (Whiteford 2000). This perception has resulted in a powerful obstacle to a community-based programme to control DF, despite the high mortality from the disease. Perception is likewise an obstacle in the Cambodian community, which has just re-emerged from three decades of civil war, social unrest, violence and poverty, and in which food and family survival are valued above all else. In such a context, health prevention is a low community priority.

Conclusions

As discussed above, considerable factors influence community participation including social, political and economic differences, epidemiology, social conditions and the strategies of programme providers or external agencies for community participation. Sustainability is often problematic because there is a shortage of resources to launch community participation projects. There is a lack of research-based information on these factors, on community structures, and on the dynamics between programme officials and local residents, all of which are crucial to the initial and ongoing success of community participation (Woelk 1992; Kelly & Vlaenderen 1996). In poor communities in poor developing countries where the first need is food for survival, the capacity and skills of communities and local resources to participate and to obtain sustainable benefits from health interventions need to be addressed. Additionally, programme providers and community members have different needs, and these need to be accommodated to ensure sustainability when the former views community participation as a means to carry out health activities, and the latter tends to participate for individual benefits. In poor urban and rural areas, structures and resources to enable community participation are lacking (Espino, Koops & Manderson 2004). Moreover, social networks to facilitate community participation are often absent. Without external support, some marginalized communities lack cohesiveness and have limited means to realize their needs and sustain participation.

In stable and less impoverished communities, people have more control over their lives and are in a better position to participate and realize their needs, whereas people in communities with an unstable government or impoverished conditions may be reluctant to work with the government for disease control purposes. Dramatic changes in recent decades in terms of population mobility and distribution also impact on sustainable community participation. Increasing landlessness, economic crises and poverty have resulted in large numbers of people moving from place to place for jobs and subsistence living. This movement has negative implications for community participation in tropical disease control and health care as migrants mainly focus on personal interest and are reluctant to participate in any long-term commitment. Therefore, a community-based dengue control programme with community participation must look beyond the mere and initial involvement of community members in planning and implementation, but also consider and deal with various contexts that may impact their perception of and hence willingness to engage in community participation over the long term. ❑

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References

Braga I, Lima J, Soares S & Valle D 2004, 'Aedes aegypti resistance to Temephos during 2001 in several municipalities in the state of Rio de Janeiro, Sergipe, and Alagoes, Brazil', *Mem Inst Oswaldo Cruz, Rio de Janeiro* vol. 99, no. 2, pp. 199-203.

Cambodia DSP 2004a, *National Health Statistics Report 2002*, Department of Planning and Health Information, Ministry of Health, Phnom Penh.

Cambodia DSP 2004b, *National Health Statistics Report 2003*, Department of Planning and Health Information, Ministry of Health, Phnom Penh.

Cambodia DSP 2005, *National Health Statistics 2004*, Department of Planning and Health Information, Ministry of Health, Phnom Penh.

Crabtree S, Wong C & Mas'ud F 2001, 'Community participatory approaches to dengue prevention in Sarawak, Malaysia', *Human Organization* vol. 60, no. 3, pp. 281-287.

Espino F, Koops V & Manderson L 2004, *Community participation and tropical disease control in resource-poor settings*, WHO/TDR, Geneva.

Fernandez E, Leontsini E, Sherman C, Chan A, Reyes C, Lozano R, Fuentes B, Nichter M & Winch P 1998, 'Trial of a community-based Intervention to decrease infestation of Aedes aegypti mosquitoes in cement washbasins in El Progeso, Honduras', *Acta Tropica* vol. 70, no. 2, pp. 171-183.

Gomez F, Suarez C & Cardenas R 2002, 'Educational campaign versus Malathion spraying for the control of Aedes aegypti in Colima, Mexico', *Journal of Epidemiology and Community Health* vol. 56, pp. 148-152.

Gubler D & Clark G 1996, 'Community involvement in the control of Aedes aegypti', *Acta Tropica* vol. 61, no. 2, pp. 169-179.

Hawe P 1994, 'Capturing the meaning of "community" in community intervention evaluation: some contributions from the community psychology', *Health Promotion International vol.* 9, no. 3, pp. 199-210.

Jennings C, Phommasack B, Sourignadeth & Kay B 1995, 'Aedes aegypti control in the Lao People's Democratic Republic, with reference to copepods', *American Journal of Tropical Medicine and Hygiene* vol. 53, pp. 324-330.

Kay B & Nam S 2005, 'New strategy against Aedes aegypti in Vietnam', *The Lancet* vol. 365, no. 9459, pp. 613-617.

Kelly K & Vlaenderen H 1996, 'Dynamics of participation in health project', *Social Science and Medicine* vol.42, no. 9, pp. 1235-1246.

Krogstat D & Ruebush T 1996, 'Community participation in the control of tropical diseases', *Acta Tropica* vol. 61, no. 2, pp. 77-78.

Lloyd L 1991, 'A community-based Aedes aegypti control programme', (Doctor of Public Health thesis) School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, Maryland.

Lloyd L, Winch P, Canto J & Kendall C 1992, 'Result of a community-based Aedes aegypti control program in Merida, Yucatan, Mexico', *American Journal of Tropical Medicine and Hygiene* vol. 46, no. 6, pp. 635-642.

Lloyd L, Winch P, Canto J & Kendall C 1994, 'The design of a community-based health education intervention for the control of Aedes aegypti', *American Journal of Tropical Medicine and Hygiene* vol.50, no. 4, pp. 401-411.

Manderson L 1992, 'Community participation and malaria control in Southeast Asia: defining the principles of involvement', *Southeast Asian Journal of Tropical Medicine and Public Health* vol. 23, no. 1, pp. 9-17.

Martínez-Ibarra J, Guillen Y, Jimenez J & Lopez M 2002, 'Indigenous fish species for the control of Aedes aegypti in water storage tanks in Southern Mexico', *Bio Control* vol. 47, no. 4, pp. 481-486.

Midgley J, Hardiman M & Narine D 1986, *Community participation, social development and the state*, Methuen, London and New York.

Morgan L 2001, 'Community participation in health: perpetual allure, persistent challenge', *Health Policy and Planning* vol. 16, no. 3, pp. 221-230.

Nam V, Yen N, Kay B, Marten G & Reid J 1998, 'Eradication of Aedes aegypti from a village in Vietnam, using copepods and community participation', *American Journal of Tropical Medicine and Hygiene* vol. 59, no. 4, pp. 657-660.

Oakley P 1991, *Understanding participation. Projects with people: the practice of participation in rural development*, Geneva, International Labour Office.

Polson K, Curtis C, Seng C, Olson J, Ngan C & Rawlins S 2001, 'Susceptibility of two Cambodian populations of Aedes aegypti mosquito larvae to Temephos during 2001', *Dengue Bulletin* vol. 25, pp. 79-83.

Renganathan E, Parks W, Lloyd L, Nathan M, Hosein E, Odugleh A, Clark G, Gubler DJ, Prasittisuk C, Palmer K & Martineau J 2003, 'Towards sustaining behavioural impact on dengue prevention and control', *Dengue Bulletin* vol. 27, pp. 6-12.

Rifkin S 1996 'Paradigms lost: toward a new understanding of community participation in health programmes', *Acta Tropica* vol. 61, no. 2, pp. 79-92.

Sanchez L, Perez D, Cruz G, Silva LC, Boelaert M & Van der Stuyft P 2004, 'Community participation in the control of Aedes aegypti: opinions of the population in one section of Havana, Cuba', *Revista Panamericana De Salud Publica-Pan American Journal Of Public Health* vol. 15, no. 1, pp. 19-25.

Service M 1993, 'Community participation in vector-borne disease control', *Annals of Tropical Medicine and Parasitology* vol. 87, no. 3, pp. 223-234.

Toledo-Romani ME, Baly-Gil A, Ceballos-Ursula E, Boelaert M & Van der Stuyft P 2006, 'Community participation in dengue prevention: an approach from the perspective of different social actors', *Salud Publica de Mexico* vol. 48, no. 1, pp. 39-44.

Whiteford L 1997, 'The ethnoecology of dengue fever', *Medical Anthropology Quarterly* vol. 11, no. 2, pp. 203-223.

Whiteford L 2000, 'Local identity, globalization and health in Cuba and the Dominican Republic', in *Global health policy, local realities: the fallacy of the level playing field*, Whiteford L & Manderson L (eds), Lynne Rienner Publishers, Boulder, pp. 57-101.

Whiteford L & Manderson L (eds) 2000, *Global health policy, local realities: the fallacy of the level playing field*, Lynne Rienner Publishers, Boulder.

Winch P, Kendall C & Gubler D 1992, 'Effectiveness of community participation in vector-borne disease control', *Health Policy and Planning* vol. 7, no. 4, pp. 342-351.

Winch P, Leontsini E, Rigau-Perez J, Ruiz-Perez M, Clark G & Gubler D 2002, 'Community-based dengue prevention programs in Puerto Rico: impact on knowledge, behaviour and residential mosquito infestation', *American Journal of Tropical Medicine and Hygiene* vol. 67, no. 4, pp. 363-370.

Woelk G, 1992, 'Cultural and structural influences in the creation of and participation in the community health programs', Social Science and Medicine vol. 35, no. 4, pp. 419-424.

Zakus J & Lysack C 1998, 'Revisiting community participation', *Health Policy and Planning* vol. 13, no. 1, pp 1-12.

New HIV prevention technologies: research progress and effective researcher-civil society partnerships

Article by Catherine Hankins

In 2005, an estimated 4.1 million people worldwide became newly infected with HIV and an estimated 2.8 million lost their lives to AIDS. By the end of 2005, this brought the estimated number of people living with HIV around the world to 38.6 million (UNAIDS 2006). The need to intensify HIV prevention has been dramatically highlighted by the effort to provide antiretroviral treatment (ART) to those in need in low- and middle-income countries, beginning with the World Health Organization/UNAIDS led "3 by 5" campaign to place 3 million people on ART by the end of 2005. An estimated 1.3 million people of the almost 6 million in need started on ART, highlighting the challenges of drug procurement and supply, HIV testing and counselling access, health-care infrastructure, health-care worker shortages, training needs, regulatory issues and costs (WHO/UNAIDS 2005). Without dramatically improved HIV prevention strategies, it will be impossible to meet treatment demand and to sustain the response over time.

While some countries have significantly increased prevention coverage, prevention programmes still reach only a small minority of those in need, and a number of prevention targets are not being reached. For example, most countries missed the 2001 Declaration of Commitment target of ensuring that 90% of young people in 2005 have access to critical HIV prevention services, including services to develop the life-skills needed to reduce vulnerability to HIV (United Nations 2006). The need for HIV prevention strategies at the scale and scope required to turn the HIV epidemic around is evident (UNAIDS 2005a). While countries intensify, diversify and target their prevention efforts, scientific work under way aims to develop and test additional tools and products to add to the HIV prevention armamentarium.

This article briefly reviews current research into vaccines, microbicides, women-initiated methods such as the female condom and diaphragm, male circumcision and pre-exposure prophylaxis, and then looks at the essential elements of effective researcher-community partnerships for the conduct of HIV prevention research.

HIV prevention trials

HIV vaccines

A vaccine to overcome HIV is our most compelling hope for bringing the global HIV epidemic under control. Developing a vaccine remains elusive due to inadequate resources, clinical trial and regulatory capacity concerns, intellectual property issues and scientific challenges. More than 30 preventive AIDS vaccine candidates are in early stages of human clinical trials in approximately two dozen countries around the world (including the promising Merck adenovirus vector vaccine, which may stimulate anti-HIV cell-mediated immunity). The Global HIV Vaccine Enterprise has rallied scientists, activists, funders and others worldwide around a Strategic Scientific Plan to rapidly advance progress towards effective HIV vaccines (Global HIV/AIDS Vaccine Enterprise 2005). The plan describes the major challenges facing the field and makes recommendations in six priority areas: vaccine discovery, laboratory standardization, product development and manufacturing, clinical trials capacity, regulatory issues and intellectual property issues. An effective HIV vaccine is likely to be 10 years or more away.

Microbicides

A microbicide is a product, such as a gel, cream, film, suppository or slow-releasing sponge or vaginal ring that could be applied topically to genital mucosal surfaces to prevent or significantly reduce the sexual transmission of HIV and other infections (International Partnership for Microbicides 2006). An effective microbicide may be able to kill or otherwise immobilize HIV; it may form a barrier between the virus and the vaginal tissue; it could boost the natural defences of the vagina against HIV; or it could prevent the virus from multiplying once it enters cells. Safe and effective microbicides could help women substantially reduce their vulnerability to HIV infection during sexual intercourse.

Nearly a dozen microbicides have entered human testing. There are six large-scale efficacy trials under way of five first and second generation microbicide products (surfactants and polymers). Various third and fourth generation options (formulations containing antiretroviral drugs or co-receptor specific blockers) are in the pipeline. They include fusion inhibitors – CCR5, gp120 and gp41 blockers and gels containing antiretroviral medications. Formulations being explored include non-coitally dependent products that could be applied daily or weekly such as vaginal rings releasing preventive levels of antiretroviral drugs, other devices in

which the microbicidal drug could be released on contact with semen and genetically modified lactobacilli which would release antiviral proteins.

Women-initiated methods: female condom and diaphragm
The female condom is a strong, soft, transparent polyurethane sheath which, when inserted in the vagina forms a barrier between the penis and the vagina, cervix and external genitalia. Put in place before sexual intercourse, it provides protection against most sexually transmitted infections, including HIV, and pregnancy. Stronger than latex and odourless, the female condom may be used with oil-based and water-based lubricants. Insertion is not dependent on male erection and, unlike the male condom, immediate withdrawal after ejaculation is not required. A second version of the female condom has been developed and, with lower production costs, it may become more accessible for women in low- and middle-income countries. A multi-site randomized controlled trial of condoms versus condoms/diaphragm/lubricant gel is currently under way in Zimbabwe and South Africa to assess whether diaphragms can play a significant role in expanding prevention choices available to women.

Male circumcision
More than 20 years of observational studies reveal that circumcised males throughout the world generally have lower HIV infection rates than uncircumcised males. Because it is unclear to what extent this may be the result of a biological effect of male circumcision, or the result of cultural or social factors that can accompany high levels of male circumcision, randomized controlled trials examining the impact of male circumcision on female-to-male sexual transmission were begun in Kenya, South Africa and Uganda. In 2005, a randomized controlled trial of over 3,200 men aged 18 to 24 years in Orange Farm, South Africa, found that adult male circumcision reduced the men's risk of contracting HIV sexually by over 60% during the 18-month study period (Auvert et al. 2005). Male circumcision is likely to help protect against HIV infection primarily by removing Langerhans cells which are target cells in the inner foreskin for HIV entry and by reducing men's risk of acquiring some sexually transmitted infections that increase vulnerability to HIV. Two other efficacy trials of adult male circumcision to reduce female-to-male HIV transmission are under way in Kenya and Uganda. All three trials involve male circumcision under local anaesthesia using one of two techniques. A fourth study in Uganda is assessing the degree of protection that male circumcision may offer to female partners of HIV-positive men.

UNAIDS is coordinating implementation of a UN Work Plan on Male Circumcision which focuses on increasing the safety of current practices while developing tools to assist countries in deciding on the place of male circumcision within comprehensive HIV programming should the remaining trials confirm the protective effect (Cassell et al. 2006). Results of the efficacy trials are anticipated in 2007. If proven effective, male circumcision will increase available proven options for HIV prevention, but male circumcision does not eliminate the risk of HIV for men. It is critical that male circumcision does not cause risk compensation (UNAIDS 2005) or the abandonment of existing effective strategies such as correct and consistent condom use, reduction in the number of sexual partners, avoidance of penetrative sex and knowledge of HIV serostatus.

Pre-exposure prophylaxis (PrEP)
Pre-exposure prophylaxis (PrEP) to prevent HIV sexual or parenteral transmission holds promise for serodiscordant couples, sex workers, men who have sex with men and injecting drug users who may be exposed to HIV despite using precautions. Small-to-medium sized phase II trials to test the use of the antiretroviral drug Tenofovir in pre-exposure prevention are under way in Atlanta and San Francisco, with larger phase II/III studies under way in Botswana, Ghana and Thailand. Some of these studies have been dogged by controversy about the adequacy of pre-trial community consultation and informed consent, linkages to HIV treatment programmes for those found to be infected at baseline or in the course of the study, and, in the case of Thailand, the lack of access to sterile needles in a study designed to examine HIV transmission among injecting drug users. Three PrEP studies were cancelled (Cambodia, Nigeria and Cameroon).

Effective researcher-civil society partnerships for HIV prevention research

The quickened pace of research on new HIV prevention approaches reflects urgent need, strong and sustained activism and new sources of funding. Often complex and expensive, prevention trials require the enrolment and retention over several years of thousands of uninfected volunteers. But it is not only a quickened pace and large sample sizes that characterize HIV prevention trials today – trial participants and communities have demanded that they be included in defining research priorities, determining how trials will be conducted and monitoring trial implementation. Many researchers have worked to respond to these demands through efforts such as including people living with HIV and community representatives on review committees and establishing community advisory boards to work on specific protocols and trials.

As seen in the controversies generated by the PrEP trials, HIV prevention research can often be highly controversial. An International AIDS Society consultation in Seattle (International AIDS society 2005) and a series of consultations led by UNAIDS involving community activists, researchers, sponsors and others identified problems in trial design and conduct in this promising research area. The consultations also defined collaborative approaches to facilitating critically important prevention research while being responsive and accountable to community needs and priorities (UNAIDS 2005c).

The UNAIDS-initiated year-long process to promote effective partnerships between researchers and civil society in HIV prevention trials was prompted by the 2004 debate

about Tenofovir PrEP trials. A wide range of stakeholders, including researchers, activists, ethicists, government officials, international agencies, civil society, trial participants, sponsors and funders participated in one of three regional consultations held in Durban, South Africa; Abuja, Nigeria; and Pattaya, Thailand which culminated in an international consultation held in Geneva in June 2005.

Two background papers were commissioned to inform discussions at the regional and international consultations, one exploring whether researchers are ethically obligated to guarantee access to antiretroviral therapy to participants who become HIV-infected during prevention trials (Weijer et al. 2005), and the other outlining gaps and inconsistencies in existing ethical guidance and highlighting relevant approaches to collaborative partnerships with communities (Collins 2005). Participants debated a number of cross-cutting issues including community engagement in study design and implementation, communication among stakeholders, vulnerable populations, and building human and physical capacity through research. Recommendations were made on models for building and sustaining research partnerships, "standard of prevention" in HIV trials, approaches to assuring provision of antiretroviral therapy to trial participants in need and the role of national policies.

Defining "community" is a challenge; increasing numbers of groups and people see themselves as part of the interested "community". Both the concept of community and terminology need to be broadened to "civil society" or "stakeholders". All parties must agree to clearly defined roles and responsibilities, aiming to find a balance between appropriate consultations with stakeholders, and conducting research in a timely fashion. Partnership agreements should include clear delineation of roles for all stakeholders and should specify responsibilities – and rights – of sponsors, governments, community, advocacy organizations and media, and researchers.

National governments should be prepared to play a strong role in providing oversight, monitoring and follow-up. They can establish national or other boards to review, approve and monitor research partnership approaches similar to those that are used for regulatory or ethical review. Although many community advisory boards have contributed significantly to developing sustained relationships and communication between researchers and community members, some have become strong interest groups lacking members that are representative and accountable to their communities. Innovative additional approaches to partnership and community engagement need to be developed and documented.

Developing and delivering a "standard of prevention" for HIV prevention trials

Prevention trials are based on the premise that despite provision of risk reduction interventions, some participants will continue to engage in risk behaviours that lead to them acquiring HIV infection. Legitimate concerns have been raised for at least 15 years that expecting researchers to provide comprehensive risk reduction counselling and services while also conducting a trial that uses HIV seroconversion to measure efficacy introduces an untenable "researchers' dilemma" or conflict of interest. Advocates in a number of settings have proposed that an outside organization provide a trial's risk reduction services and counselling. Delegating to an outside organization, an approach that separates risk reduction counselling from research and potentially reduces any real or perceived conflict of interest, may actually compromise researchers' abilities to meet ethical obligations to trial participants. Conditions for ethical conduct of HIV prevention research may also not be met where national or local policy constraints impinge on good public health practice, as is the case when a trial assessing the effect of an intervention on injecting-related HIV transmission cannot provide "standard of prevention" risk reduction tools such as sterilized injection equipment.

To address such ethical concerns, researchers should engage appropriate stakeholders in design, implementation and oversight of risk reduction interventions, tailored to the specific needs and risks of trial participants in a given community. Sponsors, researchers and activists should work together to resolve conflicts about provision of appropriate risk reduction interventions and work to develop a common "standard of prevention".

Approaches to developing and delivering antiretroviral therapy for trial volunteers

There is growing consensus that firm arrangements for the provision of antiretroviral therapy to trial volunteers who acquire HIV-infection during an HIV prevention trial should be explicitly defined in trial protocols. Trial participants who become infected during an HIV prevention trial may not need treatment for years, possibly decades. Research infrastructure and funding mechanisms may have changed dramatically; current private and public health and financing systems may no longer be in existence. Treatment protocols, drug access and pricing, and clinical monitoring will almost certainly have changed significantly. To address these dilemmas, realistic standards for care and treatment of study participants need to be developed by national and international research oversight groups.

National AIDS plans should provide clear guidance on care and support to be provided for HIV prevention trial participants who become HIV-infected, and specify the responsibilities of government, research sponsors and other stakeholders. For example, 10 African national governments, supported by the African AIDS Vaccine Programme, have national AIDS vaccine plans that define rules and terms for research conduct and post-trial access. Stakeholders participated in defining these policies, so they reflect multiple perspectives and needs. In India, an ongoing preparedness effort among stakeholders involved in HIV vaccine research has informed government policies related to clinical research, including those on intercurrent infections and mechanisms for resolving conflicts within trials. For example, trial volunteers who become HIV-infected while enrolled in trials will be provided with treatment by the trial for a period of five

years, after which they will be enrolled in the national treatment programme.

Requiring trials to provide for multiple needs of participants and setting unrealistic expectations and standards could jeopardize trial conduct and prevention research more broadly. Upfront, sponsors and researchers should specify in protocols what commitments have been made to provide services, care and treatment for volunteers who become HIV-infected during the trial (and other health outcomes as appropriate) and indicate how the services will be provided, by whom and for how long. Experiences with insurance plans, payments to trial participants, contracts with government or private providers, escrow accounts or other approaches should be documented and shared (Forbes 2006). Researchers should formalize referral networks, ensure that local services to which trial participants are to be referred have the capacity to provide needed services, and provide resources and capacity development to strengthen these services. Researchers and sponsors should link with initiatives to pilot and expand access to treatment services to attract resources for communities participating in research, so that services for trial volunteers and other community members can be expanded. This is one way of addressing the concern of what obligations researchers have to trial volunteers who discover they are HIV-infected at screening.

In reality, the number of researchers and the amount of money available for research into urgently needed new HIV prevention technologies and approaches are limited. This is a critically important, volatile and highly uncertain area that requires all partners to commit themselves to experimentation and careful documentation of approaches, successes and failures to build the best practice base on effective researcher-civil society partnerships in HIV prevention research. ❑

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References

Auvert B et al. 2005, 'Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial', *PloS Medicine*. vol. 2, no. 11, p. 298.

Cassell MM, Halperin DT, Shelton JD, Stanton D 2006 'Risk compensation: the Achilles' heel of innovations in HIV prevention?' *BMJ*; no. 332, pp. 605–607.

Collins Chris 2005, 'Gaps and inconsistencies in ethical guidance for HIV prevention research', background paper prepared for UNAIDS, June, Geneva.

Forbes A 2006, 'Moving towards assured access to treatment in microbicide trials', *PLoS Med*; vol. 3 no.7, p. 153. DOI:10.1371/journal.pmed.0030153

Global HIV/AIDS Vaccine Enterprise 2005, 'The global HIV/AIDS vaccine enterprise: scientific strategic plan. *PloS Medicine*. vol.2, no.2, p. 25

International AIDS Society 2005, 'Building collaboration to enhance HIV prevention', Global consultation on Tenofovir pre-exposure prophylaxis research, September.

International Partnership for Microbicides 2006, retrieved 8 August, from http://www.ipm-microbicides.org/microbicides/english/index.htm

UNAIDS 2005a, 'Intensifying HIV prevention: policy position paper'. UNAIDS, Geneva August 2005.

UNAIDS 2006b, 'Creating effective partnerships for HIV prevention trials: report of a UNAIDS consultation, Geneva', 20–21 June, *AIDS*, no. 20, pp. W1–W11.

UNAIDS 2005b, 'Statement on South African trial findings regarding male circumcision and HIV', media release 26 July 2005.

UNAIDS 2006, Geneva, August 2005 'Report on the global AIDS epidemic 2006'.

Weijer, Charles & LeBlanc Guy 2005, 'Revisiting the ethics of HIV prevention research in developing countries', Background paper prepared for UNAIDS, June, Geneva.

WHO/UNAIDS 2005, 'Progress on global access to HIV antiretroviral therapy: an update on "3 by 5", Geneva.

United Nations 2006, 'The declaration of commitment on HIV/AIDS five years later', report of the Secretary-General, Geneva.

Research priorities to scale up diagnosis and treatment of multidrug-resistant tuberculosis

Article by Matteo Zignol (pictured), Ernesto Jaramillo, Abigail Wright, Eva Nathanson, Fuad Mirzayev and Paul Nunn

Multidrug-resistant tuberculosis (MDR-TB) is a severe form of tuberculosis (TB) caused by strains of Mycobacterium tuberculosis which have developed resistance to the two most powerful bactericidal anti-TB drugs: rifampicin and isoniazid. The development of drug resistance is man-made, due to inconsistent, irregular or incorrect anti-TB treatment, and reflects a history of poor TB control which permits selection of naturally occurring resistant mutants.

MDR-TB has been detected in every region of the world and in all the 90 countries surveyed so far, with the highest frequencies found in the countries of the former Soviet Union and in some provinces of China (WHO 2004).

The World Health Organization (WHO) estimates that 424,000 MDR-TB cases occurred worldwide in 2004, with 62% of the estimated global burden concentrated in China, India and the Russian Federation (Zignol et al. 2006).

Although more difficult to diagnose and far more complex and costly to treat than susceptible TB, MDR-TB management has been proven feasible and cost effective in resource-limited settings (Suarez et al. 2002; Shin et al. 2004 & 2006; Lemaine et al. 2005; WHO 2005; Nathanson et al. 2006).

The WHO guidelines for the programmatic management of drug-resistant TB are now available (WHO 2006) and the Green Light Committee (GLC)[1] for access to high quality second-line anti-TB drugs at reduced prices (Gupta et al. 2001 & 2002) and the Global Fund to Fight AIDS, TB and Malaria have enabled resource-limited countries to treat MDR-TB.

The management of MDR-TB is a key component of the new Stop TB Strategy, recently launched by the WHO and partners (Raviglione & Uplekar 2006). To implement the new Stop TB Strategy and achieve the Millennium Development Goals (MDGs) (United Nations Statistics Division 2004), a Global Plan for TB control for the decade 2006–2015 has been developed. The actions and the funding required to improve TB services are described in the Plan which aims to treat 778,000 MDR-TB cases by 2015 for a cost of US$ 5 billion (Stop TB Partnership & WHO 2006).

To scale up diagnosis and treatment of MDR-TB and reach the targets set up by the Global Plan, several important research gaps need to be addressed. The most important research objectives are indisputably the development of new diagnostics to shorten the time of diagnosis, and the development of new and more effective drugs to shorten the treatment period and reduce the number of medicines currently given to MDR-TB patients.

Below are discussed some of the most relevant knowledge gaps for each of the main areas of MDR-TB control: epidemiology, laboratory, programmatic management, and drug development and management.

Epidemiology

To properly understand the epidemiology of MDR-TB and monitor TB and MDR-TB control programmes, better knowledge of the transmission dynamics of drug-resistant strains is urgently needed. It is still unclear whether drug-resistant strains (and particularly MDR-TB strains) have reduced fitness with regard to transmission compared to susceptible strains. Different studies have yielded different and conflicting results (van Soolingen et al. 1999; Kruuner et al. 2001; Dye et al. 2002). In addition, families of drug-resistant strains seem to have varying levels of virulence. For example, the association between drug resistance and increased virulence has been suggested for the so-called Beijing family and the closely related W-family (Kruuner et al. 2001; Bifani et al. 1996), but little is known about other families. Further research in this area would be beneficial to improve knowledge of the transmission and prognosis of MDR-TB based on the family of strains responsible for the infection.

The epidemiology of MDR-TB within the HIV-infected population is also not well understood and deserves more attention from the scientific community. Most of the available data have been reported from hospital settings documenting outbreaks of MDR-TB among HIV-infected patients with high mortality rates (MMWR 1991). There is little conclusive evidence of the association of HIV and MDR-TB in the general population, particularly in high MDR-TB prevalence settings (Morozova et al. 2003).

The overall effect of MDR-TB on mortality among HIV

[1] The Green Light Committee (GLC) was established in 2000 as a multi-institutional partnership to promote access to high quality life-saving second-line drugs at reduced prices for the treatment of MDR-TB; and under rigorous monitoring to prevent the creation of resistance to second-line drugs, the last line of defence against TB. The GLC delivers three integrated services: a) access to high quality second-line drugs at reduced prices for the treatment of MDR-TB; b) review of applications from countries willing to benefit from these drugs to ensure rational treatment, according to WHO guidelines; and c) monitoring and evaluation of the approved projects.

patients is still unknown but likely to be very high in many resource-limited settings where routine testing for MDR-TB is not available and many outbreaks go unreported.

Furthermore, extensive drug resistance (XDR-TB), that is MDR-TB with additional resistance to three or more classes of second-line anti-TB drugs, has been reported to be emerging globally. Little information is available at present, but one survey of the supranational laboratory network has found that 10% of MDR-TB isolates were classified as XDR-TB (MMWR 2006). Given the significance of these virtually incurable strains, further standardized surveillance of XDR-TB is required. Drug susceptibility testing (DST) methods are currently not standardized for most of the second-line anti-TB drugs. Standardized methods will greatly facilitate documentation of the magnitude and trends of XDR-TB.

Laboratory

The laboratory component is one of the most critical elements in the management of MDR-TB. Innovations and improved knowledge would be beneficial in two areas: shortening the time needed for MDR-TB diagnosis and evaluating the clinical relevance of DST for second-line drugs.

With conventional DST methods, six to 10 weeks are needed from the time the specimen is collected to the diagnosis. New techniques based on molecular methods to shorten the time required for diagnosis while maintaining acceptable levels of contamination, sensitivity and specificity should be urgently developed, and those already available should be rapidly field-tested.

Rapid genetic testing would also be useful to improve surveillance of MDR-TB in areas where laboratory infrastructure and performance are poor, and where a standard drug resistance survey would overload the laboratory. Rifampicin resistance has been determined to be a good surrogate marker for MDR-TB (Traore et al. 2000), and genetic tests for rifampicin resistance correlate well with phenotypic results as well as clinical resistance. The utilization of genetic testing for rifampicin, based at a regional or supranational reference laboratory, may facilitate the expansion of baseline surveys on rifampicin resistance and, at the same time, reduce shipment costs, loss to contamination and heightened biosafety risks by shipping out of the country sputum swabs instead of isolates. Research is needed to evaluate the feasibility of using rapid rifamicin testing in the course of routine surveys.

DST of second-line anti-TB drugs is required to design standardized or individualized treatment regimens depending on the epidemiological setting and resources available. DST of second-line drugs is not as simple as DST of some first-line drugs (rifampicin and isoniazid) because drug concentrations defining drug resistance are very close to the minimal inhibitory concentrations (Kim 2005). Research is needed to calibrate DST methods with clinical isolates, and to evaluate the clinical relevance of DST comparing laboratory results with treatment outcomes.

Programmatic management

One of the most relevant unsolved issues in the programmatic management of MDR-TB is the efficacy of individualized and standardized regimens, measured by the frequency of relapse after cure.

Three studies on the long-term follow-up of patients treated with individualized treatment regimens for MDR-TB in 1) five different settings approved by the GLC: Estonia, Latvia, Peru (Lima), the Philippines (Manila) and the Russian Federation (Tomsk Oblast); 2) Peru; and 3) Spain show relapse rates of 2.1% (range: 1.1% in Lima to 10% in Estonia), 1.2% and 0%, respectively (Nathanson et al. 2006; Shin et al. 2006; Escudero et al. 2006). Another study in Bangladesh, using a standardized regimen for MDR-TB, based on the susceptibility profiles of locally prevalent MDR-TB strains, showed a relapse rate of 2.5% after 24 months of follow-up (Van Deun et al. 2004). The above-mentioned four studies show lower relapse rates for MDR-TB treatment than for treatment with standardized short-course TB chemotherapy (Santha 2004). Possible reasons for the low relapse rates are that in all these projects a patient-centered approach was used for treatment delivery and care to ensure adherence to treatment; and also the fact that these studies received much more support than during routine programme conditions.

Additional studies are needed to examine the frequency of relapse in MDR-TB treatment programmes, whether based on standardized or individualized treatment regimens. The reasons for possibly lower relapse rates should be further investigated, especially in light of the benefits of a patient-centered approach applied in the above-mentioned studies and in GLC-approved programmes. The challenge remains to study the relationship between drug resistance patterns and the use of specific second-line drugs and TB recurrence.

Another issue of importance for MDR-TB management in resource-limited settings is the frequency of and method used for bacteriological monitoring of patients before and after culture conversion. The idea that MDR-TB treatment requires more sophisticated laboratory support is widely accepted. However, it is still debated whether patients should receive culture on a monthly basis or whether the frequency of laboratory investigations could be decreased and some of the cultures replaced by sputum smear microscopy tests. Performing sputum smear microcopy for diagnosis and follow-up is easier, less expensive and more rapid than doing culture, besides being much safer for laboratory staff. Unfortunately, the sensitivity of direct smear microscopy ranges from 50% to 70% when compared to culture (American Thoracic Society and Centers for Disease Control and Prevention 2000), which is the primary argument for replacing smear microscopy during patient follow-up. In most resource-limited settings, performing monthly culture is not affordable or feasible and therefore further research is needed to establish where and when culture can be replaced by sputum smear microscopy. Frequency and necessity of DST of first- and second-line drugs during the treatment course also require research.

Drug development and management

WHO guidelines recommend that MDR-TB patients be treated with a cocktail of at least four effective anti-TB drugs for at least 24 months (WHO 2006). The length of treatment, the

number of pills to be taken and the effect of drug side-effects are important reasons for treatment default. Unfortunately no major breakthrough in drug development has occurred in the past 30 years. The discovery and development of affordable new drugs effective against MDR-and XDR-TB that will shorten treatment are therefore desperately needed.

The supply of second-line anti-TB drugs to GLC-approved projects is challenging, particularly due to the limited number of manufacturers, the high cost and short shelf life of second-line anti-TB drugs, and the long lead time for delivery (ranging from two to six months). Moreover, at present, with 1) de facto, one single source for the supply of each second-line anti-TB drug; 2) only one manufacturer assessed as Good Manufacturing Practice (GMP) compliant by the WHO prequalification project; and 3) the small number of products in the prequalification pipeline, the interest in the market for second-line anti-TB drugs remains limited and competition between drugs' manufacturers is virtually non-existent.

The challenge for the coming years is to identify, mobilize and provide technical assistance to manufacturers – so that they can become viable players in the market for second-line anti-TB drugs – by providing quality-assured drugs at competitive prices, through a transparent tender process.

More research is needed into the demand and supply dynamics of second-line anti-TB drugs in the public and private markets. Better knowledge of existing and potential suppliers will improve our capability to meet the existing and projected demand for second-line drugs.

The above challenge concerns the existing second-line anti-TB drug portfolio. As new TB drugs to treat MDR-TB become available, new research and information challenges – in terms of regulatory and trade obstacles, marketing and supply channels, pricing etc – will arise. Therefore, as research continues on the development of new TB drugs to increase and improve the treatment options available for drug-sensitive and drug-resistant TB, the related research challenges that the advent of new drugs will bring should be carefully considered.

Conclusion

With the new Stop TB Strategy, the WHO is committed to enabling and promoting programme-based operational research as well as research to develop new diagnostics, drugs and vaccines (Raviglione & Uplekar 2006). Research is needed in any field of TB control, but particularly in the area of drug-resistant TB and MDR-TB. The success of scaling up programmatic management of MDR-TB, as described in the Global Plan to Stop TB 2006–2015 (Stop TB Partnership & WHO 2006), depends on the capacity to address the research issues discussed above which are still serious obstacles to a public health approach to the management of MDR-TB. ❑

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References

American Thoracic Society and Centers for Disease Control and Prevention 2000, 'Diagnostic standards and classification of tuberculosis in adults and children', *Am J Resp Crit Care*, vol. 161, pp. 1376-95.

Bifani PJ, Plikaytis BB, Kapur V, Stockbauer K, Pan X, Lutfey ML, Moghazeh SL, Eisner W, Daniel TM, Kaplan MH, Crawford JT, Musser JM & Kreiswirth BN 1996, 'Origin and interstate spread of a New York City multidrug-resistant Mycobacterium tuberculosis clone family', *JAMA*, vol. 275, pp. 452-7.

Dye C, Williams BG, Espinal MA, Raviglione MC 2002, 'Erasing the world's slow stain: strategies to beat multidrug-resistant tuberculosis', *Science*, vol. 295, pp. 2042-6.

Escudero E, Pena JM, Alvarez-Sala R, Vazquez JJ & Ortega A 2006, 'Multidrug-resistant tuberculosis without HIV infection: success with individualised therapy', *Int J Tuberc Lung Dis*, vol. 10, pp. 409-14.

Gupta R, Kim JY, Espinal MA, Caudron JM, Pecoul B, Farmer PE & Raviglione MC 2001, 'Public health. Responding to market failures in tuberculosis control', *Science*, vol. 293, pp. 1049-51.

Gupta R, Cegielski JP, Espinal MA, Henkens M, Kim JY, Lambregts-Van Weezenbeek CS, Lee JW, Raviglione MC, Suarez PG & Varaine F 2002, 'Increasing transparency in partnerships for health – introducing the Green Light Committee', *Trop Med Int Health*, vol. 7, pp. 970-6.

Kruuner A, Hoffner SE, Sillastu H, Danilovits M, Levina K, Svenson SB, Ghebremichael S, Koivula T & Kallenius G 2001, 'Spread of drug-resistant pulmonary tuberculosis in Estonia', *J Clin Microbiol*, vol. 39, pp. 3339-45.

Leimane V, Riekstina V, Holtz TH, Zarovska E, Skripconoka V, Thorpe LE, Laserson KF & Wells CD 2005, 'Clinical outcome of individualised treatment of multidrug-resistant tuberculosis in Latvia: a retrospective cohort study', *The Lancet*, vol. 365: pp. 318-26.

MMWR Morb Mortal Wkly Rep 1991, 'Nosocomial transmission of multidrug-resistant tuberculosis among HIV-infected persons – Florida and New York, 1988–1991', vol. 40, pp. 585-91.

MMWR Morb Mortal Wkly Rep 2006, 'Emergence of Mycobacterium tuberculosis with extensive resistance to second-line drugs – worldwide, 2000–2004', vol. 55, pp. 301-5.

Morozova I, Riekstina V, Sture G, Wells C & Leimane V 2003, 'Impact of the growing HIV-1 epidemic on multidrug-resistant tuberculosis control in Latvia', *Int J Tuberc Lung Dis*, vol. 7, pp. 903-6.

Nathanson E et al, 'Multidrug-resistant tuberculosis can be successfully treated in resource-limited settings', Emerg Infect Dis 2006; in-press.

Raviglione MC & Uplekar M 2006, 'WHO's new STOP TB Strategy', *The Lancet*, vol. 367, pp. 952-5.

Santha T 2004, 'How important is follow-up and what is the frequency of relapse after the completion of treatment', in *Toman's tuberculosis case detection, treatment and monitoring: questions and answers*, second edition, WHO, pp. 267-69.

Shin SS, Furin JJ, Bayona J, Mate K, Kim JY & Farmer P 2004, 'Community-based treatment of multidrug-resistant tuberculosis in Lima, Peru: 7 years of experience', *Soc Sci Med*, vol. 59, pp. 1529-39.

Shin SS, Furin JJ, Alcantara F, Bayona J, Sanchez E & Mitnick CD 2006, 'Long-term follow-up for multidrug-resistant tuberculosis', *Emerg Infect Dis*, vol. 12 no. 4, pp. 687-8.

Shin SS, Pasechnikov AD, Gelmanova IY, Peremitin GG, Strelis AK, Andreev YG, Golubchikova VT, Tonkel TP, Yanova GV, Nikiforov M, Yedilbayev A, Mukherjee JS, Furin JJ, Barry DJ, Farmer PE, Rich ML, & Keshavjee S 2006, 'Treatment outcomes in an integrated civilian and

References continued

prison MDR-TB treatment program in Russia', *Int J Tuberc Lung Dis*, vol. 10, pp. 402-8.

STOP TB Partnership & World Health Organization (WHO) 2006, 'Global Plan to Stop TB 2006–2015', Document no. WHO/HTM/STB/2006.35, WHO, Geneva.

Suarez PG, Floyd K, Portocarrero J, Alarcon E, Rapiti E, Ramos G, Bonilla C, Sabogal I, Aranda I, Dye C, Raviglione M & Espinal MA 2002, 'Feasibility and cost-effectiveness of standardised second-line drug treatment for chronic tuberculosis patients: a national cohort study in Peru', *The Lancet*, vol. 359, pp. 1980-9.

Traore H, Fissette K, Bastian I, Devleeschouwer M & Portaels F 2000, 'Detection of rifampicin resistance in Mycobacterium tuberculosis isolates from diverse countries by a commercial line probe assay as an initial indicator of multidrug resistance', *Int J Tuberc Lung Dis*, vol. 4, no. 5, pp. 481-4.

United Nations Statistics Division 2004, Millennium Indicators Database, New York, NY. http://unstats.un.org/unsd/default.htm (Accessed May 2006).

Van Deun A, Salim MA, Das AP, Bastian I & F Portaels 2004, 'Results of a standardised regimen for multidrug-resistant tuberculosis in Bangladesh', *Int J Tuberc Lung Dis*, vol. 8, pp. 560-7.

van Soolingen D, Borgdorff MW, de Haas PE, Sebek MM, Veen J, Dessens M, Kremer K & van Embden JD 1999, 'Molecular epidemiology of tuberculosis in the Netherlands: a nationwide study from 1993 through 1997', *J Infect Dis*, vol. 180, pp. 726-36.

World Health Organization (WHO) 2004, 'Anti-tuberculosis drug resistance in the world', report 3, document no. WHO/HTM/TB/2004.343, WHO, Geneva.

World Health Organization (WHO) 2005, 'The feasibility and efficiency of controlling MDR-TB using the DOTS-Plus strategy in the Russian Federation', document no. WHO/HTM/TB/2005.357C. WHO, Geneva.

World Health Organization (WHO), 2006, 'Guidelines for the programmatic management of drug-resistant tuberculosis', document no. WHO/HTM/TB/2006.361, WHO, Geneva.

Zignol M, Hosseini SM, Wright A, Lambregts-van Weezenbeek C, Nunn P, Watt CJ, Williams BG & Dye W 2006, 'Global incidence of multidrug-resistant Tuberculosis', *J Infect Dis*; in-press.

Hepatitis C in Egypt

Article by Hatem Mostafa El Gabaly

Hepatitis C virus (HCV) occurs worldwide with a prevalence of 1–2% in developed countries and significantly higher rates in Eastern Europe and Africa. Hepatitis C infection is the most common chronic blood-born viral infection in Egypt and a major cause of liver disease. Hepatitis C infection can lead to an acute or silent course of liver disease, progressing from liver impairment to cirrhosis and decompensated liver failure or hepato-cellular carcinoma (HCC) in a 20–30 year period. In addition, the condition may be worse in conjunction with hepatitis B and/or Schistosomiasis. Persons with HCV infection may have no symptoms for many years, and many infected people do not know they have the virus. Over 20–30 years, chronic hepatitis develops in 60–70% of HCV infected patients; liver cirrhosis develops in 10–20% and liver cancer in 1–5%.

The disease progression is influenced by other factors such as duration of infection, age at infection, sex, co-infection with hepatitis B virus, Epstein bar virus, cytomegalovirus virus, the level of HCV viraemia and its type. Because of the high prevalence rate of HCV in the general Egyptian population, it accounts for most HCC cases in Egypt, with a mortality rate range of 6-8%.

Significant risk factors in Egypt include past history of parenteral anti-Schistosoma treatment, hospitalization, surgical operations, dental care, blood transfusion and unsafe injections.

HCV is clustered into six distinct genotypes with more than 90 subtypes; the known genotypes have been numbered from 1 to 6, and studies have shown that genotype 1 is most common (about 70%). Knowledge of the genotype is important because it has predictive value in terms of the response to antiviral therapy with better response to genotypes 2 and 3. Most Egyptian cases of hepatitis C (90%) are due to genotype 4 viruses, which are uncommon in the West.

In one survey conducted among Egyptians applying to work abroad in years 1995 and 1996, a total sample of 5,071 subjects were examined in the national central laboratory in Cairo, and in the regional laboratories in Alexandria, Assuit, Gharbia and Dakahlia governorates. The prevalence rate for hepatitis B was 4.5% and for hepatitis C 31%.

Another national survey was conducted in 1997 to measure the prevalence rates of hepatitis B and C in 11 governorates: Cairo, Alexandria and North Sinai representing desert and seaside environments; Bani-suef, Menia, Sohag and Aswan representing upper Egypt; and Sharkeya, Gharbeya, Ddakhlia and Behera representing lower Egypt. The sample size was 9,800 persons, 30 clusters/governorates of which 18 (60%) were urban and 12 (40%) were rural. All the laboratory investigations were done in the Ministry of Health's National Central laboratory. The prevalence rate for HBV was 4% (3–8%), and for HCV 12.8% (9–31%).

Nowadays, a national figure for the prevalence rate of HCV positivity is not available. However, estimates can be derived from blood banks data. The percentage of discarded blood units positive for HBV and HCV in the year 2005 was 1.5% for HBV and 8.9% for HCV. The analysis of the blood samples taken by the central national laboratories for obtaining health certificates during the year 2005 shows that the percentage of positive samples for HCV ranged from 1.5% to 7.1%; while as for HBV it ranged from 0% to 3% in all governorates.

Acute viral hepatitis is less frequent in Egypt than serum antibody levels suggest. Because acute viral hepatitis has a wide clinical spectrum, many cases are undetected because of mild illness caused by initial, early-childhood exposure to hepatitis viruses.

The goal of the Egyptian national hepatitis C prevention and control programme is to lower the incidence of hepatitis C in Egypt and reduce the disease burden from HCV infections. The Egyptian government has sought to tackle the epidemic by launching initiatives on various fronts. The implementation of preventive strategies is now imperative for stopping further spread of the HCV infection. The Ministry of Health and Population has succeeded in achieving a national organization infection control (IC) structure, national IC guidelines and a comprehensive training programme.

Other activities include research in collaboration with national and foreign universities and research institutes. One initiative has been the creation of a network which has been particularly active in the past seven years, bringing together the strengths of the Egyptian Ministry of Health, the National Hepatology and Tropical Medicine Research Institute in Cairo, Ain-Shams University in Cairo, the University of Maryland in Baltimore, USA, and the Pasteur Institute in

Paris, France.

External funding to support this research has been made available through USAID, the NIH (US National Institutes of Health), the European Commission, and the French ANRS (Agence nationale de recherches sur le SIDA). This network combines field sites for research in rural and urban areas of Egypt, epidemiological expertise at Ain-shams University, and state of the art HCV laboratory and treatment evaluation facilities at the National Hepatology and Tropical Medicine Research Institute (with experts from Cairo, Menia and Assuit Universities).

The overall aim of this project was to gain better control of the HCV epidemic in Egypt through proper evaluation of the magnitude of the epidemic, knowledge of the current routes of HCV transmission, understanding of the progressiveness of HCV infection in Egyptians, elaboration of treatment protocols adapted to the local health care system and HCV vaccine development.

The main findings of the studies carried out so far demonstrate:

- the importance of the ongoing HCV transmission as shown by repeated testing of village inhabitants in rural areas, and the hospital based detection of recent infections in Cairo (we estimate that at minimum 30,000–70,000 cases are infected each year);
- the significance of community-acquired or household-acquired infections, as opposed to hospital-based or intravenous drug use transmission in Western countries;
- the relatively lower severity of chronic hepatitis among Egyptians, as compared to patients in Western countries, due to the near absence of alcohol consumption (nonetheless, out of the estimated five million chronically infected Egyptians, 500,000 may need treatment today for advanced liver disease); and
- the 50% efficacy of multiple-drug therapy among Egyptian patients infected with local variants of the virus, compared to up to 80% efficacy for the most responsive variants of the virus found in Western countries.

Treatment for hepatitis C exists, and the current drug regimens cure about 40–60% of patients, depending on the type of genetic variants of the virus. However, treatment is long (one year), poorly tolerated (many side-effects), difficult to administer (through injections, and requiring experienced physicians and laboratories for patient monitoring), and very expensive (US$ 3,000 for standard combination antiviral therapy to US$ 30,000 for pegylated combination therapy per patient treatment)[1].

Further activity is needed for the prevention and control of HCV:

- achieving high levels of awareness with regard to risk reduction strategies to prevent new infections among the general population;
- education and communication directed at health-care providers and public health professionals;
- education and communication directed at people in groups at risk for infection;
- continuous screening and testing of blood and blood products to ensure a safe blood supply;
- expansion of and maintenance of infection control practices in all health facilities;
- strengthening immunization against hepatitis B for those who are at risk of infection;
- provision of appropriate medical management and support for those infected;
- development and periodic updates of guidelines for the diagnosis, treatment and prevention of hepatitis B and C and continuing medical education programmes to disseminate this information at the local level;
- strengthening of surveillance to monitor disease trends and to evaluate the effectiveness of prevention activities;
- research activities that include:
  - establishing the national level of chronic HCV infection, its associated liver disease burden and its economic impact and future trends;
  - identifying the exact routes of community or household HCV transmission in Egypt in order to improve prevention programmes. ❑

[1] Attaching a large inert molecule to a protein is a well-established method for decreasing its clearance. Since the late 1970s, the molecule of choice for this process has been polyethylene glycol (peg). When a biologically active antiviral agent is pegylated, its half-life is increased and the rate of drug clearance is decreased, resulting in prolonged concentrations of the agent. This, in turn, may increase the extent/duration of its therapeutic activity.

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Global mental health research

Article by Vikram Patel

Mental disorders cover a wide range of illnesses and disabilities, affecting people across the lifespan. Examples of common disorders include mental retardation in childhood, substance abuse and self-harm behaviours in young adulthood, depression and anxiety in adults, and dementias in older people. Awareness about the global burden of mental illness has been growing in recent decades, spurred by epidemiological studies demonstrating the high prevalence, and adverse impact, of mental disorders in all countries of the world (World Health Organization 2001). The use of innovative measures of disease burden which assess the impact on disability demonstrated that mental disorders were leading causes of disease burden in all regions of the world (Figure 1), particularly in regions which were witnessing an epidemiological and demographic transition. These developing regions, notably in South and Central America and Asia, house nearly half the global population. Most mental disorders begin in young adulthood (Kessler et al. 2005), which may be regarded as the most productive and vibrant age group in any society – the table of leading causes of burden of disease in this age group (Figure 2) clearly show the significant contribution of mental disorders.

Mental disorders may also be risk factors for other health problems; for example, substance abuse is a major risk factor for road traffic accidents. Research has also demonstrated that people who live in conditions of social disadvantage (for example, refugees, gender disadvantaged) or economic deprivation (for example, people facing acute debts or poverty) are at greater risk for mental illness; these disorders further impoverish the person on account of the disability they produce and the high costs of care associated with mental illnesses (Patel, Kirkwood et al. 2006; Patel & Kleinman 2003). Evidence has shown that the efficacious treatment of mental disorders can reduce overall health-care costs and thus reduce the adverse economic impact of these disorders (Patel, Chisholm et al. 2003). Research has shown that mental disorders are closely associated with a number of the Millennium Development Goals (Miranda & Patel 2005) – for example, learning disabilities in childhood impair the ability of children to complete primary education, while depression in mothers impairs maternal health and adversely impacts on the growth and development of their newborn children.

Growing evidence based on clinical trials shows that locally available and acceptable interventions are effective and efficacious for the management of mental disorders (Hyman et al. 2006) (Figure 3). The final piece of evidence is that global mental health resources are grotesquely imbalanced and inequitably distributed; the overwhelming majority of resources are concentrated in rich countries while the lion's share of the burden is in low- and middle-income countries (LMIC) (WHO 2005). Despite this imbalance, the health systems of rich countries rely to an ever greater degree on mental health resources imported from LMIC.

Global mental health: what is the impact of this evidence base?

Before considering the gaps in our knowledge, we must acknowledge two major issues arising from the evidence base summarized above. First, the evidence base from LMIC where over 80% of the global population lives comprises only a tiny fraction of the research output on mental disorders globally. This gap severely stunts the development of evidence-based health policies and practice in LMIC; arguably, the impact of this gap is even greater for fields such as mental health which are heavily influenced by sociocultural factors and whose current practice and evidence base is primarily dependent on Western, particularly European and North American, cultural norms. A study in 2001 reported that countries outside the "Western" cultural world contributed only about 6% of the research published in high-impact psychiatric journals during the three-year period between 1996 and 1998 (Patel & Sumathipala 2001). The review also reported a significantly higher rejection rate for articles from non-Western countries. A few countries accounted for the majority of publications, and many of these (Japan, Taiwan and Israel) which were high-income countries accounted for over a third of publications. Thus, the true proportion of publications from LMIC was about half the rate (3.2%). The staggering under-representation of LMIC in high-impact psychiatric journals prompted the WHO to arrange a meeting of 25 editors of leading psychiatric and medical journals in November 2003 with the objective of "galvanizing mental health research" in LMIC (Editorial 2004a; Editorial 2004b). The meeting issued a consensus statement expressing concern about the wide gap in research evidence, and emphasized the role of

scientific journals in promoting research from LMIC. A series of guidelines and recommendations were adopted to strengthen LMIC representation (http://www.who.int/mental_health/evidence/en/final_joint_statement.pdf). Sadly, these initiatives have not been accompanied by a change in the proportion of representation of LMIC. A repeat study reviewing six high-impact general psychiatric journals listed on the Institute of Scientific Information (ISI) Web of Science database found that just 3.7% of the research published between 2002 and 2004 emerges from LMIC (Patel & Kim, submitted). The proportion of psychiatrists in a country has a moderate influence on a country's research output. Most of the published research focuses on adults with psychotic disorders. As much as half the research was led by authors from high-income countries. The proportion of submissions from LMIC was also very low, and articles from LMIC were significantly more likely to be rejected. These findings echo those of a recent review of all ISI journals over a 10-year period, which reported that only 6% of all mental health articles were from LMIC (Saxena et al. 2006).

Secondly, despite the evidence base, awareness about mental disorders remains very low, while stigma associated with mental disorders remains very high (Jamison 2006), and most persons with mental disorders receive either no treatment or inappropriate treatments. In some instances, the human rights of people with mental disorders are compromised, particularly in the setting of mental hospitals (National Human Rights Commission 1999). Thus, the impact of the evidence base has been limited.

Global mental health: what evidence do we need?

In 2002, the WHO proposed the Mental Health Global Action Programme (mhGAP), which is recognized as the blueprint for international action in the fields of mental, neurological and behavioural health. An important conclusion was the urgent need for research to be undertaken in and by LMIC, and for this research to be directed to the special needs of these countries. A crucial question was the strength of the existing capacity of these countries to conduct research in the fields of mental, neurological and behavioural health and the priorities of researchers and stakeholders in mental health. Thus, the identification of research capacity and priorities in LMIC was a necessary follow-up to the mhGAP-WHO initiative and studies revealing the high burden of mental disorders in LMIC. Since mental health is an important but, as yet, hardly addressed component of the 10/90 gap, the Global Forum for Health Research joined hands with the WHO to support projects aimed at mapping the research resources and agenda in LMIC, as a first step towards correcting this imbalance. This project aimed to identify the constraints and challenges that impact on research resources, the research priorities, and the impact of research on policy and programme formulation in LMIC. The project was implemented by six teams working in South and Central America, Africa and Asia and comprised a survey of indexed and non-indexed literature, and a survey of active researchers in the regions and of stakeholders of mental health research. Findings from this global survey will provide the first, comprehensive evaluation of the mental health research priorities, and the priority-setting process, from LMIC; these findings will be presented at Forum 10, the 2006 annual meeting, in Cairo.

A crucial question was the strength of the existing capacity of these countries to conduct research in the fields of mental, neurological and behavioural health and the priorities of researchers and stakeholders in mental health

From the evidence base we have, and the observations on the lack of investment and care for people with mental

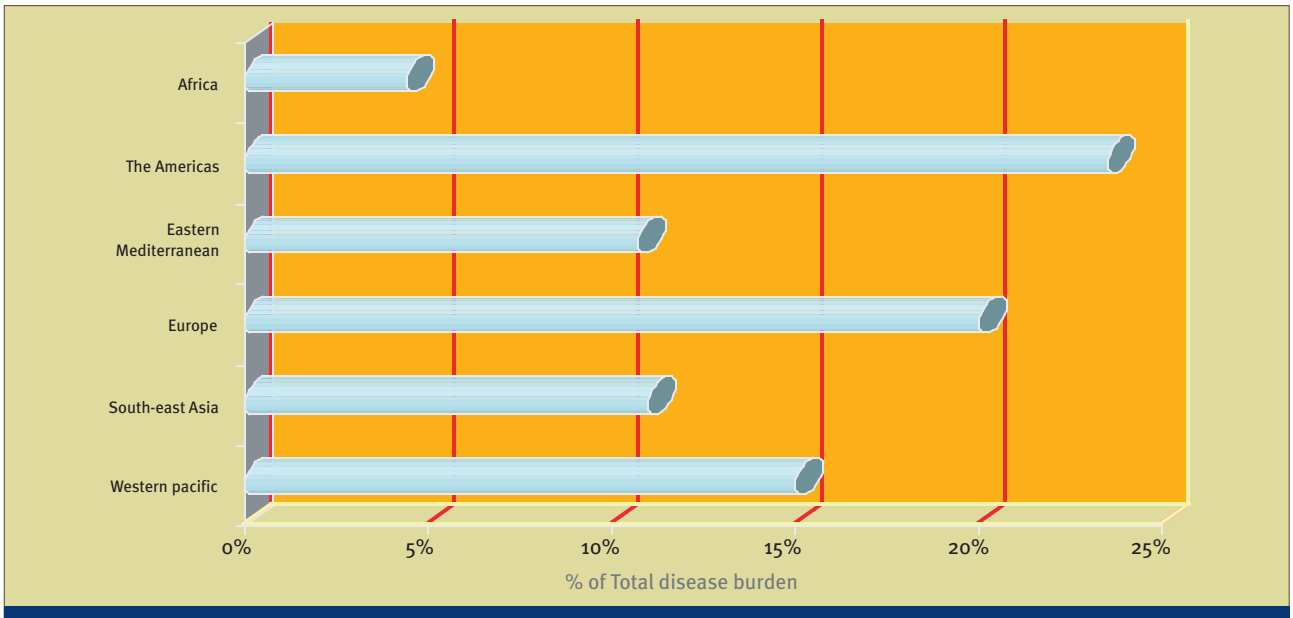

Figure 1: Disease burden of mental disorders (from the *World Health Report 2001*)

disorders, my personal list of immediate research priorities in LMIC would comprise the following topics.

- **Public health implications of mental disorders:** the splitting of mental health from physical health owes its origins to the mind-body dichotomy implicit in biomedical conceptualization of health. However, this conceptualization has done great harm to the goal of integrating mental health in all health-care activities by institutionalizing the notion, at all levels of the health system, that mental health is a separate domain of work which must be addressed by a parallel system of specialists and resources. Research is needed to counter this myth, by demonstrating not only how mental health influences physical health, and vice versa, but also how mental health interventions can improve physical health outcomes. Examples of such research questions include: what is the impact of mental illness on adherence with treatments for chronic physical health problems such as diabetes and HIV/AIDS? What is the impact of interventions for maternal depression on birth weight and child nutritional outcomes?
- **Interventions:** we need evidence to show that something can be done for mental disorders and that these interventions are feasible, affordable, acceptable, replicable and, of course, effective. We need to acknowledge that the management of many mental disorders requires multimodal interventions, often combining pharmacological and psychosocial treatments. Clinical trials of complex interventions are thus a key research priority. Examples of such research questions include: what is the effectiveness and cost-effectiveness of multimodal interventions for common mental disorders in primary health care? What is the effectiveness and cost-effectiveness of community-based interventions for reducing the chronicity and disability associated with severe mental disorders? What interventions can help reduce the stigma associated with mental disorders?
- **Children and young people:** children and young people comprise between one-third and one-half the population of LMIC. Some mental disorders are unique to childhood – they are developmental in nature and often impair the ability of the child to lead a productive and fulfilling life. Despite this, the global inequity in research on mental health is amplified manifold when considering child mental health. Even basic questions around child mental disorders, such as how different cultures conceptualize child development and developmental disorders, the burden of mental disorders in childhood, and their impact and their aetiology, remain unresearched in most LMIC. Thus, important research questions are: what is the burden, and impact, of mental disorders in childhood? What are the determinants of these disorders? What are the current care strategies for these disorders and what is the impact of these strategies? How does mental health influence reproductive and sexual health outcomes in young people, and vice versa?
- **Globalization and mental health:** globalization is a seemingly unstoppable phenomenon which is profoundly affecting the lives of people in LMIC. These effects are diverse and affect sections of the population in different ways. Some of these effects may adversely impact on the mental health of populations; for example, the reduction in import tariffs for agricultural products has been attributed as a major factor behind the spate of suicides of poor farmers in India (Sundar, 1999). Vital research questions include: how do economic reforms, such as changes in trade barriers, imposition of intellectual property right legislation, and private-public partnerships in health care impact on mental health and mental health care? What is the impact of displacement consequent to development activities, such as following the construction of large dams, on mental health?
- **Policy research:** we need research to examine why policy-makers at all levels, from international donors and multilateral agencies, to district health managers, ignore the established evidence and guidelines to promote the mental health of people in LMIC. It is a curious observation that while mental health commands a leading (relatively speaking) position in the health priority agendas for rich countries, international donors and agencies (heavily populated by people from rich countries) seem to deny this health concern for people from LMIC. Key research questions are to identify the systemic obstacles to implementing mental health programmes and policies in LMIC. Examples of such questions include identifying the reasons why large mental hospitals continue to be the focus of mental health programmes in these countries, why community

Number	Causes	% total
1.	HIV/AIDS	13.0
2.	Unipolar depressive disorders	8.6
3.	Road traffic accidents	4.9
4.	Tuberculosis	3.9
5.	Alcohol use disorders	3.0
6.	Self-inflicted injuries	2.7
7.	Iron-deficiency anaemia	2.6
8.	Schizophrenia	2.6
9.	Bipolar affective disorder	2.5
10.	Violence	2.3

Figure 2: Leading causes of the global burden of disease (in DALYs) in young adults, 15 to 44 years, in 2000 (from the *World Health Report 2001*)

Condition	Interventions	Model effect(s)
Schizophrenia	Older & newer anti-psychotic drugs; family therapy; case management	Reduced disability
Bipolar affective disorder	Lithium & valproic acid, with and without psychosocial intervention	Reduced disability & episode duration
Panic disorder	Anxiolytic drugs (benzodiazepines); older & newer anti-depressant drugs; cognitive behavioural therapy (CBT); collaborative proactive care	Reduced disability & duration
Depressive episode	Older & newer anti-depressant drugs; brief psychotherapy; collaborative proactive care	Reduced duration, disability & recurrence
Heavy alcohol use (risk factor)	Brief physician advice; taxation; advertising bans; random breath-testing	Reduced duration Reduced incidence Reduced mortality
Epilepsy (idiopathic)	Older and newer anti-epileptic drugs	Reduced disability & duration

Figure 3: Major mental disorders and interventions. Source: Hyman et al. 2006

care programmes emphasizing low-cost resources remain a distant dream for most people with mental disorders, and how these obstacles may be addressed.

Implementing the agenda: research for change

The low representation of LMIC in the international mental health literature may be attributed to a number of factors; I consider three factors as being central. First, the lack of awareness (or acknowledgement) of the evidence base, and relevant research priorities, amongst international policy-makers and donors has severely stunted the financial resources and international policy support needed for implementing sustainable research programmes in LMIC. Second, there is a severe paucity of research capacity in LMIC, compounded by the overall paucity of public health researchers and mental health professionals in these countries. Third, there is a bias against research from LMIC in many journals – the abysmal representation of LMIC in American journals is an example of this bias.

Several complementary strategies will be needed to overcome these challenges. Resources are needed to strengthen research skills and capacity in LMIC, through structured research training, including support on how to write proposals and papers. Emphasis should be laid on those countries where there is very little output, and on non-mental health practitioners to carry out mental health research. LMIC with a good research output should be encouraged to play a leading role in such capacity building, thereby strengthening South/South partnerships. Training should focus both on public health researchers (on mental health) and mental health practitioners (on research methods). Research, and publications, of neglected or less researched topics need to be given special attention. There is a need to strengthen the role of explicitly international academic journals (such as *World Psychiatry*, the official journal of the World Psychiatric Association) as they may fill the niche of playing a major role in facilitating greater LMIC representation. Alongside this, we need moves to strengthen the quality of local LMIC journals to ensure they are indexed and, thus, accessible to readers across their regions and internationally. The high standard and recent indexing of the *Revista Brasileira de Psiquiatria* serves as a model for other LMIC journals. We need to continue advocacy to international policy-makers and donors to secure their acknowledgement that people in all countries, rich and poor, have mental health needs.

Research is essential to generate the necessary evidence for an appropriate response by health policy-makers and practitioners to the largely unmet need of care for mental illnesses in LMIC. Epidemiological and health services research needs to be action-oriented, planned in close collaboration with a number of stakeholders, and disseminated in a variety of formats targeted to different user groups. There are already many existing resources for mental health research in LMIC. These include collaborative relationships between institutions, international networks for research, a growing list of donors willing to fund mental health research, and a variety of research training programmes. However, there is still a huge gap between what is available and what is needed. The development of sustainable research training programmes targeted both at mental health and public health professionals, an explicit

and coordinated global policy for funding mental health research, and development of sustainable networks of research organizations are keys to making research happen in LMIC. Achieving this goal will ultimately require an active collaboration between a number of agencies from individual research organizations to multilateral and international donor agencies and academic institutions. The ultimate beneficiaries of such capacity building would include the entire global community because the networks of skilled researchers across the world could work together to identify the causes of mental disorders and ways to improve the quality of lives of persons affected by mental disorders. ❑

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References

Editorial 2004a, 'Galvanizing mental health research in low- and middle-income countries: role of scientific journals', *Bull World Health Organ*, vol. 82, pp. 226-228.

Editorial 2004b, 'Galvanizing mental health research in low- and middle-income countries: role of scientific journals', *Acta Psychiatr Scand*, vol. 110, pp. 77-79.

Hyman S, Chisholm D, Kessler R, Patel V & Whiteford H 2006, 'Mental disorders', in DT Jamison, JG Breman, AR Measham, G Alleyna, M Claeson, DB Evans, P Jha, A Mills & P Musgrove (eds), 'Disease control priorities in developing countries' (2nd edition), Oxford University Press, New York.

Jamison KR (2006), 'The many stigmas of mental illness', *The Lancet*, vol. 367, pp. 533-534.

Kessler RC, Bergland P, Demler O, Jin R, Merikangas KR & Walters EE 2005, 'Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication', *Archives of General Psychiatry*, vol. 62, pp. 593-602.

Miranda JJ & Patel V 2005, 'Achieving the Millennium Development Goals: does mental health play a role?' *PLoS Med*, vol. 2, p. e291.

National Human Rights Commission 1999, 'Quality assurance in mental health', New Delhi: NHRC.

Patel V, Chisholm D, Rabe-Hesketh S, Dias-Saxena F, Andrew G & Mann A 2003, 'The efficacy and cost-effectiveness of a drug and psychological treatment for common mental disorders in general health care in Goa, India: a randomised controlled trial', *The Lancet*, vol. 361, pp. 33-39.

Patel V, Kirkwood BR, Pednekar S, Pereira B, Barros P, Fernandes J, Datta J, Pai R, Weiss H & Mabey D 2006, 'Gender disadvantage and reproductive health risk factors for common mental disorders in women: a community survey in India', *Arch Gen Psychiatry*, vol. 63, pp. 404-413.

Patel V & Kleinman A 2003, 'Poverty and common mental disorders in developing countries', *Bulletin of the World Health Organization*, vol. 81, pp. 609-615.

Patel V & Sumathipala A 2001, 'International representation in psychiatric journals: a survey of 6 leading journals', *British Journal of Psychiatry*, vol. 178, pp. 406-409.

Saxena S, Paraje G, Sharan P, Karam G & Sadana R 2006, 'The 10/90 divide in mental health research: trends over a 10-year period', *Br J Psychiatry*, vol. 188, pp. 81-82.

Sundar M 1999 'Suicide in farmers in India' (letter), *British Journal of Psychiatry*, vol. 175, pp. 585-586.

World Health Organization 2001, *The World Health Report 2001: mental health: new understanding, new hope*, World Health Organization, Geneva.

World Health Organization 2005, *Mental Health Atlas*, World Health Organization, Geneva.

Promoting health

More than a poster: what research tells us about healthy behaviour[1]

Article by Elaine Murphy

In the late 1970s, health experts foresaw an increasingly healthy world at the dawn of the 21st century. They were buoyed by optimism, and with good cause. In a little over 25 years – from the mid-20th century – global public health efforts had met with enormous success in beating back disease and even eradicating smallpox, one of the world's worst health scourges. Infant and child mortality had dropped in the face of massive immunization campaigns, food supplements and new treatments of common illnesses. The advent of antibiotics saved millions of lives. Life expectancy rose dramatically in both developed and developing countries, and there was no reason to doubt that the trend would continue. The famous rallying cry was "Health for all by the year 2000!" (WHO 1978).

Fast-forward to today and it is clear that, in spite of overall progress, good health still eludes billions of people. AIDS has reversed life expectancy and child survival gains in parts of Africa (Lamptey, Johnson & Khan 2006). Almost 11 million children in low- and middle-income countries die before reaching their fifth birthday (UNICEF 2005). In some countries, immunization coverage rates have declined significantly (ORC Macro 2004). Ever-growing resistance to antibiotics has diminished their once almost magical promise. Unsafe water, sanitation and hygiene lead to major afflictions in poor countries, while in wealthier countries obesity contributes to high rates of heart disease, diabetes and cancer. As research uncovers the major role behaviour plays in both causing and solving health problems, there is a growing appreciation that technology is not the only answer.

Poorest countries	Developed countries
1. Underweight	1. Tobacco
2. Unsafe sex	2. High blood pressure
3. Unsafe water, sanitation & hygiene	3. Alcohol
4. Indoor smoke from solid fuels	4. High cholesterol
5. Zinc deficiency	5. High BMI
6. Iron deficiency	6. Low fruit & vegetable intake
7. Vitamin A deficiency	7. Physical inactivity
8. High blood pressure	8. Illicit drugs
9. Tobacco	9. Unsafe sex
10. High cholesterol	10. Iron deficiency

Source: Ezzati et al. 2002

Table 1: Top risk factors leading to disease, disability or death

Responding to the many health-related Millennium Development Goals, for example, will require significant investments in behaviour-change strategies (Murphy 2005).

Table 1 lists risk factors responsible for the top causes of death and disabilities that comprise the global burden of disease, and reveals the extent that behaviour is implicated.

In poorer countries, two risk factors that can be addressed through comprehensive behaviour-change interventions are childhood underweight and unsafe sex – they contribute more to the loss of healthy life-years in the world than all diseases and injuries in high-income countries (Ezzati et al. 2006).

More than a poster

Just as many health experts saw medical technology as a panacea in an earlier era, efforts to change behaviour were similarly naive. Common tactics included booklets – often distributed to non- or low-literate audiences – or posters that exhorted people: "Breastfeed your baby!", "Use a condom!", "Don't use drugs!" Posters and booklets can be part of a comprehensive campaign to change behaviour but by themselves are highly unlikely to bring about widespread, sustainable behaviour change. Not surprisingly, research in health promotion has found that human behaviour is complex and behaviour-change approaches must be correspondingly multidimensional (Haider, Murphy & Gryboski 2005).

Today, effective health promotion programmes are based on evidence-driven theories of behaviour change (National Institutes of Health 2003). These programmes encompass extensive research on relevant audiences and the best ways to reach them; pre-testing of messages, skill-building for the desired behavioural change; multi-channelled, sustained information, education and advocacy campaigns; engagement of "champions" and other influential persons in advancing the cause; and community mobilization. They also aim at making policy, organizational, economic and environmental changes. These methods recognize that people live in a dynamic "social ecology" as well as a physical one (McLeroy et al. 1988).

The ecological perspective involves two key ideas that can help guide health interventions. First, health-related behaviours are affected by multiple levels of influence: individual factors, interpersonal factors, institutional or organizational factors, community factors and public policy factors (see Table 2). For example, a young man considers

[1] Note: For an expanded discussion of the role of behaviour in determining health outcomes and effective behaviour-change strategies, see Haider, Murphy & Gryboski (2005), Murphy (2005) and Piotrow et al. (2003).

practising safer sex or abstaining after watching a film on AIDS at school, the only AIDS education to which he has been exposed. However, his motivation is low because his friends do not believe the danger and make fun of abstaining or using condoms. Community norms encourage multiple partners for males and he only has sex with "nice girls". Moreover, health clinics refuse to serve him the one time he tries to obtain condoms. Tariffs on imported condoms make pharmacy prices too high for him, and school policies prohibit distribution of condoms to students.

The second key idea recognizes reciprocal causation between individuals and their environments: behaviour both influences and is influenced by the social environment in which it occurs. In an alternative scenario, the young man is persuaded by friends to join an AIDS peer education group that reaches out to young people to prevent HIV infection and recruit more members. The group receives wide media coverage when it organizes a series of rallies and sets up meetings with parents, teachers and community leaders on the best ways to protect youth. Parents, teachers and community leaders become increasingly concerned about young people's vulnerability, and eventually schools and youth agencies provide counselling and sex education that offers choices – abstinence, fidelity to one uninfected partner and condom use – and free condoms on site. The young man and many whom he has reached adopt protective measures.

Concept	Definition
Individual factors	Individual characteristics that influence behaviour such as knowledge, attitudes, beliefs and personality traits.
Interpersonal factors	Interpersonal processes, and primary groups including family, friends and peers that provide social identity, support and role definition.
Institutional factors	Rules, regulations, policies and informal structures that may constrain or promote recommended behaviours.
Community factors	Social networks and norms or standards that exist formally or informally among individuals, groups and organizations.
Public policy factors	Local, state and federal policies and laws that regulate or support healthy actions and practices for disease prevention, early detection, control and management.

Source: National Institutes of Health 2003

Table 2: An ecological perspective: levels of influence

Whose behaviour

As a result of understanding the reciprocal and contextual aspects of health behaviours, behaviour-change interventions now require comprehensive approaches. For large-scale, sustained improvements in health, interventions must work to change not only individuals' actions but also community norms, health system factors, and decisions of policymakers that have negative impacts on health. It is easy to see the role of the individual when identifying risk factors such as unsafe sex, smoking or spacing births too closely. But consider these important health-related behaviours: the failure of policy-makers to address the poverty of its citizens; dangerously inadequate allocations by budget makers for preventative and curative health; the practices of health-care staff who treat clients rudely and keep them waiting long hours; gender-inequitable community norms that make women vulnerable to poor reproductive health outcomes; and the decisions by officials outside the health sector that mean lack of clean water, hygiene systems and safe roads. In fact, decisions made by political and development leaders – international, national and local – often worsen poverty and poor health. Paul Farmer calls this "structural violence", and uses the example of dams in Haiti that serve the electricity needs of agribusiness, industry and the elite but inundated farmland of the poor, exacerbating poverty and hunger (Kidder 2003).

Successful interventions

It is easier to organize small-scale behaviour-change operations and many of them are successful. But is it possible to organize successful large-scale and sustained interventions? The answer lies in the title of a remarkable collection of 17 case studies: "Millions saved: proven successes in global health" (Levine et al. 2004). For example, in Poland rates of smoking plummeted to unprecedented low levels as a result of health education, taxation and legal restrictions on tobacco consumption, sales and advertising. Other programmes reduced high fertility in Bangladesh, eliminated polio in Latin America and the Caribbean, controlled tuberculosis in China, and reduced the toll of river blindness in sub-Saharan Africa. These cases underline the importance of addressing serious health problems through strategic combinations of technology (where applicable), new policies, multisectoral approaches, public-private partnerships – and sound behaviour-change interventions. The reduction of HIV prevalence by two-thirds in Uganda represents another large-scale success story of behaviour change, namely change in sexual behaviours. It involved unflagging leadership from the top, massive grassroots mobilization (including religious leaders, teachers, women's and youth organizations), addressing stigma and initiating Africa's first voluntary counselling and testing services (Green 2003). The Ugandan leadership also understood how gender inequity fuels the AIDS epidemic and took important steps to address it (Murphy & Greene 2006).

Towards effective health promotion programmes

Lessons learned from years of designing and implementing behaviour-change interventions can be applied effectively in health promotion programmes everywhere (Murphy 2005):

- Identify the specific health problem to be addressed and the corresponding behaviours that, if changed, will

ameliorate the problem. Identify the key actors at every relevant level, from the individual to the policy-maker.
- Use sound behavioural theories in designing health promotion programmes.
- Review and conduct thorough research about and with key actors; understand the reasons for the health problem, including biological, environmental, cultural and other contextual factors, and likely motivations for change. Pay particular attention to barriers to change and vulnerabilities due to social and structural inequities.
- Work to create an enabling environment through policy dialogue, advocacy and capacity building. Include the participation of relevant stakeholders as true partners in the design, implementation and evaluation of the intervention, using participatory assessment and learning tools. Ask key stakeholders to identify role models and peers who exhibit "positive deviance" – healthy behaviours different from the social norm – whom the programme can enlist to support its objectives.
- Do not neglect the practical necessities such as careful budgeting and planning to ensure the right timing, the appropriate duration of activities to show results and undertake evaluation, and identification of the right partners. Based on the likelihood that non-health sectors represent important contextual factors for health-related behaviour, be prepared to involve and coordinate other sectoral efforts.
- Organize and implement a multifaceted intervention that addresses both specific behaviours and contextual factors and reaches policy-makers, gatekeepers and direct beneficiaries. To reach key audiences, use communication channels identified through research such as mass media, face-to-face community activities, training of health workers, and policy-influencing conferences, with coordinated, mutually reinforcing messages and opportunities for community discussion. Monitor the occurrence, quality and coverage of activities and make needed corrections.
- Work to ensure sustainability. Identify mechanisms and local assets for reinforcement of positive behaviour on the individual level, institutionalization at the organizational level, and sound policies and resource mobilization at the policy level. Build on cultural values and traditions that foster mutual help and social cohesion.
- Plan for evaluation from the beginning. Ideally, design an evaluation with experimental and control groups and gather baseline data; evaluate at the end of the project, six months later, one year later, and, if possible, up to five years later. Include qualitative and participatory methods to ensure stakeholder perspectives are represented. Disseminate findings widely in user-friendly reports and meetings to spur scaling-up and adaptation of the programme.

Research gaps and agenda

- There are thousands of successful health-promotion projects in hundreds of countries. Research is needed on how to scale up the most promising projects to national level, and how to adapt them to other settings where conditions and culture may be very different.
- Research is also needed to identify the most powerful and/or cost-effective components of multiple-component behaviour-change programmes. This calls for more than an experimental group and a control group; it would mean, for example, a programme with several interventions in which one group would have all interventions but the mass media campaign, while another group would have all components but the interpersonal interventions (such as peer education and community talks). If the complete set of interventions yielded positive results, analyzing the level of success in the other two groups would help to reveal the relative value of mass media or interpersonal interventions – or reveal that all elements are necessary to produce success. In a resource-limited world, this research could contribute to cost-effective programming.
- In an era of health personnel shortages, the budgets and staffing of behaviour-change or communication units of health systems are usually inadequate. Given the role that behaviour plays in causing early death and disabilities, hiring and training specialists to conduct behaviour-change research and evaluate theory-based interventions is a sound investment (Waisbord & Larson 2005).

In sum, although pathogens, congenital factors and genetics are obviously implicated in many of the world's most pressing health problems, much more than technical fixes – increased availability of vaccines, a new generation of antibiotics or gene therapy – is needed to solve these problems (Levine et al. 2004). Human behaviour is a key factor in determining health. ❑

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References

Ezzati M, Lopez AD, Rodgers A & Murray CJL 2006, 'Comparative quantification of mortality and burden of disease attributable to selected risk factors', in AD Lopez, CD Mathers, M Ezzati, DT Jamison & CJL Murray (eds), *Global burden of disease and risk factors*, Oxford University Press, Oxford and New York, retrieved June 28, 2006 at http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/gbd/ch4.pdf

Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJL & the Comparative Risk Assessment Collaborating Group 2002, 'Selected major risk factors and global and regional burdens of disease', *The Lancet,* vol. 360, no. 9343, pp. 1347–1360.

Green E 2003, 'Rethinking AIDS prevention: learning from successes in developing countries', Praeger Publishers, Westport CT.

Haider M, Murphy E & Gryboski K 2005, *Global public health communication: challenges, perspectives and strategies*, Taylor & Francis, Philadelphia.

Kidder T 2003, *Mountains beyond mountains*, Random House, New York, pp. 37–44.

Lamptey P, Johnson J & Khan M 2006, 'The global challenge of HIV and AIDS', Population Reference Bureau, Washington, DC.

Levine R, Kinder M & the What Works Working Group 2004, *Millions saved: proven successes in global health*, (Center for Global Development, Washington, DC, p. 5.

McLeroy KR, Bibeau D, Steckler A & Glanz K 1988, 'An ecological perspective on health promotion programs', *Health Education Quarterly*, vol. 15, no. 4, pp. 351–77.

Murphy EM Promoting Healthy Behavior. 2005. Population Reference Bureau, Washington, DC, pp. 1-49.

Murphy E & Greene M 2006, *Defending the ABCs of AIDS prevention: a feminist perspective*, Public Library of Science (forthcoming, September 2006).

National Institutes of Health 2003, *Theory at a glance: a guide for health promotion*, Washington DC: National Cancer Institute, National Institutes of Health.

ORC Macro 2004, DHS Dimensions 6, no.2, accessed online 30 June 2006 at www.measuredhs.com.

Piotrow P, Rimon II J, Merritt A, & Saffitz G 2003, *Advancing health communication: the PCS experience in the field*, Baltimore: Johns Hopkins University Bloomberg School of Public Health Center for Communication Programs.

Waisbord S & Larson H 2005 *Why invest in communication for immunization: evidence and lessons learned*, Baltimore: Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs, and New York: United Nations Children's Fund.

UNICEF 2005, 'State of the world's children 2005', accessed online 30 June 2005 at www.unicef.org.

World Health Organization (WHO) 1978, Declaration of Alma-Ata International Conference on Primary Health Care, Alma-Ata, USSR.

Health promotion and early childhood development: some emerging global research issues

Article by Emily Vargas-Barón (pictured) and Robert J Melton

In developing nations, health promotion is becoming increasingly linked with early child development (ECD) as a part of integrated programming to improve child status. Comprehensive ECD programmes often include services for health, nutrition, sanitation, safety, parenting, infant and child psychosocial stimulation, preschool education, transition to primary school, juridical protection and protective services. Recent policy guidelines for preparing national ECD policies, policy frameworks and action plans emphasize the importance of taking an integrated approach to ECD and health promotion (Vargas-Barón 2005).

Recent studies on the high return on investment (ROI) of quality ECD programmes have drawn the attention of many national policy planners and leaders. Returns range from US$ 3 to US$ 17 for each US$ 1 invested – which is among the highest ROI of any social or economic investment (Lynch 2004). Estimates of the impact of ECD programmes on gross domestic product are similarly striking (Dickens, Sawhill & Tebbs 2006). These and many other studies have led policy specialists to enquire about the contents, methods and quality of ECD programmes that have achieved such striking results (Hyde 2006). It is interesting to note that most of the programmes that were evaluated to assess ROI featured content integration across health, nutrition and education, including parent education. Also, most of them began their services during the birth to three-year period and featured home visits as well as centre-based preschool services beginning at two to three years of age.

The World Health Organization (WHO) is becoming increasingly involved in integrated programming for ECD. A recent WHO study, "The importance of caregiver-child interaction for the survival and healthy development of young children" reviewed salient results in the field (Richter 2004). The WHO article, "Mental health and severe food shortage situations: psychosocial considerations" (Morris et al 2005) stressed that "…it is crucial that nutritional and psychosocial interventions are integrated". The World Bank also promotes integrated ECD, health and nutrition programming (Behrman, Alderman & Hoddinott 2004). Unfortunately, this is not always the case in developing countries where narrowly focused sectoral programmes still abound. Indeed, even within the health sector, separate micronutrient and immunization systems continue to exist – often due more to donor requirements than to national policy. Sometimes sectoral and sub-sectoral programmes have led to costly, unnecessary and counterproductive duplications of "delivery systems" for young children and their parents leaving many vulnerable children without primary health and ECD services.

The following section presents four brief descriptions of integrated programmes for health promotion and ECD. The final section offers a few topics for future research.

Four national integrated programmes for health promotion and ECD

To illustrate some of the kinds of health promotion and ECD programmes that have been developed, four national ECD and health interventions were selected in the Central African Republic, Cameroon, Kazakhstan and Belarus (Vargas-Barón 2006). All four programmes were inspired by UNICEF technical support for integrated ECD. They represent very different levels of development and types of child and maternal needs, as exhibited by the World Bank's 2006 Global Monitoring Report for the Millennium Development Goals (MDGs) that provides a good selection of child and maternal statistics on these nations (see Table 1). Seven of the eight MDGs are directly related to child and maternal status and development, and it has become clear that significantly higher investments in integrated health promotion and ECD programmes will be needed to attain these global goals.

Central African Republic (CAR)

The Programme for the Integrated Development of the Young Child (DIJE) is a community-based programme for child survival and development. The DIJE was designed to prevent maternal, infant and child mortality; chronic disease; developmental delays; and malnutrition. It seeks to improve child development through parent education, preschool education, community empowerment, women's education, water and sanitation improvement and community gardens. Due to years of national conflict and restricted financial, human and material resources, the CAR had very limited health and education infrastructures. For this reason, a community-based approach featuring village empowerment was essential.

The Ministry of Planning provides programme leadership

and ensures strong participation by the Ministries of Health, Education and Protection, university specialists and others. UNICEF, UNDP, WFP, and FAO collaborate to provide technical and material support for national specialists who implement the programme.

An initial baseline study of health, nutrition and parenting practices conducted in three provinces was used to design the DIJE programme that provides universal integrated services at the community level. All services are managed by community members who receive pre- and in-service training in: primary health education and care; nutrition education and supplementation; parent education; psychosocial stimulation; preschool contents and methods; home and community water, sanitation and safety; and child rights, birth registration and social protection. Educational contents have been adapted or derived by national specialists for local cultures. All training of trainers and parent education is provided using active methodologies that feature demonstration, practice, marionettes, songs and dance. Programme approaches include high levels of parent and community involvement as well as mother and child-centred learning. Innovative educational materials, learning toys and media have been developed, thereby enabling relatively easy programme replication. The programme features an internal evaluation and monitoring system, and initial evaluation results are very promising. Programme leadership is planning to expand the DIJE throughout CAR while seeking to find ways to ensure programme growth and sustainability in an exceedingly resource-challenged environment. Members of the DIJE currently are contributing to the preparation of a national ECD policy.

Republic of Cameroon

The Convergence Zone programme was developed by the UNICEF office in Cameroon as an innovative way to integrate its sectoral services for ECD, parent education, health, nutrition, sanitation and protection. Services are provided by national nongovernmental organizations (NGOs) that work closely with impoverished communities in Adamaoua province. The programme seeks to: ensure child protection; register children at birth; improve prenatal and postnatal health care; ensure immunization; prevent malaria and HIV infection; improve personal, food and environmental sanitation; and prepare children for success in school.

The programme provides services for pregnant women and children from birth to eight years of age. Its strategy is to build upon existing structures and to help them interrelate by providing five entry points in each community that will ensure all who enter one point will be referred to all other points. Universal services are provided in the villages and towns participating in the programme. The programme features activities with all types of potential partners: traditional authorities, religious groups, governmental programmes, and national and international NGOs. The programme model uses trained community volunteers to provide parent education. In addition to French, local languages are used, and educational materials have been extensively field-tested. Training methods include: role playing, dialogue, community theatre, songs and other activities. The programme is family-focused and child-centred, and features parent and community involvement.

The programme conducted a baseline study, and has a strong evaluation and monitoring system that is already producing impressive results. Discussions are under way about how to take the programme to scale throughout Cameroon. Sustainability will depend upon government appropriation of the approach as well as continued support by national and international NGOs.

Kazakhstan

In contrast to the CAR and Cameroon, Kazakhstan has an extensive primary health system that has been maintained despite serious reductions in funding after the fall of the Soviet Union. However, as noted in Table 1, Kazakhstan still faces some major health and sanitation challenges that affect young children. Preschool education that flourished in Soviet

Country	Goal 1: Poverty (%, US$ 1/day headcount ratio)	Goal 2: Primary education completion (%, gross intake to final primary grade)	Goal 3: Gender ratio in primary & secondary school (%)	Goal 4: Child mortality (under-5 mortality rate per 1,000)	Goal 4: Measles immunization (% of children 12–23 months)	Goal 5: Maternal mortality (per 100,000 live births	Goal 5: Skilled birth attendance (% of total	Goal 6: HIV prevalence (% of population, 15–49 years)	Goal 6: Tuberculosis incidence (per 100,000 persons)	Goal 7: Access to improved water source (% of population)	Goal 7: Access to improved sanitation facilities (% of population)
Central African Republic	56*	49*	NA	195 (+)	35	1,100	44	13.5	322	75	27
Cameroon	17.1	72	87	149	64	730	62	5.5	179	63	48
Kazakhstan	<2	110	98	73	99	210	NA	0.2	151	86	72
Belarus	<2	101	100	11	99	35	100	NA	60	100	NA

NA = Not available

* From Draft Zero of National PRSP, 2006

(Source: Sundberg 2006)

Table 1: Country-level status re Millennium Development Goal indicators linked to early childhood development

times has been drastically reduced, and many parents are poorly prepared for parenting. The Better Parenting Programme (BPP) seeks to improve child development by imparting key parenting skills. It hopes to achieve its objectives through improving the skills of professionals who provide health-care services directly to families with children from zero to three years of age. The BPP and its training materials were developed by the National Healthy Lifestyles Centre (NHLC) in conjunction with the Ministry of Health (MOH) within the framework of the National Programme on Reform and Development of the Health Care System of 2005 to 2010 (UNICEF 2004). Although the Ministry of Education assisted at the outset, it is not involved in programme development. An excellent baseline study revealed basic child care-giving needs, and as a result 14 key family and community practices were identified to promote child survival and development.

The BPP addresses the following major types of problems:

- lack of parenting skills for health care, breastfeeding, nutrition and child development;
- poor professional capacity for parent education, including home visiting and counselling techniques, breastfeeding, complementary feeding, child development, health care, prenatal nutrition and health care, and other topics;
- the health system's focus on the sick child rather than on preventive primary health care for mothers and children; and
- lack of understanding about child-centred, family-focused, community-based and integrated ECD services at all levels: planners, decision-makers, communities, parents and national mass media.

The BPP provides universal services with integrated contents, and has developed materials in Russian and Kazak. It makes effective use of interactive training methods to prepare outreach nurses who provide home visits for pregnant women and parents with infants and young children. The programme evaluates training results but as yet has not evaluated outcomes related to improving parenting skills and child development. The BPP does not feature community participation and parents have not been involved in programme management or programme development processes; however, its services are family-focused and child-centred.

The BPP has inspired interest in developing a national ECD policy. At the present time, the MOH plans to take the programme to scale within Kazakhstan, and it is developing standards and training systems to enable this expansion.

Belarus

The Positive Parenting Programme (PPP) was developed to improve the physical, psychosocial and cognitive development of young children within a family-supportive environment. It seeks to improve parents' knowledge and skills in order to improve child development. The Ministries of Health, Education, and Labour and Social Protection are actively involved in the PPP. Intersectoral coordination is strikingly effective in Belarus. These three ministries lead the PPP initiative, with support from various Belarusian universities, institutes, hospitals and clinics, and preschools.

A baseline study, conducted in 2002, revealed serious deficits in parental knowledge and skills. The Ministries developed a wide range of materials for professional and parent training for all parents, with a special emphasis on parents with children with disabilities, developmental delays or challenges in their family life. A wide range of culturally appropriate parenting materials and media were prepared in order to fill major gaps in materials for parents.

The PPP complements and supplements existing materials for parent education and support, especially in the fields of health and nutrition, which are used in several innovative programmes and initiatives for young children and parents. These programmes are strikingly child-centred and family-focused, and they include Early Childhood Intervention (ECI) services for children with developmental delays, special education centres for children with disabilities, urban and rural preschools and family therapy programmes. The PPP provides a wide variety of materials and media that respond to the expressed needs of parents and specialists for guidance, including many areas of health and nutrition. Varying models of parent education and support are called the "Parents' University", "Mothers' Schools", "Mothers' Clubs" or "Family Clubs". Regulations are being developed for these groups, constituting an initial form of standards for parent education and support in Belarus. These parenting programmes have been officially approved by the MOE for application in preschools and various health services throughout the nation.

The PPP has stimulated Belarus to develop a National ECD Policy Framework, national preschool standards and new open preschool models especially for rural preschools. Essentially, the PPP has become sustainable since all institutions providing parenting education in Belarus now use its materials.

Recommendations for research on health promotion and ECD

The linkage of the fields of health promotion and ECD represents an important domain for basic and action research. A series of research programmes is urgently needed to help ensure the maximization of programme investments, especially in developing nations with very scarce resources. At present, none of these programmes can be assessed by a standardized measure for both ECD and health promotion. Good health indicators exist but none are currently available for ECD. Our recommendations below reflect these prevailing needs:

1. It is essential that a standardized set of outcome indicators regarding child development be developed, field-tested and linked to household surveys, including the DHS and the MICS. Such indicators should also be nested within more comprehensive monitoring and evaluation approaches to help ensure that health and nutrition interventions are well integrated with psychosocial stimulation and parent education.
2. Increasingly, decentralized governmental units are

developing ECD and health programmes. How can we best ensure that communities rank their most compelling health and child development concerns as priorities for investment?

3. It is critically important that developmentally and culturally appropriate health education and services be included within ECD programmes. But do we know which health services and ECD components are the most appropriate in specific circumstances? What has worked well, where and why? Case studies and state-of-the-art reviews are needed on how health and nutrition education and care can be best integrated within ECD programmes at national, provincial and community/neighbourhood levels.

4. ECD, health and nutrition programmes require systems for pre- and in-service training. Which national systems for "polyvalent" (multisectoral) training have been most effective and why? What types of evaluation research should be conducted on integrated training programmes to identify the most effective training methods and contents?

5. Which types of programme monitoring and evaluation systems have been most effective in helping to ensure training results are achieved, not only in terms of training workshops but most importantly in terms of improved child, family and community outcomes?

6. What types of policy frameworks are most effective for ensuring the good and balanced development of young children? What types of policies help establish successful and sustainable integrated programmes for health promotion and ECD?

7. Several countries have developed integrated ECD policies that feature strong investment in health promotion. What has been the impact of these policies on health and child development outcomes?

8. Many nations with high levels of severe poverty have many children with developmental delays that are linked to malnutrition, chronic illnesses and a lack of basic health services. What assessments exist that would help national leaders and community workers to assess children with developmental delays?

9. Many nations with high levels of developmentally delayed and other vulnerable children lack quality Early Childhood Intervention (ECI) services. How can we best promote the implementation of experimental ECI programmes in developing nations to ensure children receive developmentally appropriate services?

10. Inadequate funding is available for internal and external evaluations of integrated health promotion and ECD programmes. We recommend that at least 10% of intervention programmes should be dedicated to evaluation and monitoring.

11. Finally, it is clear that increased financial support is required for integrated health promotion and ECD. What types of international and national investment strategies that might help ensure programmes for health promotion and ECD will be expanded rapidly to meet needs for achieving MDGs and other goals for child development and poverty reduction?

These are only a few of the many challenges for future research on the interface of health promotion and ECD. Many more will occur to our readers, and we welcome an active exchange of ideas on this compelling topic. ❑

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References

Behrman J, Alderman H & Hoddinott J 2004, *Hunger and malnutrition*, The World Bank, Washington, DC.

Dickens WT, Sawhill I & Tebbs J 2006, *The effects of investing in early education on economic growth*, The Brookings Institution, Washington, DC.

Hyde K 2006, *Investing in early childhood development: the potential benefits and costs savings*, Association for the Development of Education in Africa (ADEA), Paris.

Lynch RG 2004, *Exceptional returns*, Economic Policy Institute, Washington, DC.

Morris J, Chopra G, van Ommeren M & Saxena S 2005, *Mental health and severe food shortage situations: psychosocial considerations*, WHO, Geneva.

Richter L 2004, *The importance of caregiver-child interaction for the survival and healthy development of young children*, World Health Organization, Geneva.

Sundberg M 2006, *Global monitoring report, Millennium Development Goals: strengthening mutual accountability, aid, trade and governance*, World Bank, Washington, DC.

UNICEF 2004, *Kazakhstan: final progress report*, Dutch Partnership Funds for Early Childhood Development, UNICEF Country Office, Astana.

Vargas-Barón E 2005, *Planning policies for early childhood development: guidelines for action*, UNICEF, UNESCO, ADEA, Latin American Network for Early Childhood Development, Paris (this publication is available electronically in English, French, Spanish, and soon in Russian).

Vargas-Barón E 2006, *Comparative study of parenting programmes: Belarus, Bosnia/Herzegovina, Georgia and Kazakhstan*, UNICEF, Geneva (this study will be available after September 2006).

The Internet and public health: an experience that works

Article by Ismail Serageldin (pictured) and Ron LaPorte

This article recounts an experience for which the driving force was Professor Ron LaPorte of the University of Pittsburgh, and a small group who believed in his vision of using the Internet for promoting public health and the sharing of knowledge. Ismail Serageldin, Director of the Bibliotheca Alexandrina (BA), highlighted this initiative at the scientific symposium that accompanied the inauguration of the Library of Alexandria in 2002. Since that time, the BA, the new library of Alexandria (www.bibalex.org), has been one of the international homes of the Supercourse, whose story unfolds in the paragraphs below.

Public health benefits enormously from the spread of public sanitation and personal hygiene, as well as public awareness about the risks of, and effective measures to fight, various threats to the well-being of people. Today, the Information and Communication Technologies (ICT) revolution has made possible national and international contacts as never before. Yet, 80% of the world's population still lives deprived of quality and timely online access to the most relevant scientific information that could affect basic health and well-being. Furthermore, in many developing counties, science teachers have neither the tools nor the means to present general science and health issues to their students in an effective way.

There is enormous benefit in being able to provide up-to-date information to the rest of the world in real-time. Here is where the Supercourse approach, with its Just-In-Time (JIT) lectures and knowledge delivery systems, has provided significant help to:

- deliver urgently needed information to people who can use it to combat disease, poverty, hunger and malnutrition;
- build ties across nations and expand the community of science across "silos" of specific disciplines and sub-disciplines; and
- furnish quality JIT materials to assist those who are dealing with crisis situations.

Through use of Internet-based approaches, and reliance on the ubiquity of PowerPoint presentations all over the world, we have established communities of practice in the area of public health and epidemiology. This experience, in other words, has shown a major return on very limited investments of public funds, largely through the commitment of a few learned individuals and the positive reaction and participation of thousands of individuals all over the world who were moved by the vision and enthralled by the content of the material. Ultimately, hundreds of thousands participated and millions benefited.

In the world of health knowledge there are "haves" and "have-nots". During the past few years, we have been developing a new system for global training in prevention, making shared networks and knowledge available to all, especially to reach the unreached with state-of-the-art scholarly global prevention knowledge. We are succeeding in our mission to build and distribute high quality prevention knowledge to the teachers of the world.

Global health network and the Supercourse

We have used the Internet to link 30,000 faculties from 151 countries. The network is used to collect the best possible PowerPoint lectures on prevention, and to share these lectures among the group and the world (www.bibalex.org; www.pitt.edu/~super1). We have been very successful in obtaining some 2,600 lectures. These have come from many distinguished practitioners and scientists including six Nobel Prize winners, and 60 members of the Institute of Medicine. This community of practice bridges political and geographic divides. It includes 1,800 members from Muslim countries, 500 from the former Soviet Union and 5,000 from the USA, all working as scientists and scholars. Many of the participants view the project as promoting equality and sharing of the most precious resource of scientists: knowledge. Our plan is to empower the teachers of the world, by offering them this material and the support of this community of practice.

The programme is not driven by developed countries alone. There are outstanding lectures from developing countries such as a lecture on avian flu from Pakistan and the Philippines, one on West Nile fever from Egypt, and another lecture on iodine supplementation from India. We share the knowledge among ourselves and with others. It is "open source" in that copyright is retained by the authors, who agree to make their lectures available for free. The lectures have been distributed with 42 mirrored servers (copies of the lectures) in the USA, Sudan, Mongolia, Russia, Egypt and elsewhere. The lectures are also distributed without charge on

CDs, and recipients are asked to copy the CDs and give them to at least five other people, preferably students. Over 50,000 centres worldwide have a Supercourse CD. The Supercourse is now one of the biggest and best known global health projects. Its network of collaborators includes the Library of Alexandria, as well as more than 5,000 universities worldwide.

Best scientists, best lectures reaching the most people

We are in an age where we can start to bring the best possible materials to the teachers and students of the world. We have begun demonstrating this with the "Cutler Lecture", which is the most important international health lecture given annually at the Graduate School of Public Health in Pittsburgh. When Eric Noji MD, a leading expert on disasters, gave the 2005 lecture at the University, we used a multi-channel real-time approach to make it available via web casting, web archiving and I-pod technologies. Teachers are now also able to download it using ppt and pdf technologies as well as Supercourse technology. In addition, we used a viral marketing strategy by sending out the lecture to 30,000 people and asking them to forward it to others. Our goal was to make the lecture available to high bandwidth Silicon Valley, as well as low bandwidth Sudan. It proved to be successful beyond our expectations. For the hour of the lecture, we had set a limit of 500 incoming links as we had figured that most links would be from classes of 50 faculties and students. We were enormously surprised when for that one hour 2,500 links in fact visited, representing perhaps 100,000 people, notably some from Tehran at 2 o'clock in the morning and others from Beijing and elsewhere in China.

This was a very important exercise as we found that there is a huge demand for good prevention information, and that we can deliver this in almost every country using web casting. Many teachers who can not be reached immediately can access the information through CDs and through lectures on slides, overheads or paper. There is no question in our minds that we can reach a significant percentage of teachers in the world using multiple channels. The teacher is critical to help his/her students assimilate the provided material that may come from a scientist with a different culture or frame of reference.

The work originated in Pittsburgh, but the Supercourse and the Library of Alexandria work closely together. The Library has distributed thousands of CDs containing the Supercourse; the Supercourse also has a lecture on the Library of Alexandria. We wish to build a bridge between East and West, and have worked closely to build a Muslim Scientific Supercourse of 1,800 individuals closely interacting with the USA and the West. Public health is everyone's concern. A copy of the Supercourse is on the Library of Alexandria server and the Pittsburgh and Alexandria teams work closely together.

Helping in crisis situations: Just-in-Time (JIT) lectures

We discovered the power of JIT lectures during the Bam earthquake in Iran. This also brought Ali Aralan into the Supercourse. Days after the Bam earthquake, we created a lecture by one of the most important persons in global disasters, Eric Noji MD. Within days of this, Ardalan from Tehran created a wonderful lecture on the Bam earthquake which was used worldwide.

As soon as hurricane Katrina was on the radar, Ali Ardalan and Ron LaPorte contacted 30 meteorologists worldwide, and within two days, a collaborative scholarly lecture on "What is a hurricane" was created

We discovered that most disasters have a "prodrome". This is a period of time before which the major effects of a disaster are felt. For example, the twin hurricanes in the USA had a four to five day period before striking land. During this period, we reasoned that we could rapidly establish a lecture and make it available. As soon as hurricane Katrina was on the radar, Ali Ardalan and Ron LaPorte contacted 30 meteorologists worldwide, and within two days, a collaborative scholarly lecture on "What is a hurricane" was created. All the while, people of the world were obtaining their public health and meteorological information from CNN and seeing crushed houses and floating dead bodies. Our particular concern was what we call the "epidemiology of fear", whereby much of the damage to a country from a disaster is likely to come from fear and panic on the part of those not directly affected. By sending the JIT lectures to all the schools in Texas and Pennsylvania, and to all the epidemiologists in Texas, as well as 42 of the 50 states, we were able to present certain disaster realities that could perhaps lessen potential levels of fear and panic among these populations.

We did the same thing with the earthquake in Pakistan. Ali Ardalan from Iran prepared a beautiful scholarly lecture on "What is an earthquake" (see www.pitt.edu/~super1/). Khawar Kazmi MD, undertook to distribute this to the schools of Pakistan where there were 54 million students. This was of particular concern inasmuch as Pakistani television continually showed images of crushed schools and children being pulled out from the rubble. In such an event, children scared of school need not be. Our lecture presents the science, showing how earthquakes develop, and also showing that although an earthquake is deadly, a person is 40 times more likely to die of a heart attack and that in any one year a child has one chance in 300,000 of dying in an earthquake. This is not to downplay the importance of earthquakes, but is important for students to know their actual risk, to counter the fear driven by images in the media with a more rational assessment of the real level of risk.

So what is the Supercourse?

The Supercourse we have implemented consists of:

- **Open source:** global faculties share their best PowerPoint lectures on prevention; experienced faculty members beef up their lectures with little struggle; new instructors

reduce preparation time with better lectures; faculties in developing countries use current scientific template lectures to build their own.

- **"Coach educators":** the Library of Lectures consists of exciting lectures by scholars in prevention; the classroom teacher "takes" them out for free; faculties who contribute lectures answer questions promptly through a global help desk.
- **Teaching faculty:** lecture contributors include six Nobel Prize winners, 60 IOM members and other top people, nearly half of whom are from outside the USA.
- **Mirrored servers:** we have 45 mirrored servers in Egypt, Sudan, China, Mongolia and other places.
- **Free CDs:** we have distributed 20,000 Supercourse CDs.
- **Multiple channesl**: in addition to PowerPoint, we use multiple knowledge channels to share information including web and pod casting.
- **Teaching a million:** the best teachers should produce the best lectures to teach thousands if not millions; we tested this with our disaster lectures and are likely to reach a million students with a single lecture.
- **JIT lectures:** we created scholarly lectures within days after the Bam earthquake, hurricanes Katrina and Rita, and avian flu, then "drilled" these into the classrooms of the world, reaching 120 countries.
- **Quality control:** there is very little scientifically based and effectively administered quality control in education; we have been exploring scientifically based quality control from other disciplines.
- **Global health society:** we are building a global health society which will include a journal and meeting.
- **Global health school:** we are creating some new models for Global Health Schools that would be inexpensive and small, but of high quality, nimble and sustainable.
- **Progress:** we published over 170 papers in journals including *Nature, The Lancet, BMJ, Nature Medicine* and *PNAS* among others; our web pages have been identified among the top 100 by *PC Magazine*; we receive 75 million hits a year and will probably help teach over a million students; we are the largest supplier of lectures on global health in the world.

The Supercourse uses the power of local classroom teachers and enhances their ability to teach. The goal is to provide the best possible template lectures over the Internet using the open source system to "beef up" the lectures worldwide. This improves teaching with less struggle and scientists help scientists without expensive middlemen publishers. We have already seen enormous success with thousands of instructors, the teaching of up to a million students with a single lecture, and the collection of the best scientific teaching materials on prevention.

We see this as an important means to bring the top experts of the world to the table, and have them work together. Scientists want to collaborate across their boundaries and we have established a means by which this can occur. The future of all of our countries is our health and our children. We can train students now – by making accessible and sharing the prevention knowledge of the world – so that we all will live longer and more productive lives.

Our vision: an international portal for activist science

As the Supercourse progresses and other topics beyond epidemiology and public health are added, it will become a portal for science education, covering topics from health to crisis management, with posted information organized into coherent domains of knowledge and made available, searchable and downloadable for free. The Library of Alexandria is ready to host this portal and maintain it. It has just formally joined the Digital Library Federation, a group of some 30 institutions that include the Library of Congress, MIT, Caltech, Stanford, Harvard and Yale, and thus has the wherewithal to undertake this task. It is also collaborating with the French Academy of Sciences to Arabize the portal "La main à la pâte" (Hands on Science for young people), and will host that portal as well.

Communities of practice: in every domain, in every country in the world. Networked communities of practice will be engaged in the promotion of science and education, using the tools of the 21st century to address the global problems of ignorance, poverty, disease and malnutrition. These linked thematic communities of practice will become a network of networks, a very powerful tool for the promotion of international collaboration in many fields.

Crisis teams: drawing from different communities of practice and building on experience it will be possible to create crisis teams to address the needs of different crisis situations from around the word. These will include combinations of scientific/technical expertise and ICT expertise. The presence of such teams means that we will also build on shared experience from different crisis situations to become ever more effective.

Golden lectures: a selection of "best lectures" that results in millions of people being able to have the experience of attending such an event, and the storage of such video-recorded lectures for others, will over time create a great educational legacy. Here the goal is to create multiple channels of lectures which include web casting, video, web archiving, PowerPoint and pod casting. The more channels we have, the easier it is to cross the digital divide.

Derivative materials: from the crisis situations and the communities of practice as well as the golden lectures, we will have important inputs for people who may want to make movies and documentaries for television broadcast.

Distribution systems to schools: our mission is to reach the teachers of the world with very high quality lectures to be used in their classrooms. We will establish an Internet-based supply chain which will be an end-to-end solution to bring the best possible global scientific materials into the classrooms of the world.

If these be dreams, let us salute the dreamers. Were it not for dreamers, men would be still living in caves. In the exciting world of the new century, of the Internet and of instant communications, of plentiful knowledge and willing minds and hands across the planet, is it conceivable that basic knowledge of science should remain hostage to those

who control books and textbooks and those who have the means to buy them? Surely, we can do better for the 80% of humanity that is presently inadequately equipped to participate in the exciting scientific and technical revolutions of our time. As teachers are empowered to provide such material in every classroom, the younger generation of students will be better able to take charge of its own destiny, to harness technology to its needs and to become real producers of knowledge, not just consumers of technology. This is a future that is within our grasp. We intend to do our part to make it happen. ❑

Ismail Serageldin, *is Director of the Library of Alexandria, also he chairs the boards of directors for each of the BA's affiliated research institutes and museums and is Distinguished Professor at Wageningen University in the Netherlands. He serves as chair and member of a number of advisory committees for academic, research, scientific and international institutions and civil society efforts which includes the Institut d'Egypte (Egyptian Academy of Science), Third World Academy of Sciences (TWAS), the Indian National Academy of Agricultural Sciences and the European Academy of Sciences and Arts. He is founder and former Chairman of the Consultative Group on International Agricultural Research (CGIAR, 1994–2000), the Global Water Partnership (GWP, 1996–2000) and former Chairman of the Consultative Group to Assist the Poorest (CGAP), a microfinance programme (1995–2000). he has also worked in a number of capacities at the World Bank, including as Vice President for Environmentally and Socially Sustainable Development (1992–1998), and for Special Programmes (1998–2000). He has published over 50 books and monographs and over 200 papers on a variety of topics including biotechnology, rural development, sustainability and the value of science to society. He holds a Bachelor of Science degree in engineering from Cairo University, and a Master's degree and PhD from Harvard University. He has received 18 honorary doctorates.*

Ron LaPorte *is Professor in the Department of Epidemiology at the University of Pittsburgh. His research focuses on improving public health in poor populations around the World by making a state-of-the-art prevention information accessible to them via the Internet.*

Research in primary health care: a prevention measure against pandemics

Article by Mohsen Abdel-Hamid Gadallah (pictured) and Mohamed Farouk Allam

A strong primary health care (PHC) research system, with sufficient capacity to address local and national needs and to link evidence to practice and policy-making, is needed in every country (Donaldson, Yordy & Lohr 1996; Ministerial Summit on Health Research 2004). The Alma-Ata conference recommended that health-care systems have a sound foundation in PHC and acknowledged that research is a basic requirement for PHC development (World Health Organization 1979).

Research in PHC is needed to narrow the gap between practitioners and consultants/academics. This issue is especially critical in developing countries where there is not only a huge gap between PHC clinicians and academic researchers, but also significant demographic variations in PHC diagnosis, treatment and referral. These variations which exist for example between affluent and poor urban dwellers and even more so between urban and rural inhabitants may well bias the clinical trial population samples studied at the secondary level and underestimate the prevalence of disease as compared with observations in primary care. Thus, Wilson et al. (2000) pointed out that clinical trials, especially in developing countries, must be conducted in PHC since interventions based on secondary care research may have limited value in the community.

In summary, there are several well-argued reasons why research is needed in PHC (Askew et al. 2004):

- Research improves patient care.
- Research is important for teachers of general practice, providing an evidence base for best practice.
- Research stimulates intellectual rigour and critical thinking.

Definitely, research in PHC could make a difference to clinical practice in many areas such as prevention (hypertension and cardiovascular disease), management of illnesses that seldom reach hospitals (sore throat and acute otitis media), pre-hospital diagnosis of serious conditions (cancer, diabetes and heart failure) (Little et al. 1997; Kinmonth et al. 1998; Jolly et al. 1999; Wing et al. 2003; Glasziou et al. 2004; Hamilton & Sharp 2004; Del Mar, Glasziou & Spinks 2004). In addition, investment in PHC research not only helps generate clinical evidence, but also clinical leadership and service quality (Mant et al. 2004).

PHC clinicians, especially in rural areas, have contact not only with their patients, but also with their living and working environments. They are appointed the task of providing curative and preventive services, together with collecting data for the health information system. Therefore, research in PHC should be seen as a cornerstone in the preparation against pandemics. Expanding PHC research on influenza viruses, for example, will lead to better understanding of how these viruses change over time and spread. Indisputably, research in PHC, rather than in secondary or tertiary care, on influenza viruses could generate new, effective measures of prevention and treatment that would improve the ability to respond to a pandemic.

Taxonomy of PHC research

Research in PHC extends to include five categories:

1. **Methods:** research into the methods being used to create new knowledge and to link it to practice. This would include, for example, research into the ways to develop and use PHC research networks, how to survey patients and collect data, how to run randomized controlled trials in PHC settings and how to best translate research into practice.
2. **Clinical:** research to guide clinical practice. This would include, for example, research into the epidemiology and natural history of common diseases, the utility of continuity of care, the methods to improve the interactions between patients and clinicians, how to best treat common infections or psychosocial problems, and the integration of social and environmental factors into care.
3. **Health services:** research that provides information about how to provide patient care. This would include, for example, research into how to best use non-physician clinicians, the impact of continuity of care, how to develop systems to address mental health issues or how to manage information flow in practice.
4. **Health systems (also called operational research):** research that guides policy at national or regional levels. This would include, for example, research to guide the development of payment systems, how to integrate PHC with other health-care services, how to strengthen community participation for health, or how to develop socially equitable systems (Starfield 2001). Health systems research can help countries to set targets, assess progress and develop better ways to link research to teaching and clinical care.
5. **Educational:** research to guide education both for trainees and for clinicians in community practices. This would include,

for example, research that leads to understanding how to develop optimal under- and postgraduate programmes that assure a greater number and quality of PHC clinicians; and how to conduct research to better define educational needs (Starfield 1996; Mold & Green 2000).

The 10/90 gap in health research

The term "10/90 gap" was coined to describe the imbalance in how research resources were being allocated, following the estimate made in 1990 that less than 10% of global health research resources were then being applied to the health problems of developing countries, which accounted for over 90% of the world's health problems. The term continues to serve as a symbol of imbalance in the allocation of global health research resources and shows clearly in the under-investment in health research and development for the needs of low- and middle-income countries where PHC is of utmost importance (Global Forum for Health Research 2004).

The 10/90 gap in PHC research

In PHC research, the 10/90 gap is particularly acute. It is believed that PHC clinicians are undervalued, overworked and no longer in control, which suggests that they may have little time or resources to undertake research. Furthermore, the dominance of biomedical research has meant that, in most developed countries, a clinical academic career track is deeply unattractive in terms of salary, security and workload (Chew & Williams 2001).

Certainly, PHC clinicians publish less research than specialists, markedly less considering the greater proportion of practising PHC clinicians to specialists (Is primary-care research a lost cause? 2003). For example, in Australia throughout the 1990s, there was only one research publication per 1,000 PHC clinicians per year, whereas comparable figures for surgeons, physicians and public health physicians were 61, 105 and 148 respectively (Askew, Glasziou & Del Mar 2001).

In England, the subcommittee of the health service's Central Research and Development Committee stated that there is an urgent need for both research and researchers in PHC (National Working Group Report 1997). However, while this recommendation seems to be backed by political will, it has not yet received sufficient financial support.

Recently, McAvoy (2005) calculated expenditure on PHC research in Australia, the Netherlands, New Zealand and the United Kingdom to compare these amounts with overall public expenditure on health and medical research. The results showed that despite having very different health-care systems, all four countries invest a minimal amount of public funding in PHC research (less than US$ 1.50 per capita). Compared with hospital- and laboratory-based research, PHC receives significantly fewer resources (Table 1).

	All health and medical research (1995) [A] US$	PHC research (2002–03) [B] US$	[B] as a proportion of [A]
Australia	28	1.16	4.1%
Netherlands	34	1.08	3.2%
New Zealand	11	0.75	6.8%
United Kingdom	34	1.48	4.4%

Table 1: Public expenditure (US$ per capita) on PHC research in proportion to all health and medical research

In spite of this data, it remains very difficult to calculate the exact figures for expenditure on PHC research. This could be attributed to the following reasons:

- overlap between project funding, capacity building, service development and information support;
- some research in PHC being "hidden" within larger programmes such as alcohol and drugs, TB, HIV and health technology assessment;
- multiple sources of funding.

Unfortunately, PHC research is still the missing link in the development of high-quality, evidence-based health care for populations. Although there has been a trend, at least in the developed world, towards PHC-oriented, evidence-based health-care systems, this has not been accompanied by an equivalent investment in research efforts (Rosser & van Weel 2004).

According to Paul Thomas (2000), PHC clearly needs more research and research needs more PHC.

Solutions for the 10/90 gap in PHC research

Currently, government decision-makers, funding agencies, researchers and public health specialists are more aware of the 10/90 gap (Global Forum for Health Research 2003). The recognition of the problem is a big step forward. However, we are still far from real solutions. The alarming question still persists: how can we reorient research towards the world's key health problems?

It has been suggested that PHC research programmes might need special funding to enable them to become established because of "bootstrapping" problems (becoming established from a low resource base), their track record and the bias towards basic research. Increased activity in PHC research is always going to be hampered by the current lack of infrastructure and expertise.

Proposals to increase PHC research include government-led investment in interventions such as strengthening PHC departments and colleges and supporting PHC academics; establishing practice-based networks; fostering international initiatives for cross-national efforts; and engaging individual PHC practitioners in research projects (Del Mar & Askew 2004). These proposals have been incorporated by the World Organization of Family Doctors (WONCA) into nine recommendations to build research capacity, but implementation will require dedicated funding (van Weel & Rosser 2004).

Currently, it is believed that to advance PHC research we must ensure that trainees have a positive research attitude; develop academic clinician-researchers; lobby for primary care research funding; support practitioners doing research in their own practice; sustain practice-based research networks; and study important questions relating to, for example, costs in

diagnosis and treatment, fundamentals of how decisions are made by physicians and patients, the impact of health and illness on patients and providers and so forth (Herbert 2004).

Another suggestion (Wilson et al. 2000) was to develop PHC research networks to increase the number of service practitioners (e.g. general practitioners, nurses and community practitioners) participating in research and to in effect increase the diversity of the population studied.

Regarding avian influenza, collaborative studies such as that reported by Ungchusak et al. (2005) have rarely brought clinical, epidemiological and virological experts together. Collection of sequential patient samples often begins too late, or patient and epidemiological data are not accompanied by vital complementary information. An international clinical-research network on avian influenza in selected countries in Asia could be the foundation for faster and more productive investigations and serve as a nucleus for an integrated clinical, epidemiological and virological network on emerging infectious diseases (Stöhr 2005).

Conclusion

There is a global need for – and continuing lack of – PHC research and clinical-academic integration. During pandemics, information is urgently needed from primary care providers to support research areas such as case management, early intervention and risk assessment. Such research, if undertaken in PHC rather than in secondary or tertiary care, could generate new, effective measures of prevention and treatment that could then in turn better enable the primary care community to respond to pandemics. New strategies and funding are strongly recommended to cope with these gaps and other health-care needs of the 21st century. ❑

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References

Askew D, Del Mar C, McAvoy B & Lyle D 2004, 'General practice research', in *General practice in Australia*, Australian Government Department of Health and Ageing, Canberra.

Askew DA, Glasziou PP & Del Mar CB 2001, 'Research output of Australian general practice: a comparison with medicine, surgery and public health', *Medical Journal of Australia*, vol. 175, pp. 77–80.

Chew M & Williams A 2001, 'Australian general practitioners: desperately seeking satisfaction', *Medical Journal of Australia*, vol. 175, pp. 85–6.

Del Mar C & Askew D 2004, 'Building family/general practice research capacity', *Annals of Family Medicine*, vol. 2, suppl. 2, pp. s35–s40.

Del Mar CB, Glasziou PP & Spinks AB 2004, 'Antibiotics for sore throat (Cochrane Review)', *Cochrane Database Systematic Reviews*, vol. 2, no. CD000023.

Donaldson M, Yordy K & Lohr K 1996, *Primary care America's health in a new era*, National Academy Press, Washington, DC.

Glasziou PP, Del Mar CB, Sanders SL & Hayem M 2004, 'Antibiotics for acute otitis media in children (Cochrane Review)', *Cochrane Database Systematic Reviews*, vol. 1, no. CD000219.

Global Forum for Health Research 2004, *Monitoring Financial Flows for Health Research*, vol. 2, Geneva.

Global Forum for Health Research 2003, press release. Retrieved June 15, 2006, from http://www.globalforumhealth.org

Hamilton W & Sharp D 2004, 'Diagnosis of colorectal cancer in primary care: the evidence base for guidelines', *Family Practice*, vol. 21, pp. 99–106.

Herbert CP 2004, 'Future of research in family medicine: where to from here?' *Annals of Family Medicine*, vol. 2, suppl. 2, pp. s60–s64.

'Is primary-care research a lost cause?' 2003, *The Lancet*, vol. 361, pp. 977.

Jolly K, Bradley F, Sharp S et al. 1999, 'Randomized controlled trial of follow up care in general practice of patients with myocardial infarction and angina: final results of the Southampton heart integrated care project (SHIP)', *British Medical Journal*, vol. 318, pp. 706–11.

Kinmonth AL, Woodcock A, Griffin S et al. 1998, 'Randomized controlled trial of patient centred care of diabetes in general practice: impact on current well-being and future disease risk (The Diabetes Care from Diagnosis Research Team)', *British Medical Journal*, vol. 317, pp. 1202–8.

Little P, Gould C, Williamson I et al. 1997, 'Reattendance and complications in a randomized trial of prescribing strategies for sore throat: the medicalizing effect of prescribing antibiotics', *British Medical Journal*, vol. 315, pp. 350–2.

Mant D, Del Mar C, Glasziou P et al. 2004, 'The state of primary-care research', *The Lancet*, vol. 364, pp. 1004–6.

McAvoy BR 2005, 'Primary care research — what in the world is going on?' *The Medical Journal of Australia*, vol. 183, no. 2, pp. 110–2.

Ministerial Summit on Health Research 2004. Retrieved February 7, 2005, from http://www.who.int/rpc/summit/agenda/en/mexico_statement_on_health_research.pdf

Mold JW & Green LA 2000, 'Primary care research: revisiting its definition and rationale', *Journal of Family Practice*, vol. 49, no. 3, pp. 206–8.

National Working Group Report 1997, R & D in primary care, HMSO, London.

Rosser WW & van Weel C 2004, 'Research in family/general practice is essential for improving health globally', *Annals of Family Medicine*, vol. 2, suppl 2, pp. s2–s4.

Starfield B 2001, 'Improving equity in health: a research agenda', *International Journal of Health Services*, vol. 31, no. 3, pp. 545–66.

Starfield B 1996, 'A framework for primary care research', *Journal of Family Practice*, vol. 42, no. 2, pp. 181–5.

Stöhr Klaus 2005, 'Avian influenza and pandemics – research needs and opportunities', *The New England Journal of Medicine*, vol. 352, no. 4, pp. 405–407.

Thomas P 2000, 'The research needs of primary care', *British Medical Journal*, vol. 321, pp. 2–3.

Ungchusak K, Auewarakul P, Dowell SF et al. 2005, 'Probable person-to-person transmission of avian influenza A (H5N1)', *The New England Journal of Medicine*, vol. 352, no. 4, pp. 333–40.

van Weel C & Rosser WW 2004, 'Improving health care globally: a critical review of the necessity of family medicine research and recommendations to build research capacity', *Annals of Family Medicine*, vol. 2, suppl. 2, pp. s5–s16.

Wilson S, Delaney BC, Roalfe A, Roberts L, Redman V, Wearn AM et al. 2000, 'Randomized controlled trials in primary care: case study', *British Medical Journal*, vol. 321, pp. 24–7.

Wing LM, Reid CM, Ryan P et al. 2003, 'A comparison of outcomes with angiotensin-converting-enzyme inhibitors and diuretics for hypertension in the elderly', *The New England Journal of Medicine*, vol. 348, pp. 583–92.

World Health Organization 1979, 'Formulating strategies for health for all by the year 2000: guiding principles and essential issues', document of the Executive Board of the World Health Organization, vol. 1, Geneva.

Disability and disaster


Article by Ashok Hans (pictured left) and Nizni Hans

In recent years, many natural and man-made disasters have struck regions across the globe – the Asian tsunami that devastated regions as far as the east coast of Africa, followed by Hurricane Katrina along the US Gulf Coast and the Kashmir earthquake in India and Pakistan. These disasters affect most the vulnerable groups within a community, including women, children, the elderly and the disabled (International Disability Rights Monitor 2005; Kett & Yeo 2005). It is important to note, moreover, that disasters disproportionately affect persons with existing disabilities as well as generating new disabilities.

This article concentrates on one category of the vulnerable – the disabled – during disasters and focuses on a research agenda on the subject.

The basis for a research agenda

In poor regions of the world, disasters compound the difficulty of accessing resources especially among the disabled, an invisible minority. Health care is one of the major significant factors during a disaster, but it becomes particularly difficult in poor developing countries because disasters demand emergency services on a large scale. The inability of most of these countries to cope is not only an issue related to lack of finances but also of trained manpower. It has come to be universally recognized that the rights of disabled persons are ignored during disasters as they are invisible as a group with very little voice, and with no role in the development agenda.[1]

The participants of a satellite meeting organized to discuss the subject during the Global Forum's 2005 annual meeting agreed that in order to protect the rights of the disabled, standards are needed.[2] They advanced the view that there is a need to address the issue at two levels: 1) issues specific to disasters; and 2) issues related to the structural changes required to reduce disability among people living with impairments of any kind, including in disaster regions.

Scope of the issue

The World Disability Summit in Winnipeg (2004) brought forward a resolution that was accepted by the 700 delegates, that all disaster preparedness and response plans should contain policies and strategies for the inclusion of disabled people. The intent is to take this resolution forward, and in this context it must be ensured that:

- although the focus will be on disabled people, efforts should be made against differentiating on the basis of gender, caste, colour, creed or any other social hierarchy within the community itself, bringing to the fore instead the continuous obstacles facing all disabled persons – employment, the rural-urban gap, social activities, etc. – and how they contribute to a lack of inclusion in preparedness and response to natural and man-made disasters;
- a "level playing field" is created by introducing measures for active participation among members of the disabled community in governance, e.g. attendance at meetings and policy-making initiatives at all levels, to ensure that their right to participate is not violated.

In the context outlined above, efforts should be made to enhance research possibilities and use findings in disability studies to effect social change and construct new inclusive, equality-seeking structures; and to look at intersections of social hierarchy, marginalization and exclusion (employment, income, savings, etc.), and other cultural constructs that undermine identity/inclusion/rights.

The research should consider the following:

- **review of legislation on existing international standards:** what has been done, what gaps there are, i.e. in the Sphere project (which is based on a medical and not social model) and if there is any national legislation;
- **situational analysis:** current situation, weakness of existing laws, policies, programmes, services and responses;
- **current practices:** what is already happening in the area

1. In 1999, when the super cyclone struck the east coast of India killing thousands and devastating the region, agencies from all over the world under the coordination of the UN Development Programme (UNDP) poured in aid, but despite attempts by the author's organization, Shanta Memorial Rehabilitation Centre (SMRC), disability was completely left out of all activities. The same was noticed in all recent disasters except in Kashmir (on the Pakistan side) where some steps were taken by the World Bank and Handicap International to include the disabled.

2. A workshop was organized on "Setting international standards for the inclusion of disability in disaster response" by the SMRC, India in collaboration with the Global Forum for Health Research, Geneva, Switzerland, held in Mumbai, India on 17 September 2005, as a satellite meeting (coordinated by Mary Anne Burke from the Global Forum) to Forum 9. Participants included disabled activists, UN officials, academics etc. For details on the Mumbai proceedings, see www.smrcorissa.org.

of disasters and what need there is for integrating disability;
- **educational pedagogy:** best practices, inclusion principles, budgetary needs;
- **statistics:** data including community mapping to know where people are when disasters strike and to allow rapid assessment of needs during each disaster because all disasters have different impacts; data on budgets and exclusion issues;
- **monitoring and evaluation:** of the whole system and issues of governance, inclusion and decision-making; completion of an inventory of organizations involved in disaster response management at the national and international level; and
- **funding issues:** research needed on costs related to inclusion; resource flow issues of the World Bank, the Asian Development Bank and other bilateral and multilateral agencies.

The driving questions for research are:
- how we can help clarify research questions currently being pursued on the subject;
- grass-roots issues identified by disabled people's organizations (DPOs), including cultural barriers, intersections of social hierarchies (gender, income, class, etc.) and community communication systems (how they work and best practices);
- coping mechanisms, e.g. mental health issues – psychosocial disabilities and interface with disaster and medical interventions versus social interventions regarding disabled persons – when are they needed, how to define which is appropriate and when? Research on community coping mechanisms, especially indigenous coping capacity; and
- review baseline information – policies, legislation, programmes, services, standards, protocols, budgets, institutional responses and coordination (transactional costs) at the international, national and local level – and analyse its inclusivity and effectiveness in being responsive to disability management issues.

Specific issues related to disability

It is important that through research we are able to provide a set of policy guidelines or principles to stakeholders in the region (governments, NGOs etc.) to be followed during disasters, which would include, among others, measures to:
- ensure that disability organizations are actively involved with disaster relief organizations and governments in the overall governance of response coordination offices during disasters;
- ensure that relief workers understand and are sensitive to disability issues;
- ensure that universal design principles are met in facilities, such as housing services, so disaster relief services can ensure that they are disability-friendly and accessible for both the people who become impaired during disasters and for disabled people already living in disaster-affected countries;

It is clear that there is tremendous scope for carrying out research related to the disabled so that their inclusion during disasters becomes easier

- ensure medical and epidemiological monitoring of internally displaced people, including elaboration of a database of people directly affected by the disaster due to respiratory infection, wounds and injuries resulting in impairment, and of disabled people whose health and well-being may be put at risk during and post-disaster;
- ensure support to medical services and to local groups, with priority given to ensuring access to supports and services for people whose health and well-being are particularly at risk during these times (disabled people, pregnant women, very young and very old people, orphans etc);
- ensure training, awareness-raising and availability of resource materials; and
- ensure research into how representation can be increased when DPOs are still very small and urban-based.

Partnerships in research

Research should be linked to as many actors as possible to make it holistic:
- **Private/industry:** there should be a role demarcated for the private sector in promoting research on the above issues and providing funds for technology etc.;
- **Universities and other academic institutions:** should identify and carry out research linked to community researchers, so that the disabled needs and voices are their own and not of the institutional researchers; and
- **Government and UN bodies:** should carry out country situational analysis, data collection and preparation of national reports.

Research challenges

The challenges before us will be related specifically to measures of integrating uniform engagement of the various groups in the planning segment of disasters, with an understanding of disability as a social and human rights issue (World Bank 2006); to get governments and civil society activists to plan the research agendas together, and to take into account cross-current issues such as gender environment, psychosocial issues, disability diversity concerns, human and material resources, and training and networking; and finally, to look at individual needs while also mainstreaming in practical terms and maintaining a theoretical perspective.

The research strategies should therefore be multiple and based on knowledge of the disabled themselves.

Conclusion: principles to guide the research

It is clear that there is tremendous scope for carrying out research related to the disabled so that their inclusion during

disasters becomes easier. These efforts would assist in the dissemination of information to aid workers and funding agencies, and to government officials in charge of policy-making and formation of standards at all levels. It is important to start a dialogue between all stakeholders and the disabled so that justice will no longer be denied to the latter.

Exclusion of the disabled in any form is an injustice that contravenes their rights. Our work should undertake a human rights approach; it should explore ways to develop "voice" in a way that is credible and empowering, and carry out research that would effect social change and construct new inclusive, equality-seeking structures. ❑

Ashok Hans has been involved with disability work for the last 20 years. His work has focused on disasters for the last six years. He has been campaigning for disabled rights for inclusion at all international forums including the United Nations. In addition, Ashok Hans is Executive Vice-President of the Shanta Memorial Rehabilitation Centre (SMRC), in Bhubaneswar, India; Member of the National Disaster Management Authority (NDMA) Task Force India (Chaired by Prime Minister Dr Manmohan Singh); and Chair of the International Taskforce on Inclusion of Disability in Disaster Preparedness and Response (ITDDPR).

Nizni Hans has just completed her Master's degree from the Tata Institute of Social Science in rural and urban development. Her focus of work has been on gender and also the environment.

References

International Disability Rights Monitor (IDRM) 2005, 'Disability and early tsunami relief efforts in India, Indonesia and Thailand'.

Kett SS & Yeo R 2005, 'Disability in conflict and emergency situations: focus on tsunami-affected areas', International Disability and Development Consortium (IDDC), University of East Anglia.

World Bank 2006, retrieved at http://w4ww.dgroups.org/groups/worldbank/Disaster-Disability.

Building research capacity in LICs

The potential role of social science research in demographic surveillance systems

Article by Margaret Gyapong

Over the last 50 years, achievements in science and technology have been phenomenal with many discoveries which have increased our knowledge of the environment, ourselves and the relationship between the two. Several theories have been propounded on why diseases occur and how to treat and avoid them, and indeed, many successes have been chalked up through the discovery and introduction of new technologies (oral rehydration salts, ivermectin and the smallpox vaccine). Consequently, life expectancy has gone up by over 20 years in many low-income countries, and on average infant mortality has reduced by about 50%. These developments can be attributed to intensive research and development activities in the health sector which have led to the discovery of a large arsenal of drugs, technologies previously unthought-of and our ability to process large volumes of information in the decision-making process. Despite these achievements, the world is at a stage where the foundations of these gains are being threatened by factors both within and outside the health arena. Millions of people still live without access to basic services and their health is desperately poor (Bloom & Knowles 2005). The very existence of humanity is being threatened not only by diseases, but also by the ardent neglect of the knowledge accumulated over the years and of basic social and cultural norms.

In order to combat disease and promote health there is the need to understand how diseases that afflict us originate in the context of people's living conditions and lifestyles. There is the need to understand how health problems are communicated in ways that are culturally prescribed, and how they are labelled and experienced in accordance with existing cultural concepts and belief systems. Natural sciences alone can tell us what happens, but delivering effective interventions require more. To do this health research must increasingly have a social and ethno-cultural outlook. Health research must focus more on health promotion, prevention of diseases and protection from injuries by emphasizing more on the adaptation of cultural norms in the fight against diseases (Quarshigah 2006). Children are still dying of malaria, mothers through childbirth, and after 25 years HIV/AIDS is showing no sign of burning itself out: there is the need to rethink health policies especially in developing countries where the burden is greatest. This can only be done if the right balance is found between research and the design of appropriate interventions for the myriad problems faced by people living in the developing world.

Sickness is a major contributor to poverty, but there is little systematic information about how livelihoods are affected when a family member suffers from a serious health problem, or about how family community or other social networks help households cope. Biomedical science has dominated health research, although public health epidemiology and health economics have also played a major role. The other social sciences have made only modest contributions; however, social scientists working with the appropriate stakeholders are capable of formulating clear research questions based on good theory to explain situations, design interventions and predict outcomes. It is in light of the above that this article seeks to look at the potential role of social science research in research that seeks to inform policy and make a difference in the lives of the vulnerable in developing countries. (Meng et al. 2004)

Defining concepts

Social science research

Social science research is the branch of science that deals with the institutions and functioning of human society, and with the interpersonal relationships of individuals as members of society. The social sciences comprise many disciplines and include but are not limited to anthropology, sociology, economics, political science, demography and communications (Williams et al. 2002). Research in the social sciences is important in that:

- control tools more often than not do not reach affected populations (who are the poor and marginalized), as health systems fall short of the potential for effective delivery;
- social factors to a large extent shape the epidemiology of infectious diseases and the challenges for control; and
- social science research can assist in identifying bottlenecks in the health service delivery systems and suggest pathways for better and more efficient diffusion of control technologies; it can elucidate social and economic forces as they affect biological events (TDR 2005).

In order to meet the needs of the poor and marginalized,

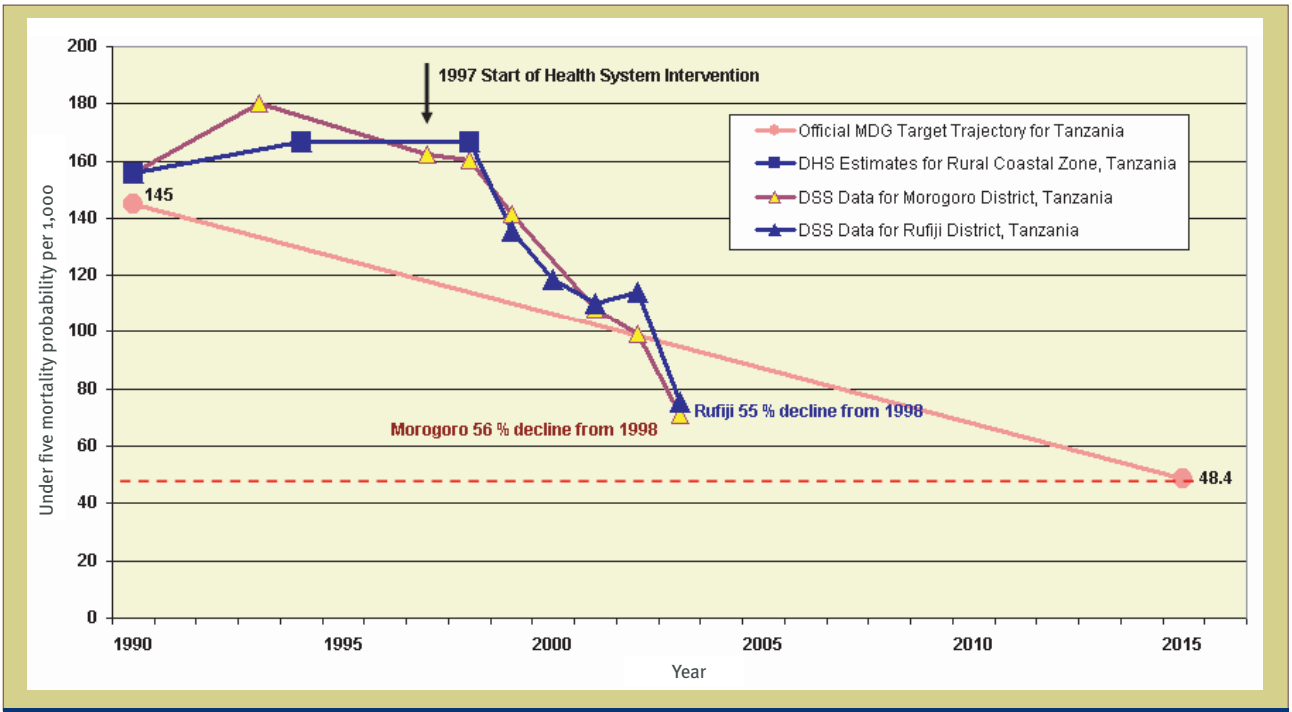

Table 1: Reversing the trend in child mortality – after district-level health systems interventions in Tanzania

there is the increasing need to conduct research which is necessary to facilitate uptake and utilization of new and improved interventions. This requires skills, capacities and partnerships that are outside the biomedical domain. Such skills can apply social science concepts and methods to population health research (TDR 2003).

Demographic surveillance systems

A demographic surveillance system (DSS) is a set of field and computing operations to handle the longitudinal follow-up of well defined entities or primary subjects (individuals, households and residential units) and all related demographic and health outcomes within a clearly circumscribed geographic area. A DSS follows up the entire population of such a geographic area. In the world today, there are 37 such sites in Africa, Asia, Oceania and Central America that belong to the INDEPTH Network (An International Network of field sites with continuous Demographic Evaluation of Populations and Their Health in developing countries) (INDEPTH Network 2006).

At these sites, the most common method of data collection is through censuses, sample surveys and vital events registration; and the method of drawing the sample is through probability or non-probability sampling. The objectives of these DSS sites range from tracking social change in populations (Gwembe, Zambia), providing a framework to evaluate social marketing (Ifakara, Tanzania), to providing information for health policy and planning which is the ultimate aim of all the sites. (INDEPTH Network 2002)

Meeting the MDGs: a look at demographic surveillance systems

The eight Millennium Development Goals (MDGs) formulated during the Millennium Summit held in New York, USA in 2000 were aimed at cutting world poverty by half and ensuring basic human rights, health education, shelter and security. These goals have quantified, time-bound targets and have been described as the most comprehensive and specific poverty reduction targets the world has ever established, as reported by the Secretary General to the General Assembly in 2001. The world has less than a decade left to achieve these goals and with the rate at which developing countries are going, it is clear that the set targets may not be reached by 2015 (World Health Report 2005). Some countries have seen progress but overall proportions of undernourishment remain high with little change. Mortality remains high, HIV/AIDS is pandemic in southern Africa, and malaria and tuberculosis remain significant threats. In most of the developing world today, child mortality continues to be over 120/1,000 and maternal mortality over 500/100,000 live births.

Despite this gloomy picture, it is possible with the advantage that DSS have in collecting longitudinal data (as shown by the Tanzania Essential Health Interventions Project) that there is hope. Figure 1 below indicates progress made by two districts over a four-year period.

In Rufiji and Morogoro, child mortality within these districts (with a combined population of more than 700,000) has fallen by more than 40%, which puts them well on the way to achieving the MDG related to child health. These gains are attributable not to a single intervention but to a range of simple measures to improve health system efficiency and to allocate health funds more in proportion to the local causes of mortality (quantified using data collected from DSS) (Savigny 2005).

Table 2 shows that most of the information required to meet the three disease-specific goals and targets of the MDGs, which can enable health planners to put into place specific interventions, is collected routinely by DSS sites and forms the core of information generated by these sites.

Goal Number	Target No	Indicator Number	Comment
4: Reduce child mortality	*5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.*	13: Under-five mortality rate 14: Infant mortality rate 15: Proportion of 1 year-old children immunized against measles	Collected routinely at DSS sites
5: Improve maternal health	*6: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio.*	16: Maternal mortality ratio 17: Proportion of births attended by skilled health personnel	Collected routinely at DSS sites
6: Combat HIV/AIDS, malaria and other diseases	*7: Have halted by 2015 and begun to reverse the spread of HIV/AIDS*	18: HIV prevalence among pregnant women aged 15-24 years 19: Condom use rate of the contraceptive 19a - Condom use at last high-risk sex 19b - Percentage of population aged 15-24 years with comprehensive correct knowledge of HIV/AIDS 20: Ratio of school attendance of orphans to school attendance of non-orphans aged 10 to 14 years	Collected in sample surveys at some sites (e.g. South Africa) Collected routinely at DSS sites
	8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	21: Prevalence and death rates associated with malaria 22: Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures 23: Prevalence and death rates associated with tuberculosis 24: Proportion of tuberculosis cases detected and cured under Directly Observed Treatment Short Course (DOTS) strategy	Collected in sample surveys at some DSS sites (Ghana, Burkina Faso, Kenya, Tanzania etc.)

Table 2: Kind of data collected at DSS Sites

What contribution can social science research make to DSS sites towards reaching MDGs?

Globalization and global movements of people over the last two to three decades have resulted in rapid demographic and social transformations. The implications of this for the general well-being of individuals and the 'community' are a challenge to monitor. However, the ability to determine desirable outcomes and optimal policies to achieve these outcomes is hampered by the lack of understanding of the fundamental ways in which individuals within a given context interact with their physical, social and cultural environments. (Allotey, research proposal)

As indicated earlier, three of the MDGs related directly to health interconnect with the other goals which focus on poverty and hunger, education, gender, the environment, science and technology, and water and sanitation; and the onus rests on governments and the international community to address the complex social, economic and political issues if the MDGs are to be met on time (Sommerfeld 2005). Many of the issues raised can be addressed through implementation research, which is influenced by the broad social science agenda on development and health, and involves both basic social science research to provide better understanding of certain phenomena and applied research into the effectiveness of interventions or conditions of scaling up.

Having a mix of the broad social science disciplines (medical anthropology, medical sociology, social and cultural epidemiology, economics demography and health policy) and the different data collection techniques they bring to bear can go a long way to enhance data collection at these sites, where data is collected from all populations in the demographic surveillance area twice, thrice or four times a year depending on the site. Potential questions that can be addressed include:

- why are some societies better than others at protecting the health of their members?
- what factors constrain people's access to medical knowledge and effective health care?
- how do publicly subsidized services and government-supported safety nets interact with household coping mechanisms?
- what are the best strategies for the public sector to employ in scaling up cost-effective health interventions?
- what can governments do to encourage public and private health providers to perform well?
- how can people become informed consumers and citizens who take responsibility for their own health and exert a positive influence on health systems?
- what information do governments need about patterns of illness among the poor, and social, economic and institutional circumstances to select the most appropriate arrangements to protect them from falling into extreme poverty?
- what gender-sensitive interventions can be put in place to address disparities in health care?
- to what extent are observed individual characteristics such as health status, gender attitudes, preference for particular government policies, or consumer choices patterned by personal endowments such as personality, age, sex, or level of education; and to what extent are they patterned by the social, cultural and environmental context in which the individual exists?

The gap that needs to be filled

While the 20th century has seen an extraordinary advance in the social sciences, especially at the levels of theoretical constructs, methodology and data generation and

management (Wagner 1999), in the countries where tropical diseases are endemic, health social sciences lag behind (TDR 2005). There are few health social scientists, many of whom have little or no knowledge of the health system and consequently lack the skills to conduct health systems/implementation research. There are also people working within the health system who conduct social science research without the requisite knowledge of theoretical constructs, thus leading to poor interpretation of results. The lack of social science capacity may contribute to the unsuccessful implementation of control strategies and the reasons could be:

- weak links and/or synergies, collaborations and dialogue between social scientists and those involved in communicable disease control programmes, policy-makers and NGOs; the research control divide is noticeable and a challenge to overcome;
- social scientists are not part of the technical or administrative structures of the health sector and communicable disease control teams, thus there is no clear career structure for professional work in health social science; and
- investments by endemic countries into universities are generally low, and social sciences are given even lower priority.

In order to combat disease and promote health, it is important that every country develops the required capacity to identify, innovate and adapt technology to its own needs and constraints in order to better address its burden of issues related to health and disease (TDR 2005). It is important to strengthen social science research capacity in developing countries in order to improve policy formulation. This is because research in the social sciences is critical to an understanding of the context within which such policies are formulated and implemented (Block 2005). ❑

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References

Allotey P. 'Health habitats: a community observatory for monitoring the effects of place and space on society' (Research proposal)

Block MG 2005, 'Capacity for health systems research in developing countries', IDS Policy Briefing, Issue 23 May 2005, Institute of Development Studies.

Bloom G & Knowles C (eds.) 2005, 'Mobilising social science research to improve health', IDS Policy Briefing, Issue 23 May 2005, Institute of Development Studies (IDS), Sussex.

INDEPTH Network 2002, 'Population and health in developing countries', vol. 1, Population, health and survival at INDEPTH sites, International Development Research Centre (IDRC), Ottawa.

INDEPTH Network 2006. Retrieved August 29, 2006 from http://www.indepth-network.net/dss_site_profiles/dss_sites.htm

Meng Q, Shi G, Yang H, Gonzalez-Block M & Blas E 2004, *Health policy and systems research in China*, Special Programme for Research & Training in Tropical Diseases (TDR)/WHO, Geneva.

Quarshigah C 2006, speech by the honourable Minister of Health at the High Level Ministerial Meeting held in Accra, 15th -17th June 2006

Savigny D, Kasale H, Mbuya C & Reid G 2005, *Fixing health systems*, IDRC, Ottawa.

Sommerfeld J 2005, 'Social science research and the millennium development goals', IDS Policy Briefing, Issue 23 May 2005, Institute of Development Studies (IDS), Sussex.

TDR 2003, *Implementation research in TDR: conceptual and operational framework*, TDR/WHO, Geneva.

TDR 2005, *Making health research work for poorer people: Progress 2003-2004*, Seventeenth Programme Report, TDR/WHO, Geneva.

Wagner P 1999, 'The twentieth century the century of the social sciences?' *World social science report*, UNESCO and Elsevier.

Williams HA, Jones C, Alilio M, Zimicki S, Azevedo I, Nyamongo I, Sommerfeld J, Meek S, Diop S, Bloland PB & Greenwood B 2002, 'The contribution of social science research to malaria prevention and control', *Bulletin of the World Health Organization*, vol. 80, no. 3.

World Health Report (2005), 'Make every mother and child count', WHO, Geneva.

African PhD research capacity in public health: raison d'être and how to build it

Article by Sharon Fonn

Noting the huge health challenges facing sub-Saharan Africa today, this article explores firstly why research capacity in public health is an essential contribution to development and population health in Africa, and secondly, why African research capacity is required. The article describes a considered best practice method for building this capacity, why it should be at the PhD level and how, once built, it can result in sustainable research output and new generations of African researchers.

Africa carries a disproportionate burden of ill-health and its health systems under perform.

Over the past number of years the World Health Organizations' World Health Report has focused on the various threats to health internationally (WHO 2003), on HIV specifically (WHO 2004), and on maternal and child health (WHO 2005). Each of these reports has highlighted the disproportionate burden of disease borne by sub-Saharan Africa. Specifically, preventable causes of mortality (maternal mortality, tuberculosis, malaria, diarrhoea and acute respiratory illness in children) and in the last decade the HIV epidemic and the newer epidemic of chronic diseases (Leeder et al. 2004), have all made urgent demands on health services, and are ongoing issues that impact negatively on health and development in Africa. Each of the above WHO reports and other research (Schneider et al. 2006) have highlighted the need to take a health systems approach in addressing health in Africa, and have identified the need to build health systems in Africa.

These are not the only factors influencing poor health in Africa, and the need to address the social determinants of health (both in Africa and worldwide) is central to gains in health status (Wilkinson & Marmot 2003). Health-related interventions that are culturally inappropriate are less likely to have impact, yet public health interventions internationally assume a Western health-care model. Where there is cultural acceptance of Western medicine systems, this approach can result in high levels of health-care usage and trust in this approach even in countries where this is not the dominant ideology (Gilson 2005). However, this kind of response is not guaranteed and limitations have been found for interventions that do not take contextual factors into account (Petros et al. 2006).

Context is important

While it is clear that health systems need to be built, supported and developed, the approach to health systems development is contested. Many international actors, including the WHO in some instances, promote public-private partnerships as a method of addressing health needs. This approach is encouraged in the face of cross-national evidence linking higher levels of private finance and provision to worse health outcomes (People's Health Movement, Medact and Global Equity Gauge Alliance 2005), and the negative impact of privatization in health financing on access to and equity targets for reproductive health (Ravindran & de Pinho 2005). Thus there is clearly a role for research that is context specific to inform how health systems can be developed so that they do address the epidemics of infectious diseases and the now increasing burden of chronic diseases at a population level. Context-specific research is also needed to develop methods and interventions that result in high levels of coverage, that reach preferentially those most in need (poor, rural, female) and that promote the ability of the population to reach levels of community and individual fulfilment.

Health-seeking behaviour, too, is context specific. Western systems of understanding health and disease are not universal and alternative, and sometimes dualistic and conflicting models operate within communities and individuals. These influence health-seeking and health-related behaviour. This is the case too for diseases of major public health importance: for example, for sexually transmitted diseases (Paxton et al. 1998) and for HIV (Golooba-Mutebi & Tollman IN PRESS; Agadjanian 2005). Research to understand health-seeking behaviour is urgently required to inform health interventions so that they are appropriate and most likely to result in improvements in population health, in particular, for the major epidemics facing sub-Saharan Africa today.

Public health as a fundamental discipline for health and development in Africa

This perspective: that attention to health issues in Africa is urgent; that understanding health and health interventions requires attention to the multifaceted determinants of health; that health systems need to be developed to promote equity to have an impact at the population level; and that context is an important factor in understanding all of this, leads to certain conclusions. It requires that interventions take a population focus – to make an impact at the population rather

than individual level. In order to make such an impact, interventions need to be underpinned by an understanding that health and well-being are affected by interactions among multiple determinants of health. This is the public health approach recognized by public health professionals in Africa, but also internationally (Gebbie, Rosenstock & Hernandez 2003). This is what sets public health as a discipline apart from other areas of health specialization. At least for a significant proportion of public health professionals, achieving greater health equity is a core value, and this too is perhaps unique to the discipline of public health. In order to describe, understand and impact on the social determinants of health, and be able to develop interventions and systems to improve health status and redress inequity in health and access to health services, a range of disciplinary approaches are required.

Public health is by definition multidisciplinary, including epidemiology, biostatistics, environmental health, health services administration, social and behavioural science, policy studies, health systems research and health economics. More importantly, public health is transdisciplinary, where the methodological approaches of these contributing disciplines are used in combination to inform our understanding of health and increasingly our health-related interventions (Gebbie, Rosenstock & Hernandez 2003). Public health as a discipline is thus centrally placed to address the key health issues facing Africa at present. An urgent expansion in high quality public professionals is required.

Development will increasingly depend on a country's ability to understand, interpret, select, adapt, use, transmit, diffuse, produce, and commercialize scientific and technological knowledge in ways appropriate to its culture, aspirations, and level of development

Training in Africa for Africans

A recent survey has indicated that of 53 countries surveyed in Africa, there is no provision for public health training in 27 countries (51%); there is one programme in 16 countries (30%) and there is more than one programme in 10 countries (19%) (Strehler 2003). It is thus not surprising that there is great demand from African students for public health training, in African countries where such training is offered and an even greater demand for training in Northern institutions. In the latter case, however, there are certain disadvantages. It is almost always more expensive to send students for training at Northern institutions compared to Southern institutions. Moreover, the courses offered at Northern institutions are often not relevant to issues that Southern students face. The high level of resources available in Northern institutions often means that students learn in an environment that is at odds with the reality at home. In addition, experience has shown that a significant proportion of African students trained in Northern institutions, even when they work on issues pertinent to their home country, do not return home but take up jobs in the North. Training Africans in Africa would be more appropriate and less expensive. It would also offer the opportunity of building an ongoing network of researchers through an active alumni programme for graduates.

Training Africans in Africa is also important as context is central to understanding how health systems function. For health systems to make a positive contribution to population health and to redress inequity, interventions in health systems development need to be context-specific

Training Africans in Africa is also important as context is central to understanding how health systems function. For health systems to make a positive contribution to population health and to redress inequity, interventions in health systems development need to be context-specific. Context is also fundamental to understanding individual health-related behaviours, and this means that research to understand health-related behaviours needs to be conducted in those parts of the world that experience the highest rates of ill-health. Further, it is people who are of that context who are most able to conceptualize research that is relevant.

"Development will increasingly depend on a country's ability to understand, interpret, select, adapt, use, transmit, diffuse, produce, and commercialize scientific and technological knowledge in ways appropriate to its culture, aspirations, and level of development" (Farley, Crawford & Watson 2003). Fundamental therefore to the generation of appropriate solutions for health and development in Africa is research – conceptualized, conducted, analysed and published by Africans. Strategic partnerships with international partners are essential and desirable, but Africa needs to take a lead role in many of these partnerships.

In order to take a leadership role, African researchers need to develop research capacity at a high level through PhD programmes. What distinguishes PhD-level training is that it is at this level that abstraction becomes a central part of the research process. Doctoral candidates work with data, abstract meaning from it and apply the findings. This distinguishes them from members of a team, in that they draw conclusions from their own research but also develop further research questions. The successful PhD graduate is someone who is able to develop investigator-driven research rather than participating as a trial site or implementing donor or other funding agency research agendas. PhD graduates have the potential to become research leaders. That these graduates are appropriately trained in Africa means they are able to apply their research skills and leadership to local priorities. In addition, PhD graduates provide supervision to master-level students at African institutions. This raises the level of supervision available to masters students, since many of them are currently supervised by people who themselves have only a masters level qualification. They also become role

Experience has shown that selecting candidates who are able to return to adequately functioning home institutions where they have funded posts results in a win-win situation. The institution which provides the PhD training is not the only institution to benefit. The provision of 're-entry grants' to fund research once the graduate returns home allows the sending institution to benefit as well

models who promote research and who demonstrate that research capability is also the preserve of Africa.

African PhD programmes

Historically there has been investment to expand the base of masters-level research scientists with the vital skills and qualities necessary to contribute to research focused on promoting health and development on the African continent. These programmes are now well established in a few countries in Africa. The success of such programmes have led international institutions such as the WHO, World Bank and UNDP Special Programme in Research and Training in Tropical Diseases (TDR) with years of investment and experience in developing research capacity in developing countries, to now preferentially send students for masters-level training to institutions in Africa rather than the previous practice of sending them to Northern institutions (Waylings 2006). These and other programmes provide a "pipeline" of promising PhD candidates. There is a great need to develop young, emerging African scientists in the quantitative and social sciences for health and to move towards taking leadership in research. Enhancing young researchers' expertise will increase the community of African scientists able to respond to key public health challenges, including HIV/AIDS and persisting TB and malaria on the one hand, and emerging noncommunicable disease and violence on the other. Setting up sustainable institutional capacity to offer PhD-level training in Africa is the next logical step.

Building this research capacity in Africa[1] is a challenge. It must be fostered in environments where precipitous economic decline occurred in the 1980s. The subsequent introduction of various forms of structural adjustment policies, either internally or externally imposed, in most countries in sub-Saharan Africa has resulted in reductions in social spending. This has decreased support for higher education. In the face of decreased funding and more recently increasing concern with providing undergraduate education, institutions have been unable to maintain the physical infrastructure required to support an environment conducive to research, have overburdened and underpaid staff who have taken on consultancies to supplement their income to maintain a basic standard of living or left for Northern institutions where they can continue research as a career – placing further demands on those who do remain in Southern academies. Thus significant investment to fund catch-up and to develop new capacity for higher education in Africa is required. This is widely recognized. The Commission for Africa (Commission for Africa 2005), which defined its brief as producing clear recommendations for the G8, EU and other wealthy countries as well as African countries, stated that "health and the building of capacity for research and innovation are prominent features of development" and that "donor governments should also fund research, led by Africa, to boost the continent's science, engineering and technology capacity".

What funding then is required? Building research capacity is a long-term investment. Research capacity is acquired through praxis under guidance. This implies that PhD candidates are located in an academy that has sufficient ongoing research and staffing to nurture, mentor and supervise their research. While there are a number of institutions in Africa that have ongoing and cutting edge research, few have spare human resources to supervise PhD students. Therefore not only are bursaries and scholarships for PhD candidates required, but funding of more senior members of the academia is also required to allow them the time required to supervise PhD candidates.

Further, given that resources are scarce and that public health is interdisciplinary in nature, a grounding that acquaints all candidates with the language of each (or a selection) of the fields that contribute to public health through an organized course-work component to the PhD programme is essential. This will result in graduates who are able to work in transdisciplinary research and be able to take up research positions in a number of circumstances across the continent rather than being specialized within only the in-depth narrow focus of their particular research endeavour. In order to create such a cadre of PhD candidates in a cost-effective manner, having a series of cohorts of PhD candidates, rather than funding only one or two students, makes more sense.

A few research institutions in Africa at which these cohorts of PhD candidates could be concentrated and where links between these institutions could exist or be developed should be identified. Links between the identified institutions would allow them to develop collaborative activities such as shared faculty and joint annual seminars. These institutional area(s) of expertise would thus be shared so that PhD candidates do get the kind of exposure that allows them to work in a trans-disciplinary way. These institutions should be funded to develop PhD programmes, and the institutions' existing research should be further supported and extended to nest PhD candidates in them; increased funding should also allow senior faculty time to supervise the students. Linkages with institutions internationally through postdoctoral and senior faculty exchanges would increase local African capacity in the short term until such posts could be taken up by African graduates of the PhD programme.

The cohorts of students also become a resource for each other, work in teams, and create relationships that will be

[1] This section is drawn from collective views which evolved at two meetings to discuss PhD training in Africa. One in Accra Ghana in February 2006 hosted by INDEPTH and bringing together INDEPTH Demographic Surveillance Sites and Universities from Ghana, Kenya and South Africa and the 4th Wits-Brown-Colorado-African Population and Health Research Centre Colloquium on Emerging Population Issues May 2006. Both these meetings explored the potential and obstacles for creating PhD-level training in Africa.

sustained after they qualify as professional academics. They have the potential to create networks of PhD graduates across Africa who would be able in time to develop cross-disciplinary and cross-national research projects, learning from the similarities and differences in each of their contexts to inform health and development interventions for Africa.

Experience has shown that selecting candidates who are able to return to adequately functioning home institutions where they have funded posts results in a win-win situation. The institution which provides the PhD training is not the only institution to benefit. The provision of "re-entry grants" to fund research once the graduate returns home allows the sending institution to benefit as well.

Experience with this approach at the master's level has led to success in at least South Africa, Ghana and Uganda. This needs to be extended to PhD-level training so that Africa can take a lead in research for health and give meaning to the claim that "national leadership and global solidarity can result in significant improvements in all countries" (WHO 2006). It has been found that "targeted investments in research can yield high impact economic and social results" (Farley, Crawford & Watson 2003). ❑

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References

Agadjanian V 2005, 'Gender, religious involvement, and HIV/AIDS prevention in Mozambique', *Social Science & Medicine* vol. 61, pp. 1529-1539.

Commission for Africa 2005, http://www.commissionforafrica.org/english/report/introduction.html accessed 27 June 2006.

Farley S, Crawford M & Watson R 2003. 'Strategic approaches to science and technology in development', The World Bank Policy Research Working Paper Series 3026.

Gebbie K, Rosenstock L & Hernandez LM (eds) 2003, '*Who will keep the public health? Educating public health professionals for the 21st century*', National Academy of Sciences.

Gilson L 2005, editorial: 'Building trust and value in health systems in low- and middle-income countries', *Social Science and Medicine* vol. 61, pp. 1381-1384.

Golooba-Mutebi F & Tollman SM (in-press), 'Confronting HIV/AIDS in a rural South African Village: the impact of health-seeking behaviour', *Scandinavian Journal of Public Health*.

Leeder S, Raymond S, Greenberg H, Liu H & Esson K 2004, '*Race against time; the challenge of cardiovascular disease in developing economies*', Columbia University, New York.

Paxton LA, Kiwanuka N, Nalugoda F, Gray R, Wawer MJ & Rakai Project Study Group 1998, 'Community based study of treatment seeking among subjects with symptoms of sexually transmitted disease in rural Uganda', *BMJ* vol. 317, pp. 1630-1.

People's Health Movement, Medact and Global Equity Gauge Alliance 2005 Global Health Watch 2005–2006: '*An alternative World Health Report*', Zed Books, London.

Petros G, Airhihenbuwa CO, Simbayi L, Ramlagan S & Brown B 2006, '*HIV/AIDS and "othering" in South Africa: the blame goes on*', Culture Health & Sexuality Routledge, vol. 8, pp. 67-77.

Ravindran TKS & de Pinho H (eds) 2005, 'The right reforms? Health sector reforms and sexual and reproductive health', Women's Health Project, School of Public Health, University of the Witwatersrand, Johannesburg.

Schneider H, Blaauw D, Gilson L, Chabikuli N & Goudge J 2006, 'Health systems and access to antiretroviral drugs for HIV in Southern Africa: service delivery and human resources challenges', *Reproductive Health Matters*. vol.14, no. 27, pp. 12-23.

Strehler A 2003, 'Mapping public health education capacity in and for Africa', Afrihealth, retrieved from http://afrihealth.up.ac.za/reports/Afrihealth_nov2002.PDF

Waylings S 2006, TDR Research Strengthening Committee meeting, 6–10 March.

Wilkinson R & Marmot M (eds) 2003, *Social determinants of health: the solid facts*, 2nd edition, WHO Regional Office for Europe, Copenhagen.

World Health Organization 2003, '*The World Health Report 2003 – shaping the future*', WHO, Geneva.

World Health Organization 2004, '*The World Health Report 2004 – changing history*', WHO, Geneva.

World Health Organization 2005, '*The World Health Report 2005 – make every mother and child count*', WHO, Geneva.

World Health Organization 2006, '*The World Health Report 2006 – working together for health*', WHO, Geneva.

Inclusive research for sustainable development: enabling people to help themselves[1]

Article by Pia Rockhold

Health is a basic human right central to security, quality of life and economic growth. Increasing social and health disparities within and between countries are a threat to sustainable development. Indeed, equity is central to health research, health promotion for improved public health, and people's active involvement in health and health research (Bangkok 2000).

In developing countries, the need to increase the capacity to produce and use knowledge cannot be overstated. Knowledge is a critical determinant of economic growth, standard of living and development. Long-term growth rates in OECD economies depend on maintaining and expanding the existing knowledge base (OECD 1998). Substantial inter- and intra-country variation in the diffusion of advances in knowledge has been linked to dramatic improvements in health, independent of high or rapidly growing incomes (Deaton 2004).

Knowledge leads to better technologies and diagnostic methods, improved application of cost-effective interventions, more informed health-care users and promotion of healthy lifestyles. Knowledge is used for decision-making in the delivery of health services and the formulation of public policies (Frenk 2004). Most low- and middle-income countries (LMIC) do not allocate sufficient resources to health research. In 2001, an assessment of global resources for health research noted that none of the developing countries studied had met the 1990 Commission on Health Research for Development's (CHRD) recommendation to spend as much as 2% of the national health budget on health research – only India, Brazil and Cuba had spent notably closer to the target of 1–2% (Global Forum for Health Research 2004). Likewise, most donors fall short of the recommended allocation of 5% of their health development budget for health research and research capacity building (CHRD 1990). In particular, very little research has been done in the area of health equity (Sen, George & Ostlin 2002).

Chronic ill-health and disabilities – a growing epidemic

Average global life expectancies have increased dramatically since the 1960s, but the levels of inequity remain high across and within countries (Jamison 2006). Globalization, environmental changes, urbanization, ageing of the population, and advances in medical science and technology, have contributed to a global increase in chronic and noncommunicable diseases, especially from cardiovascular diseases, cancer and psychiatric disorders. The major causes of mortality in LMIC are presently estimated at 53.8% from noncommunicable diseases, 36.4% from communicable diseases, and 9.8% from injuries, road traffic accidents, violence, war, civil unrest and natural disasters. Poor and rich die of malnutrition, cardiovascular diseases and stroke (27.6%), cancer (10.2%), chronic respiratory conditions (6.5%) and diabetes (1.6%), while living with substance abuse, mental health problems, degenerative joint diseases, visual, hearing and other impairments (Mathers, Lopez & Murray 2006). Eighty per cent of noncommunicable disease deaths occur in LMIC. The attached, but often underestimated, long-term morbidity and disability result in human suffering and decreased national and global economic development, as does the toll of chronic communicable diseases, such as lymphatic filariasis and HIV/AIDS.

Conflict situations and disasters cause more mortality and long-term physical and psychosocial disability than any major disease, disproportionately affecting women and children, either directly through injuries, sexual abuse, mental and emotional distress, or indirectly though disruption of health and education services, lack of fuel, water, energy and jobs (Murthy & Lakshminarayana 2006; CBR 2000). Armed civil or societal conflicts were numerous and widely distributed throughout the world in the 1980s and '90s, but have since concentrated mainly in Africa, South and Central Asia and the Middle East. Over one third of developing countries have been directly affected by serious conflicts since 1990 and nearly two-thirds for seven years or more (Marshall & Gurr 2005). Generally, conflicts tend to be of some duration and of an intensity aiming to wound, rape and disable civilians. Leaving people disabled, rather than killing them, places a large economic burden on the family and the country. Landmines alone injure a minimum of 20,000 people annually; mostly civilians (96%) and a large proportion (24%) are younger than 15 years of age. Globally, there are more than 350,000 disabled landmine survivors, the majority amputees (Landmine Monitor 2005). Disabled civilians, especially females, often have less access to prosthetics rehabilitation and other services than do soldiers. Disabilities are also incurred and exacerbated in the context of

[1] This article has been sponsored by the World Bank.

The magnitude of the global problem of disability is enormous. More than 600 million people, with 400 million living in developing countries – or about 10% of any population and 20% of the world's poorest – live with some form of significant disability

natural disasters, disproportionately affecting persons with disabilities and creating a new "generation" of disabled people in need of rehabilitation and support (WHO 2005).

Girls and women are more likely to become disabled as a result of violence, armed conflicts, ageing and gender-biased cultural practices limiting their access to food, shelter, health care, safe working environments, marriage and social integration. Disabled females face double discrimination and, in turn, fare worse than non-disabled women and disabled men on most indicators of financial, educational and vocational success (Rousso 2000). Abuse and violence is a significant cause of physical and mental disabilities in women (Raye 1999). Disabled women and children are at high risk of being mentally or physically abused[2]. Moreover, abuse by household members often remains unreported to avoid further stigmatization (Elwan 1999).

The size of the disability problem

The magnitude of the global problem of disability is enormous. More than 600 million people, with 400 million living in developing countries – or about 10% of any population and 20% of the world's poorest – live with some form of significant disability[3] (WHO 1999). These figures can be higher in countries devastated by war or natural disasters. Recent studies in selected developing countries indicate a disability percentage of 10 to 12 with about 3% of the entire population having severe impairments (Flores, Yepez & Pramatarova 2005; INEC Nicaragua 2003; IDB 2005; World Bank 2006). The number of people with disabilities is increasing creating an overwhelming demand for health and social services, while emphasizing the need for more inclusive societies with increased participation of disabled people. It is expected that over one billion people will be living with disability by 2050 (Mayhew 2003).

Mental, physical or sensory impairments and disabilities range from mild to moderate and severe. But disability is not simply a medical condition. It results from the complex interaction of impairment, an individual's health condition and personal factors, with culture, institutions and environment. Disability is a relative term, difficult to observe and requiring subjective assessment by the affected individuals and the society (Elwan 1999). It is a continuous indicator of disparities and inequities in health and development.

Definitions, measurements and prevalence of disabilities[4] vary greatly across countries. Many developing countries vastly underestimate the prevalence of disability. Often families hide disabled family members. Where people with disabilities are not visible in society, it becomes even more difficult to recognize and address the issue. As data and methods improve, current estimates may increase tenfold (Mont 2005).

Disability and poverty

People with disabilities tend to be among the most deprived and neglected human beings in the world. Quite often they are not only the poorest of the poor in terms of income[5] but their need for additional income to cover the expenditures associated with alleviation of their disabilities is often substantial. The poverty line for disabled people should include these additional expenditures (Sen 2004).

The link between disability and poverty seems to be relatively straightforward, but the concepts are very political and poorly defined (Seddon & Yeo 2005). The hard statistical evidence is also limited (Eide & Loeb 2005). Moreover, the perception of disability is often greatly influenced by social and cultural factors, ignorance, superstition or fear. People living with disabilities face negative attitudes, stigma and discrimination (Llagan 2003). Where resources are scarce they are given the lowest priority. Both poor and disabled people are excluded from society, the decision-making process and the right to vote. They are marginalized and isolated; economically, socially and politically deprived; and lack access to information, education, health care, water, sanitation, employment and credit (Yeo

Conflict situations and disasters cause more mortality and long-term physical and psychosocial disability than any major disease, disproportionately affecting women and children, either directly through injuries, sexual abuse, mental and emotional distress, or indirectly though disruption of health and education services, lack of fuel, water, energy and jobs

2005). Disability not only affects disabled persons and their families, but entire societies, as a large proportion of the population is economically unproductive with high demands for economic and social support (Tudawe 2001).

The impact of disability on the national GDP depends on the age- and gender-specific prevalence of various disabilities. The economic loss, for example, according to UNICEF, is higher in developing countries with relatively high proportions of disability in children under 15 years and economically productive groups as compared to high-income countries where high proportions of disability is related to ageing. Unemployment rates are high for disabled people, and often families affected by disability not only have additional costs, but also lose income caring for a disabled family member. The GDP lost as a result of short- and long-term disability in LMIC has been estimated to be around 6% (Metts 2004).

[2] HIV/AIDS/STI and unwanted pregnancies affect disabled people disproportionately, as they often have less access to health education, are assumed to be sexually inactive and are more likely to fall victim to sexual abuse. Exploitation is especially high for people with intellectual, speech and hearing disabilities.

[3] These figures can be higher in countries devastated by war or natural disasters.

[4] Most of the time what is actually measured is the impairments not the disabilities.

[5] About 82% of disabled people live below the poverty line in developing countries (Sen 2004).

International development targets like the Millennium Development Goals (MDGs) of universal primary education and poverty alleviation can only be achieved through a barrier-free environment and the inclusion and engagement of disabled and poor people in the decisions and processes which affect their lives

Needs assessment

The objective of development must be to enhance equity and alleviate poverty. Enabling people to help themselves is the only sustainable development solution. Despite the emergence of international standards, manuals and guidelines to promote the inclusion of people with disabilities in development and in-country legislations and policies, disabled people remain largely excluded (UN 1982; UN 1994; MIUSA 2003; EB114/4 2004).

Core actions that will enable an integrated comprehensive approach to disability – thus increasing equity – should focus on enhancing the global awareness and knowledge of and commitment to:

1) preventing impairments and disability (World Development Report 2006);

2) ensuring access to effective health care, rehabilitation, support and other services for persons with disabilities, including assistive devices, vocational training, psychosocial support, speech therapy, accessible infrastructure and communication; and

3) adopting an overall inclusive development approach with appropriate adaptation of society, e.g. removing the physical and attitudinal barriers, and ensuring equal opportunities enabling disabled people to participate in society and contribute to sustainable economic growth (UN 1982; UN 1996; EB114 2004).

The inclusive approach supports the principles of equal rights for all. Instead of targeting the poor and vulnerable with "charity-like assistance", which only enhances their dependence on external assistance, the inclusive approach ensures that vulnerable and disadvantaged groups, like the disabled, are fully and effectively involved as equal partners in the formulation, management and evaluation of inclusive policies, strategies and plans.

International development targets like the Millennium Development Goals (MDGs) of universal primary education and poverty alleviation can only be achieved through a barrier-free environment and the inclusion and engagement of disabled and poor people in the decisions and processes which affect their lives. Human rights are central because they empower all people to make effective decisions about their own lives (DIfD 2001).

Inclusive health research and research capacity building

The inclusive approach has implications for national policy and planning, as well as for health research (Rockhold, Adjei & Jegathesan 2005). The gap in the area of disability- and impairment-related health research in LMIC is huge. The present availability of scientific information and data are, with a few exceptions, fragmented, poor in quality, non-comparable with limited applicability and mainly exploratory in nature (Eide & Loeb 2005).

In defining the global, regional and national disability related research agenda it is essential to ensure that the investment of different and multiple stakeholders is managed effectively in a cohesive, intersectoral and systematic way, with emphasis on identification of key priorities at the various levels and translating knowledge into action to improve public health (WHO 2004).

The UN, WHO and the Washington Group presently work to improve the standardization, availability and accuracy of disability related statistics to be collected through national surveys and censuses[6]. The local ownership of these surveys and censuses strengthens the national capacity for data collection, analysis and use. Obtaining a more accurate picture of the age, gender, cause and other stratum-specific prevalence data of various disabilities, further enables national planning of health, social and other services.

Traditionally, most disability and development research has been done by non-disabled researchers in the North working with people with disabilities, individuals or disabled people's organizations (DPOs), as passive subjects. With increasing demand for involvement of the beneficiary in the research, e.g. disabled people in disability-related research, Northern-based researchers have begun to involve partners from developing countries, but often the research agenda is pre-set (Albert 2005). Southern-based research institutions and organizations (including DPOs) and community groups targeted for research (e.g. disabled people) need to take a lead in planning for and management of local health research, including disability related development research (Albert et al. 2005).

Inclusive research involves vulnerable and disadvantaged groups at all stages of research, from development of the agenda, priority setting, and grant writing to fund management, implementation, analysis, dissemination and the translation into meaningful action. Inclusive research can greatly enable equitable sustainable development.

Close collaboration between decision-makers, DPOs and researchers improves the quality and usefulness of research, promotes health, empowers disabled people and strengthens organizational capacity building to enhance access and participation in society (Block, Skeels & Keys 2006; Dube 2005; Oliver 1997). A locally developed national research policy, strategy and plan reflecting the country's short- and long-term needs and priorities as an integrated component of the national development plan and budget is essential to provide a framework for national coordination of research and resource allocation and use within the country.

The country's national research strategy and plan should include disability related research and involve people with disabilities as active participants and researchers. The institutions and society should be accessible to disabled people. Research should be demystified and accessible to all, including people with sensory disabilities. Improved

[6] www.un.org/esa/socdev/enable

communication, information, knowledge sharing and use are key to development and essential in working together, to attract funds and to ensure policy and poverty relevant research. Strengthening of South–South networks for regional research capacity building retains human resources in the region. North–South collaboration adds value if demand-driven and coordinated by the South (Rockhold 2004).

Comprehensive qualitative and quantitative country or area-based action-oriented situation analysis, including and drawing on human resource and institutional assessments, will facilitate the development of a national action plan for inclusive health research and development. The human resource and institutional assessment needs to contain a research capacity analysis of the national institutions for health research and disability. Short-term strategies should aim to train researchers in disability and inclusive research approaches, and decision-makers and disabled people in research methodology. Long-term strategies must aim to produce, implement and monitor a comprehensive national plan for development and strengthening of sustainable human resources, institutions and organizations for inclusive national health research and development.

In conflict, post-conflict and emergency environments, where the prevalence of impairment and disability is especially high, disabled people should be included in the short- and long-term needs assessments and management of emergency operations, reconstruction and development. Further enhanced coordination with stronger linkages between emergency and development aid, ensuring sustainable financing and a redefinition of society, utilizing this opportunity for creation of a "new" and more inclusive society based on equitable inclusive research is key to sustainable development. ❑

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References

Albert B 2005, 'Lessons from the Disability Knowledge and Research Programme'.

Albert B, Dube AK, Hossain M & Hurst R June 2005, Research gap analysis report for DIfD.

Bangkok 2000, The Bangkok declaration and Charter for Health Promotion, International Conference for Health Research, Bangkok, August 2004.

Block P, Skeels SE, Keys CB 2006, *Participatory intervention research with a disability community: a practical guide to practice*.

CBR News, Community Based Rehabilitation News no. 32, December–March 2000.

CHRD 1990, *Health research. Essential link to equity in development*, Oxford University Press.

Deaton, A 2004, 'Health in an age of globalization', working paper 10669, National Bureau of Economic Research, Cambridge, MA.

DIfD 2001, 'Realizing human rights for poor people'.

Dube AK April 2005, 'Participation of disabled people in the PRSP and PEAP process in Uganda'.

EB114/4 May 2004, 'Disability, including management and rehabilitation', Executive Board 114th Session, WHO, Geneva.

Eide AH & Loeb ME July 2005, 'Data and statistics on disability in the developing countries'.

Elwan A December 1999, 'Poverty and disability. A survey of the literature', SP discussion paper no. 9932, World Bank.

Flores R, Yepez D & Pramatarova M 2005, 'Ecuador: la discapacidad en cifras', report prepared for the World Bank by CONADIS, Instituto Nacional de Estadísticas y Censos de Ecuador, NEC y Inter-American Development Bank.

Frenk J 2004, the Ministerial Summit on Health Research, Mexico 2004.

Global Forum for Health Research 2004, 'Monitoring financial flows for health research', vol. 2.

Llagan VM 2003, Disabled Peoples International, http://www.internationaldisabilityalliance.org

Instituto Nacional de Estadisticas y Censos de Nicaragua 2003, 'Encuesta Nicaragüense para personas con discapacidad'.

Inter-American Development Bank 2005, 'Disability definitions, sources, questions and prevalence rates in Latin America and the Caribbean: an overview', (www.iadb.org/sds/wid_6496_e.htm)

Jamison DT 2006, *Disease control in developing countries*, World Bank.

Landmine Monitor Report 2005: 'Toward a mine-free world', Land Mine Monitor Editorial Board, Mines Action Canada.

Marshall MG & Gurr TR 2005, 'Peace and conflict. A global survey of armed conflicts, self-determination movements, and democracy', Center for International development & Conflict Management, University of Maryland, USA.

Mathers CD, Lopez AD & Murray CJL 2006, 'Global health statistics'.

Mayhew Les 2003, 'Disability – global trends and international perspectives', Innovation, vol. 16, no. 1.

Metts R November 2004 'Disability and development', background paper prepared for the Disability and Development Research Agenda Meeting, World Bank.

MIUSA 2003, *Building an inclusive development community. A manual on including people with disabilities in International development programs*, Mobility International USA (MIUSA).

Mont D July 2005, 'Research is key to moving disability up the economic development agenda', *Development Outreach, Disability and Inclusive Development*, World Bank.

Murthy RS & Lakshminarayana R February 2006, 'Mental health consequences of war: a brief review of research findings', *World Psychiatry* vol. 5, no. 1.

OECD 1998, 'Technology, productivity and job creation. Best policy practices'.

Oliver M 1997, 'Emancipatory research, realistic goal or impossible dream', in C Barnes and G Mercer: *Doing disability research*, the Disability Press, Leeds.

Raye K 1999, *Violence, women and mental disabilities*, Mental Disability Rights International.

Rockhold P November 2004, 'Research needs and requirements to achieve health, health equity and development beyond the objectives of the MDGs', Global Forum for Health Research, Mexico.

Rockhold P, Adjei S & Jegathesan M 2005, *The External Evaluation of*

References continued

Council on Health Research for Development, Swiss Development Cooperation.

Rousso H 2000, 'Girls and women with disabilities – an international overview and summary of research', Rehabilitation International and World Institute of Disability.

Seddon D & Yeo R 2005, 'Disability poverty and the new development agenda'.

Sen A 2004, *Disability and justice', keynote speech, conference on disability and development*, World Bank.

Sen G, George A & Ostlin P, February 2002, 'Engendering health equity. A review of research and policy', Harvard Center for Population and Development Studies, working paper series, vol. 12, no. 2.

Tudawe I 2001, 'Chronic poverty and development policy in Sri Lanka', Chronic Poverty Research Centre, working paper no.9, Institute for Development Policy and Management, Manchester.

UN 1982, The World Programme of Action concerning disabled people adopted by UN Assembly resolution 37/52.

UN 1994, The standard rules on the equalization of opportunities for persons with disabilities, New York.

UN 1994, The Salamanca statement and framework for action on special needs education.

UN 1996, *The disability dimension in development action*, manual on inclusive planning, the National Research and Development Centre for Welfare and Health in Finland, STAKES.

World Development Report (WDR) 2006, chapter seven, 'Human capacities'.

WHO 1999, WHO press release, December 1999.

WHO 2004, WHO, Geneva.

WHO 2005, 'Disasters, disabilities and rehabilitation'.

World Bank 2006, 'People with disabilities in India'.

Yeo R September 2005, 'Disability, poverty and the new development agenda', Disability Knowledge and Research Programme.

The imperatives for research on the health workforce in Africa

Article by Gilles Dussault (pictured), Delanyo Dovlo and Demissie Habte

Sub-Saharan Africa (SSA) has the highest maternal and infant mortality indicators of all regions of the world, and AIDS, malaria and tuberculosis are present in pandemic proportions. In the long term, factors such as a stable political environment, more rapid economic growth, improved education, access to safe water and sanitation, and adequate nutrition can contribute enormously to improving the health status of Africans. Meanwhile, there is an immediate and urgent need for access to well performing health services to respond to the crippling disease burden faced by the population. Following the *World Health Report 2000* (WHO 2000), we define the "performance" of a health services delivery system (HSDS) in terms of provision of services that are accessible according to need, are produced in an efficient manner, respond to users' expectations, and offer protection against financial risks induced by health problems.

The performance of HSDS is influenced by numerous factors: policies; inputs such as infrastructure, financial and human resources for health (HRH); information and knowledge; and processes such as governance, regulation and management. All play an important role, but HRH are especially critical. The professional and clinical behaviour of health workers, the decisions they make and the level of effort which they contribute determine the volume and quality of services that are available. Oddly enough, research on these topics is grossly neglected compared to research on diseases and health problems. This is true globally, but more so in low-income regions and particularly in SSA (Global Forum for Health Research 2004; Joint Learning Initiative 2004; WHO 2006). This article advocates for more research on the health workforce, on those who translate the biomedical knowledge into interventions and services, and proposes an agenda for research in Africa.

Why is more research on workforce issues needed in Africa?

A first argument is that there is an expressed need (not necessarily translated into a demand for research) to better understand these issues. All global programmes (The Global Alliance for Vaccines and Immunization, UNAIDS, STOP-TB, Safe motherhood, The Global Fund to Fight AIDS, Tuberculosis and Malaria) addressing health priorities acknowledge that HRH problems constitute the single most important obstacle to achieving their goals and objectives. A consensus has now emerged that improved policies and practices are needed to augment the number of qualified staff, to retain them, to enhance their professional competencies, and to sustain their motivation to deliver effective services. Research is needed to support the process of designing and implementing such policies and interventions.

A complementary argument is that although valid knowledge about the effectiveness of good workforce arrangements already exists, little is known about how to implement and sustain these arrangements, particularly in low-income countries. For example, it is recognized that the best way to reduce maternal mortality is to ensure access to qualified attendance during pregnancy and at delivery. Indeed, WHO data shows that the level of neonatal and maternal mortality correlates with availability (density) of health workers (WHO 2005). The Joint Learning Initiative (JLI) also showed a marked correlation, after controlling for factors such as "income poverty", between the density (so not simply having a skilled person within reach but in the right numbers in relation to population size) and maternal, infant and child mortality (JLI 2004). A significant finding was that a 10% increase in health worker density created a 5% reduction in child and infant mortality and 10% in maternal mortality. The indication was that a threshold of 2.5 trained health workers per 1,000 population resulted in adequate basic coverage of health services (about 80% coverage). SSA at the time had an average of 0.98 health workers per 1,000 population (JLI 2004).

Evidence is mounting that expanding the scope of occupational cadres, like nurses, and using new models of care management can significantly increase the effectiveness of services (Hall et al. 2001). This has been studied mostly in high-income countries, but there is no logical reason for saying that it is not applicable in poorer environments if adequate training and working conditions are made available.

The question then is how can the potential benefits of increasing health worker density be achieved in SSA? More and better understanding of the various dimensions of health workers' characteristics and behaviour, and of the factors that influence them, can help inform choices about health workforce policies and management.

Which research is needed?

Research needs are derived from the gap between available knowledge and that deemed useful for policy and decision-making and for effective delivery of health services. In SSA, very little is known about the health workforce. Even the most

basic data on how many workers there are, where they work, and their level of productivity is usually missing. This is not surprising, knowing that research on health services in general is little developed in the region and that research capacity in HRH, in particular, remains very limited. Outside of South Africa, there is no institution with a research programme on HRH in the continent, and the number of individuals who engage in HRH research is woefully low.

Since health workforce challenges are context specific, a first principle in approaching needs is that these should be defined at national level. This implies, at a minimum, an initial review of the current HRH situation, with a view to identifying bottlenecks which need to be unlocked to improve the performance of health personnel and to make services more accessible, more efficient and more effective.

A unique feature of Africa is that it is the region where the Millennium Development Goals (MDGs) are more at risk of not being achieved. This calls for research on the HRH dimensions to reverse current trends. For example, the evidence establishing the number and type of health workers required to meet the MDGs needs further scrutiny. Estimates of human resource requirements in a number of SSA countries show that significant increases in the supply of health workers will be required to meet basic needs and the MDGs (Kurowski et al. 2004). Evidence is accumulating on the additional burden that the HIV/AIDS pandemic places on HRH requirements, both as a danger in drawing essential staff away from existing services and also as an example of new skills required of health workers such as voluntary counselling and testing (VCT). Estimates for providing highly active antiretroviral treatment (HAART) to 10,000 people in Zambia indicate a need for full-time equivalents (FTEs) of 13 doctors and nurses, 15 pharmacists and 32 laboratory technicians. Attaining a 4% uptake of VCT countrywide will require full-time equivalence of 15% of the entire public sector laboratory staff; and achieving a five-year coverage target for full HAART for an estimated 300,000 clients will require 50% of the existing medical workforce full-time (Kombe 2003).

Even in relatively well resourced sub-Saharan African countries like South Africa, international migration, which induces shortages and internal misdistribution of health workers, is a major problem that needs to be better understood. A study that examined intentions to migrate among health workers in six African countries revealed disturbingly high rates (WHO 2004), but more information is needed to understand how workers move from intention to action, and under which conditions they can be retained.

Another area for research is that of the scaling-up of the capacity of production of training institutions. Aid agencies are now considering support to employing more health workers in Africa to accelerate progress towards the MDGs. Even after improving the productivity of the current workforce and integrating the portion of the workforce which, paradoxically, the health labour market has not been able to absorb (in several countries some qualified personnel are unemployed), there will be a need for additional workers. How many, which type, how to train them, how to strengthen training capacity as well as quality of training, and additional costs are topics for operational research of immediate interest. To attain the right density of health workers, some element of skill delegation may need to take place, but this should be cognizant of the limitations that can arise in skill levels and the high level of supervision and support needed to be truly effective. Even more importantly, the contribution of such health workers and the type of supportive environment required ought to be examined critically.

A way to select topics is to focus on performance dimensions of the workforce and their determinants. The principal dimensions are coverage (whether the workforce covers all types of needs and populations, and is well distributed geographically), productivity, and technical and service quality (whether services meet the professional standards appropriate to the context, and meet the expectations of users). Performance is itself determined by policies, by working conditions, systems of incentives, management structures and processes, and obviously by the social and professional characteristics of the individual health workers.

The following topics are proposed to be part of the basic research portfolio:

- **Coverage:** the profile of the health workforce (including informal workers), trends, predictable changes.
  - Distribution by occupational group, by level of care, by geographical location, by employer (public or private), dynamics of the labour market (incentives, pay and other differentials, attrition rates and causes), alternative staffing patterns.
- **Supply:** the process of producing the workforce that involves training capacity, needs, effectiveness of strategies, contents of curricula, quality assurance mechanisms, cost of training, recruitment/retention of trainers, skills mix and numbers of each needed at different levels of the health system, i.e. community, sub-district and district levels.
- **Productivity:** the performance of health workers and its determinants; productivity, technical quality, service quality; motivation, absenteeism, career/work expectations, work satisfaction. In the African context, special attention to auxiliary and community-based workers, to the constraints which they face, and how these can be dealt with is needed.
  - The work environment: management processes, logistic support, incentive systems, safety and security, labour relations.
  - Policy processes, formulation, implementation, planning, governance, regulation.

This range of research needs demands much time and effort, and some prioritization will be necessary which is why we conclude with a suggestion for an agenda for action in HRH research.

Agenda for action

Given the dearth of HRH research in SSA, the first item on the agenda is the development and strengthening of research capacity. Although each country ought to develop its own capacity, a strategic approach will be first to have at least one

HRH research unit, embracing a critical mass of researchers, per subregion with a strong institutional base and sufficient funds. The subregion may be of linguistic, geographic or purposive grouping. In view of the multiple dimensions of workforce issues, teams of researchers need to be multidisciplinary in order to cover demographic, behavioural, economic and policy aspects. A solid expertise in statistics and in policy analysis is an obvious prerequisite, as well as capacity to assess research needs and to communicate results.

A second critical item is to include the different stakeholders in the definition of the research agenda, to enhance ownership and the likelihood of implementation. When the JLI (JLI 2004) offered a three-pronged strategy to improve the state of the health workforce, it stressed that the above can be implemented only in the context of an agreement amongst all stakeholders, specifically ministries of health, education, finance and civil service, health training institutions, health workers, professional associations, etc. It proposed the formation of a multi-stakeholder national body empowered to address issues affecting the health workforce by using operations research and lessons from experience to identify successful practices and by monitoring their implementation. An example of such an initiative is found in Latin America, where a network of HRH observatories is in place and supports that role. (http://www.observatoriorh.org/eng/index.html)

A third item, also very critical, is the development of an information system or database on health workers. Information needs to be collected and updated on a regular basis. This can be done by the Ministry of Health, or by an independent agency such as an observatory or a research centre. Data can be collected directly or through the intermediary of organizations like professional councils, which, in most countries, would supposedly require significant effort to strengthen their capacity.

We propose the following as priority topics for HRH research:

- Situational analysis of the state of HRH to identify constraints and obstacles to the achievement of the health goals of the country, e.g. adequacy of number; geographical distribution to identify imbalances in public/private, primary/tertiary, rural/urban deployment; attrition rates; skill mix and proficiency levels; motivation and determinants; etc.
- Compilation and analysis of policies and practices of positive incentives and disincentives influencing workers' decisions and behaviour.
- Compilation and analysis of feasibility of policy options and practices, with a focus on those that have been successfully used in other countries, particularly in countries with similar socioeconomics levels.
- Operations research on interventions to address issues of retention, motivation and productivity, and scaling up to a national level once shown to work.
- Development of minimum standards of staffing at each health level based on the country's resources.

Problems troubling HRH basically arise from lack of proper management. Management is both art and science and it can best be perfected through an iterative process of carefully conducted operations research leading to modifications, evaluation, and if needed further research. Therefore, research on the health workforce differs significantly from biomedical research (e.g. randomized, double blind control trials), and the norms of validity and generalizability cannot be as strict. At present, what is most urgently needed is context-relevant valid knowledge to inform policies and managerial practices. This is particularly important in view of the fact that poorly informed decisions and interventions can have long-term effects, as they take time to implement and may be difficult to reverse. This is something poor countries can hardly afford.

The recent recognition of the critical importance of workforce issues in the health sector by countries and their international partners is welcome, but thus far, it has induced little change in their approach. This is a major gap in the efforts of SSA countries and the international community to move towards the MDGs. Given the time needed to develop the research capacity and production that is critically needed, an agenda for action needs to be implemented now. ❑

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References

Global Forum for Health Research 2004, Alliance for Health Policy and System Research, 'Strengthening health systems: the role and promise of policy and systems research', Geneva.

Hall LM, Doran DI, Baker GR, Pink GH, Sidani S, O'Brien-Pallas L & Donner GJ 2001, 'A study of the impact of nursing staff mix models and organizational change strategies on patient, system and nurse outcomes', Canadian Health Services Research Foundation, Ottawa.

Joint Learning Initiative 2004, *Human resources for health: overcoming the crisis*, Harvard University Press, Cambridge, MA.

Kombe, G. 2003, *The costs of anti-retroviral treatment in Zambia*, Abt Associates Inc, Bethesda, Maryland.

Kurowski C, Wyss K, Abdulla S, Yemadji ND & Mills A 2004, 'Human resources for health: requirements and availability in the context of scaling-up priority interventions in low-income countries', Case studies from Tanzania and Chad, Department for International Development (DFID), London.

World Health Organization 2000, *World Health Report, Geneva*.

World Health Organization 2004, *World Health Report, Geneva*.

World Health Organization 2005, *World Health Report, Geneva*.

World Health Organization 2006, *World Health Report, Geneva*.

Evaluating health research capacity building: an evidence-based tool

Article by Imelda Bates (pictured), Alex Yaw Osei Akoto, Daniel Ansong, Patrick Karikari, George Bedu-Addo, Julia Critchley, Tsiri Agbenyega and Anthony Nsiah-Asare

An increasingly important goal of governments and external agencies in developing countries is the need for "capacity building" in health research. Although a poorly defined and understood concept, capacity building would essentially allow *de novo* health research programmes to be facilitated and existing programmes to be strengthened (see Wojtas 2004 and page 14 in Sawanwela & Neufeld 2001). For health research, the goal of building capacity is thus to improve the ability to conduct research, to use results effectively and to promote demand for research (see page 14 in Sawanwela & Neufeld 2001). Prioritizing the need for the international community to make a "quantum leap in capacity building", as suggested in 1998 by the Director-General of the World Health Organization (WHO), would improve health and reduce poverty in developing countries (Nchinda 2002).

To achieve this goal, there is an urgent need for an evidence-based tool for determining whether the required infrastructure is present in a given setting, as well as for underpinning the design and evaluation of capacity-building programmes in health research. Here, we describe the development and use of such a tool through analysis of published models and effective capacity-building principles, together with structured reflection and action (see page 9 in Sawanwela & Neufeld 2001) by stakeholders at the Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana.

Challenges faced in building and supporting research capacity at KATH

KATH benefits from a new management team that is committed to developing the hospital and medical school into a regional centre of excellence for research, teaching and clinical care. Although local clinicians had previously been involved in multinational research projects, these projects had largely been generated by external agencies. Local staff lacked experience in the conception and design of projects, and the hospital lacked local role models and tutors for generating *de novo* research. Consultant posts at KATH remained vacant because senior clinical trainees had difficulty in completing the prerequisite research component of their exit examinations for West African Colleges. Tellingly, when asked why they had not completed their specialist exams, the most common reason given by KATH health professionals was apprehension of starting their own research programmes. KATH management needed a tool that they

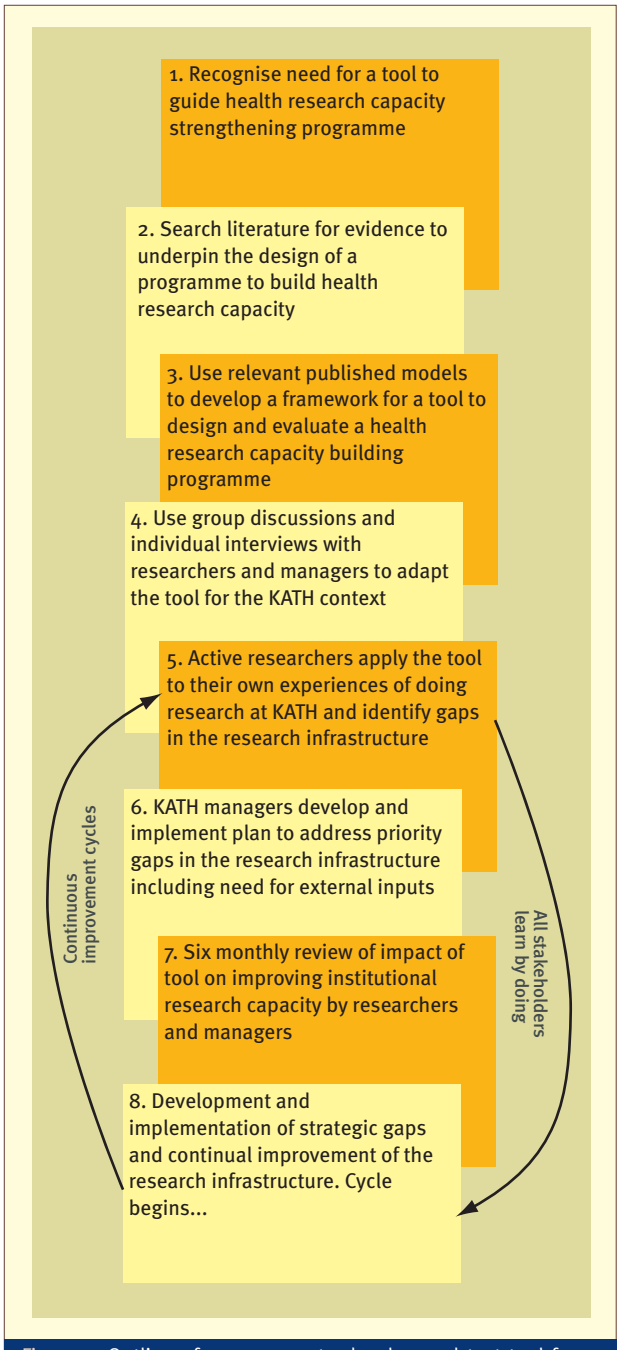

Figure 1: Outline of programme to develop and test tool for evaluating research capacity at KATH

could use to ensure that all necessary resources were in place to support local research. Unfortunately, the literature specifically describing the building of health research capacity is scarce and tends to emphasize micro-level activities, such as choosing research trainees (e.g., Nchinda 2002), without considering how these activities can be integrated into the wider research system. Moreover, much of the available information on building research capacity is based on retrospective reports of external consultants, and the perspective of implementing capacity building in a developing country is almost never represented (Jenisch & Pilley 2003). Our aim therefore was to develop an evidence-based tool that could be used to guide the design, implementation and evaluation of capacity building in health research programmes.

Developing an appropriate evaluation tool

We used a three-stage approach: (1) searching the literature for existing tools and models; (2) analysing best-practice examples to guide the overall framework; and (3) adapting the framework into an operational tool that met the specific needs of KATH. By using translational research principles to analyse our findings, we systematically extracted and extrapolated stakeholders' evidential and experiential stories (see page 9 in Sawanwela & Neufeld 2001), and used this information to inform the overall design of our programme. Figure 1 outlines the stages of development and testing of the tool designed for use at KATH.

Literature search

We searched the following electronic databases: MEDLINE, Ingenta and Science Direct using keywords, such as "capacity building", "capacity development", "developing countries" and "Africa". We retrieved the full text of any relevant papers, including articles cited in the reference lists of these papers. Because there is limited information about health research capacity building in peer-reviewed literature, we also consulted books, websites of organizations working on health and research capacity building (e.g., websites of WHO, United Nations agencies, the European Community and the International Development Research Centre), and references provided by colleagues. This evidence was used to derive a definition of health research capacity building, to identify existing capacity-building models and to synthesize best-practice examples to derive key principles. Dataset S1 gives a detailed overview of our literature review on capacity building. We found that many different definitions have been applied to capacity building according to the particular level – "micro", "meso" or "macro" (focused on in European Centre for Development Policy Management 2000a) – but that one of the most widely used definitions is "an ability of individuals, organizations or systems to perform appropriate functions effectively, efficiently and sustainably" (Milen 2001). By combining the definition for generic "capacity building" with published evidence and our practical experiences of developing a planning and evaluation tool, we have defined building capacity for health research as "an ability of individuals, organizations or systems to perform and utilize health research effectively, efficiently and sustainably".

Using published best-practice examples to design the evaluation programme

No tools currently exist that are specific for evaluating health research capacity-building programmes. However, the literature review was helpful for identifying ineffective capacity-building strategies, such as "bolting-on" capacity building to research projects initiated by a specific donor in developing countries (Paliamentary Office of Science and Technology [UK] 2004). It was also useful as a means of highlighting the generic principles underlying successful capacity building. We grouped the generic principles that consistently emerged from the literature as best practices into themes that emphasized the importance of three concepts. The first theme was a "phased approach"; this requires the sequential involvement of all stakeholders in assessing capacity gaps, developing strategies to fill these gaps, and evaluating outcomes (Milen 2001). The second theme was "strengthening of existing processes"; this is an iterative and flexible process that focuses on enhancing local ability to solve problems, define and achieve development needs, and then incrementally incorporate expanding circles of individuals, institutions and systems (United Nations Development Program 1998). The third theme was "partnerships"; for effective or sustained capacity building, it is essential that the various partners involved have similar concepts (European Centre for Development Policy Management 2000) and share responsibilities and obligations, with local partners taking ownership and leadership (Milen 2001; Development Assistance Committee 1996). Thus, the function of external expertise is to facilitate the development of local skills through learning by experience, rather than merely acting as a "donor" who retains control of the funds and expertise over a poorer "beneficiary" partner.

Developing and adapting the evaluation tool

An illuminating finding of the literature search was that there was no model that had been specifically designed with health research capacity building in mind. Indeed, the most useful model was one that had been developed for institutionalizing quality assurance (QA) (Silimperi et al. 2002) because it focused on defining, measuring and improving quality. This mirrors the processes required for capacity building in health research: defining the institutional systems needed to support research, enumerating existing and missing resources, and improving research support by addressing identified gaps. The QA institutionalization framework represented a synthesis of over ten years' experience in developing countries, and was derived from a combination of organizational development and QA literature. The framework described organizations as passing through four phases when they implement innovation: awareness, experiential, expansion and consolidation (Table 1). In the course of adapting our framework into a tool that was relevant to KATH, we were also influenced by a

Phase	Characteristics	Activities	Indicators of progress
Awareness	Local decision makers identify need and purpose of research capacity-building programme	Demonstrate need (e.g., baseline assessment and comparative data)	Deliberate decision to improve research capacity to improve quality of care
		Create local awareness	
		Plant seed of "need for change"	
Experiential	Organization introduces and evaluates research "learning"	Implement small-scale, local research activities	Increased leadership with evidence of improved research support services (e.g., research committees established and improved access to resources)
		Develop mechanisms for dissemination of results and lessons learned	
Expansion	Strategic expansion of research activities in scale and scope	Develop strategies for expansion (e.g., expand into national-level programme)	Demonstrable improvements in research quality
	Increased organizational capacity to conduct research	Invest in developing research leadership	Agreed commitment to long-term continuation
		Wide dissemination	
Consolidation	Anchor research activities into organizational/ national operations	Develop strategy to take corrective action for weaker components of programme	Full implementation of research activities that are integrated into daily responsibilities throughout the organization
	Identify and prioritise to address gaps in capacity	Enhance coordination of research strategies and activities	
		Consolidate research learning environment	

Table 1: Framework for designing and evaluating a health research capacity-building programme

published framework for dissemination and implementation of evidence-based medicine (EBM) (Garner et al. 2001). This prompted us to change the name of the "experiential" phase to "implementation", as this was more appropriate to a research programme. To meet the specific needs of KATH, local research stakeholders participated in adapting the tool. These stakeholders comprised ten KATH health professionals (nine clinicians and one physiotherapist), and senior hospital managers – including the chief executive, medical director and heads of departments. Individual and group discussions took place during a workshop for the health professionals. Stakeholders considered each phase in the framework (Table 2), and suggested characteristics, activities and indicators of progress in building research capacity that met the needs of KATH and that could be feasibly measured or shown. The stakeholders' suggestions were incorporated into the framework to create an operational tool that could be used to identify gaps in the research infrastructural support at KATH (Table 2). This ensured that a holistic approach was taken to developing the research capacity in the hospital, rather than a fragmented, unfocused approach.

Using the evaluation tool at KATH

Identifying strengths and weaknesses in research capacity

In the year following development of the tool, the ten health professionals undertook a research project as part of a workbased course to prepare them for the research component of their professional exams. By comparing their actual research experiences at KATH with the components itemized in the evaluation tool, they were able to identify aspects that were well supported by the institution and aspects where support was lacking or could only be provided by external facilitators. The comparison was achieved through group discussions and analysis of individual reflective statements about their research experiences, using a standard qualitative research approach known as "grounded theory". Individual statements were scrutinized, and themes relating to research infrastructural support were extracted. Cycles of scrutinizing, extracting data and allocating it to themes were repeated until no new themes emerged (Glaser & Strauss 1967).

A comparison between the themes that emerged from this process with the capacity-building evaluation tool identified strengths and weaknesses in the research infrastructural support. Strengths included the peer-support mechanisms within KATH, which occurred predominantly in three different contexts (peer group committees to review research proposals, small group work within course workshops and crossdepartmental research meetings). Peer support to promote workbased learning is an evidence-based educational approach (Hodkinson & Hodkinson 2004), so the peer-support mechanisms in KATH corresponded to components of the evaluation tool. Weaknesses that emerged included gaps in knowledge concerning research resources available on the Internet, particularly systematic searching of the published literature.

Prioritizing and implementing actions for addressing gaps in the research capacity.

A nominal group technique (Dobbie et al. 2004) was used to achieve consensus among researchers about aspects of research support that were lacking in KATH and to agree on which of these should be prioritized. For this technique, researchers used their experiences of doing research and the evaluation tool to write their own observations on areas of research infrastructure that were lacking at KATH. These were categorized into themes by the whole group and ranked according to their importance for supporting research. Gaps that were identified as priorities included provision of local statistical expertise, lack of researcher skills in critical literature reviews and inadequate Internet access. These gaps were presented by the researchers to senior managers in KATH as a list of recommendations, and the managers incorporated activities to address these

Phase	Characteristics	Activities	Indicators of progress
Awareness	Strategic aim to develop the hospital as a centre of research excellence	Baseline assessment of quality of care against guidelines	Commitment of funds from Ghana and UK partners to improve capacity for conducting research and utilising findings
	Hospital management has proactively encouraged evidence-based health care	Create local awareness of need to improve institutional research culture	Partners' roles and responsibilities defined
	Health professionals need research skills for career progression and to implement evidence-based health care	Plans for research capacity building discussed at local and national level and with donors	
Implementation	Develop a course at KATH to teach research skills using evidence-based educational methods	Establish research skills course and develop into UK-accredited diploma	Improved institutional research support services (e.g., Internet access, research support group, and local research funds)
	Identify available resources and gaps in provision to support research	Institutional assessment of needs to support research	Researchers awarded diploma
Expansion	Broaden research course participation to all health professionals and managers	Participants from clinical and non clinical specialities enrolled in course	Broad research scope within and beyond the hospital
	Provide infrastructure support for expanded programme	Involvement of national organisations in the programme (professional colleges and Ministry of Health)	Educational QA processes operational
	Increase organisational capacity to conduct and utilize research	National dissemination meeting	Research results incorporated into audit cycles
	Disseminate programme		Long-term funding secured
			KATH-led research papers published and grants obtained
Consolidation	Research activities anchored into organisational and national operations	Research activities integrated into daily responsibilities throughout the organisation	Health research included in undergraduate/postgraduate curricula
	Effective research infrastructure	Research support team established	Departmental budgets allocated in proportion to research activities and outputs

Table 2: Adaptation of the framework into a tool that was relevant to the needs of KATH

recommendations in their annual plans and budgets in 2004/2005 and 2005/2006. Progress was reviewed with the managers and the researchers at the six-month course workshops (Table 3).

What was achieved by using the tool?

Progress in strengthening the research infrastructure in KATH has been achieved both for individuals and for the institution. For individuals, a course to teach research skills has been established in partnership with the Liverpool School of Tropical Medicine (LSTM). Local facilitators have been trained to run the course and funding has been secured so that within three years the course will be wholly the responsibility of KATH staff, with LSTM providing external quality reviews for the course. At an institutional level, an Internet suite has been refurbished and equipped for use by researchers, research support meetings are now a regular monthly event and KATH has trained its own clinical biostatistician to support its researchers. Within 18 months of the original recommendations, KATH management and researchers have achieved many of the indicators of progress listed in the evaluation tool, and have developed plans to achieve the remaining indicators within the next two years. Naturally, progress in some indicators, particularly those relating to using research results to improve the quality of clinical care and encouraging whole departments to be more proactive about research, will be slow and could take several years to achieve.

Discussion

What have we learned?

The evaluation tool has enabled researchers and hospital managers to work together to achieve a common goal of improving the research capacity in KATH. They have monitored their progress against predetermined standards and have identified and filled gaps in research infrastructure. The evaluation tool should be flexible enough to incorporate changes in the local environment and the needs of KATH, and consequently we plan to re-evaluate and amend it within five years. Because changing the research culture of an institution is a complex process, some important components that should have been included in the tool might have been overlooked. For example, dialogue between scientists and nonscientists, as well as nonhealth-sector workers, is important for developing and sustaining health research capacity (Nchinda 2002). Such interactions are not represented in our tool, which has focused instead on building institutional capacity. The success of the process by which this tool was developed and tested confirms the importance of the generic principles underlying effective capacity building that we extracted from the literature. We used a phased approach to engage stakeholders in identifying strengths and weaknesses, and then to develop, implement and monitor action plans to address these gaps (Milan 2001). Part of this process involved identifying and strengthening existing processes and building up local resources, rather than developing new parallel systems (Renzi 1996). This strengthening process included formalizing the peersupport meetings that researchers had found so helpful, and expanding the existing Internet facilities. The process is a good example of a genuine partnership for problem solving that is built on trust, common interest, long-term commitment, and shared responsibilities and obligations (European Centre for Development Policy Management 2000b; Fowler 2000). Although funding for the process was initially shared between KATH and LSTM,

Priority gaps identified in the research capacity at KATH	Progress in filling the research capacity gaps
Improve access to Internet and research literature, especially electronic resources (e.g., journals, CDs, Cochrane reviews), and training in computer skills to access these efficiently	Workshops on critical appraisal and literature search techniques held annually in KATH run by local facilitators
	Dedicated Internet suite provided in KATH for researchers, and Internet access within each department improved
	KATH researchers receive regular updated Cochrane review information
Training in biostatistics and better access to expertise in statistics and epidemiology	Local biostatistician trained, and provides support to KATH researchers
	Statistician from neighbouring institution also contracted to provide research support
Local research fund to support "seed" and pilot projects	Funding for local start-up projects earmarked in hospital budget and allocated to KATH researchers
Diploma in project design and management course institutionalized sustainably within KATH to maintain a critical mass of research-aware health professionals across all disciplines	Plan developed for local course facilitators to take over complete running of course within three years; funding secured through the Ministry of Health
	Specialities represented in the course now include all clinical specialities, as well as physiotherapy, nursing and administration
	Delivery of the course and marking of assignments completely taken over by KATH, with external QA review from the UK
	Training workshop to increase the number of course facilitators and project supervisors in KATH completed May 2006
Promote a culture of research across KATH and use local research results to improve patient care	Cross-departmental research meetings established as regular monthly events in KATH to provide peer support for researchers
	Hospital management has provided a dedicated administrator to support research activities
	Research activities and publications included in annual assessments of hospital departments
	Head of KATH QA unit trained in clinical audit and plans developed for incorporation of researcher's results into audit cycles to improve clinical care
	Plans developed to link departmental funding to research activities and outputs

Table 3: Use of the evaluation tool to identify and address gaps in research capacity within 18 months

KATH has maintained ownership and leadership, and is now totally funding the capacity-building process. Each partner had clearly delineated roles, and mechanisms and timescales for transfer of skills from LSTM to KATH staff were agreed on early in the process. Two important criteria for this project's success were the motivation of the researchers and the strong leadership and commitment of KATH managers. Participation of all stakeholders in the design of evaluation indicators is recognized to promote motivation and commitment (see Chapter 7 Horton et al. 2003). The rate of progress is likely to slow down over the next few years, as the institutional shift towards research begins to involve individuals who might not have the high motivation of the managers and researchers, but the tool nevertheless provides a means for maintaining focus on achieving some of the more difficult indicators.

How transferable are these lessons and the tool? The generic principles of effective capacity building – phased approach, strengthening existing systems and partnerships for problem solving – were derived from contexts that were not health sector-specific, and yet they have been applied successfully here. However, the evaluation tool was developed for the context of health research at KATH, and its value and transferability in other contexts would need to be assessed. Although the framework from which the tool was derived incorporated all the elements of a research process, such as problem identification, priority setting, and research use (see page 16 in Sawanwela & Neufeld 2001), the specific components used to produce the operational tool would need to be adapted to suit the specific needs of other institutions. Monitoring and evaluation is the most difficult and neglected component of capacity-building programmes because they can take over 20 years to achieve their objectives (United Nations Development Program 1998), and some outcomes, such as organizational culture, are difficult to measure (Land 2000). Different users of evaluations will have different priorities, and the use of an evaluation tool helps to promote agreement on the purpose of the evaluation and the indicators (World Health Organization 1995). The major advantages of our tool are that it enables an institution in a developing country to set its own priorities, to have control over local capacity building (Chataway et al. 2005), and to evaluate progress in building capacity from its own perspective rather than from that of an external agency. ❑

***Imelda Bates** and her colleagues in Kumasi have been working together for over 20 years to strengthen postgraduate training within Komfo Anokye Teaching Hospital for health professionals. This partnership has used many different strategies ranging from short overseas attachments to long-term, long-distance mentorships to develop skills for individuals. Over the last few years their efforts have focused on establishing a critical mass of health professionals within institutions who understand research and can use it to improve the quality of patient care.*

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References

Chataway J, Smith J, Wield J 2005, 'An Africa- Canada-UK exploration: Building science and technology capacity with African partners'. Ottawa: International Development Research Centre. Available: http://www.idrc.ca/roks/ev- 70877-201-1-DO_TOPIC.html. Accessed 5 June 2006.

Development Assistance Committee 1996, 'Shaping the 21st century: The contribution of development cooperation'. Organisation for Economic Co-operation and Development, Paris. Available: http://www.oecd.org/dataoecd/23/35/2508761.pdf. Accessed 5 June 2006.

Dobbie A, Rhodes M, Tysinger JW, Freeman J 2004, 'Using a modified nominal group technique as a curriculum evaluation tool'. *Fam Med,* vol. 36, pp. 402–406.

European Centre for Development Policy Management 2000a, Modernising international cooperation: Lessons and opportunities, ACPEU partnership. Issues paper 3. Maastricht (Netherlands).

European Centre for Development Policy Management 2000b, 'Modernising international cooperation: Lessons and opportunities, ACP-EU partnership. Case study 6. Maastricht (Netherlands)

Fowler A 2000 'Questioning partnership: The reality of aid and NGO relations', *IDS Bulletin*, vol. 31.

Jentsch B & Pilley C 2003, 'Research relationships between the South and the North: Cinderella and the ugly sisters?' *Soc Sci Med*, vol. 57, pp. 1957–1967.

Garner P, Meremikwu M, Volmink J, Xu Q & Smith H 2001, 'Putting evidence into practice: How middle and low income countries "get it together"'. *BMJ*, vol. 329, pp. 1036–1039.

Glaser BG & Strauss AL 1967, *The discovery of grounded theory*. Chicago: Aldane. p. 271.

Hodkinson H & Hodkinson P 2004, 'Rethinking the concept of community of practice in relation to schoolteachers' workplace learning'. *Int J Training Development*, vol. 8, pp. 21–31.

Horton D, Alexaki A, Bennett-Lartey S, Brice KN, Campilan D, et al. 2003 'Evaluating capacity development: Experiences from research and development organizations around the world'. Ottawa: International Development Research Centre. 188 p. Available: http://www.idrc.ca/en/ev-31556-201-1-DO_TOPIC.html. Accessed 12 June 2006.

Land A 2000, 'Implementing institutional and capacity development: conceptual and operational issues'. ECDPM Discussion paper

Maastricht (Netherlands): European Centre for Development Policy Management.

Milen A 2001, 'What do we know about capacity building? An overview of existing knowledge and good practice'. Department of Health Service Provision. World Health Organization. Available: http://www.unescobkk.org/fi leadmin/user_upload/aims/ capacity_building.pdf. Accessed 7 June 2006, Geneva.

Nchinda TC 2002, 'Research capacity strengthening in the South'. *Soc Sci Med*, vol. 54, pp. 1699–1711.

Parliamentary Office of Science and Technology [UK] 2004 'Scientific capacity in developing countries. London: Parliamentary Office of Science and Technology'. Available: http://www.parliament.uk/documents/upload/POSTpn216.pdf. Accessed 5 June 2006.

Renzi M 1996, 'An integrated tool kit for institutional development'. *Public Admin Dev,* vol. 16, pp. 469–483.

Silimperi DR, Franco LM, Veldhuyzen van Zanten T & MacAulay C 2002, 'A framework for institutionalising quality assurance'. *Int J Qual Health Care*, vol. 14 (Suppl 1), pp. 67–73.

Suwanwela C & Neufeld V 2001, 'Health research for development: Realities and challenges'. In: Neufeld V, Johnson N, editors. 4. Ottawa: International Development Research Centre. Available: http://www.idrc.ca/books/ev-27424-201-1- DO_TOPIC.html. Accessed 5 June 2006.

United Nations Development Program 1998, 'Capacity assessment and development, in a systems and strategic management context'. Technical Advisory Paper 3. United Nations Development Program, New York. Available: http://www.capacity.undp.org/indexAction.cfm?module=Library&action=GetFile&Docume ntID=5072. Accessed 5 June 2006.

World Health Organization 1995, *WHO global programme on AIDS: Consultation of strengthening NGO HIV/AIDS umbrella initiatives*, World Health Organization, Geneva.

Wojtas O 2004 June 25, 'New head will extend learning body's reach'. *The Times Higher Education Supplement:*, vol. 11.

Research on violence and injuries

Road traffic injuries in low-income countries: a policy and investment gap

Article by Adnan A Hyder

Worldwide, unintentional injuries accounted for more than 3.5 million deaths in 2001, and were responsible for more than 113 million Disability Adjusted Life Years lost (DALYs) in 2001 (Peden et al. 2004); more than 90% of these occurred in low- and middle-income countries (LMIC). Road traffic injuries (RTI) accounted for the greatest burden of deaths from unintentional injuries in LMIC in 2001, or about 34% of the total burden (Figure 1). RTI death and DALY rates are higher in males compared to females globally and in LMIC (Table 1). Based on road crash costs from 21 developed and developing countries the average annual cost of road crashes was found to be equivalent to about 1% of gross national product in developing countries, 1.5% in transition countries, and 2% in highly motorized countries. The annual burden of road crash costs is about US$ 518 billion globally and about US$ 65 billion in LMIC, exceeding the total annual amount these countries receive in development assistance (Jacobs, Aeron-Thomas & Astrop 2000).

Causes of road traffic injuries

As with most diseases, the causes of RTI are multifactorial. Macroeconomic, social and contextual factors play a role in injury causation but are difficult to quantify and assess individually. The epidemiological paradigm of host, vector and environmental factors that contribute to RTI has been extended to consider each factor in relation to the timing of injury occurrence (Haddon 1968). This paradigm, the Haddon matrix, provides a comprehensive framework in which to consider the multitude of factors that may play a role in the causal pathway (Table 2).

The increasing volume of travel is one of the main factors contributing to the increase in RTI in LMIC. Motorization rates rise with income (Kopits & Cropper 2005), and a number of LMIC experiencing growth have seen a corresponding increase in the number of motor vehicles in use (Ghaffar et al. 1999). In some LMIC, this growth has been led by an increase in motorized two-wheeled vehicles, one of the least safe forms of travel, resulting in concurrent increases in related injuries (Zhang et al. 2004). The rapid growth in motor vehicles in many LMIC has not been accompanied by improvements in facilities for these road users or by facilities that respond to the continued predominance of non-motorized traffic (Khayesi 2003). Many of the technical aspects of planning, highway design, traffic engineering and traffic management are also absent in LMIC (Tiwari 2000).

Data obtained from routinely collected police reports in a number of LMIC show that speed is a leading cause of road traffic crashes (Afukaar 2003; Odero, Khayesi & Heda 2003; Wang et al. 2003), accounting for up to 50% of all crashes. Studies conducted in LMIC, show that alcohol had been consumed by drivers in 33 to 69% of crashes in which drivers were fatally injured, and 8 to 29% of crashes in which drivers were not fatally injured (Odero, Garner & Zwi 1997). Alcohol consumption by pedestrians also increases their risk of injuries and in at least some LMIC more than 50% of fatally injured pedestrians had consumed alcohol (Peden et al. 1996). A recent study from China shows that the risks of a crash doubled with chronic sleepiness on the part of the driver (Liu et al. 2003), and surveys of commercial and public road transport in a number of African countries have shown that drivers often work unduly long hours and go to work when exhausted (Mock, Amegashi & Darteh 1999; Nafukho & Khayesi 2002).

Road-related and vehicle-related factors may also increase the risk of crash involvement. Specific factors related to road planning include traffic passing through residential areas, conflicts between pedestrians and vehicles near schools located on busy roads, lack of median barriers to prevent dangerous overtaking on two-lane roads, and lack of barriers to prevent pedestrian access onto high-speed roads (Ross et al. 1991). While in-vehicle crash protection is related to the severity of crash injuries, many engineering advances are not present in vehicles in LMIC (Odero 1997); for example, few LMIC require the fronts of cars or buses to be designed in a way that would protect vulnerable road users (Mohan 2002).

A significant risk factor for increased injury severity in motorcycles is riders' failure to use motorcycle helmets (Liu et al. 2004). Studies in a number of Asian countries have shown that failure to use helmets, use of nonstandard helmets, and use of improperly secured helmets is not uncommon, even where countries have mandatory helmet-wearing laws (Conrad et al. 1996; Kulanthayan et al. 2000). The failure to wear helmets is also a risk factor for increased injury severity among bicyclists. Lack of seat-belt use is a significant risk factor associated with injury severity among vehicle occupants, and yet many LMIC have no requirements

Category	Global			LMIC		
	Total	males	Females	Total	males	Females
Deaths (per 100,000 population)						
All unintentional injuries	57	74	41	62	79	43
RTI	19	28	11	20	30	11
DALY losses (per 1,000 population)						
All unintentional injuries	20	25	15	22	27	16
RTI	6	8	3	6	9	4

Note: All figures are rounded to the nearest 1,000.

Table 1: Losses from road traffic injuries (RTI) by gender, worldwide and in low- and middle-income countries (LMIC), 2001

for seat-belts to be fitted in cars or used (Peden et al. 2004).

Interventions for road traffic injuries

Evidence of the effectiveness of RTI interventions in LMIC is relatively uncommon. While the proven efficacy of some interventions does not require replication in LMIC, strategies that may be effective in developed countries may not necessarily be appropriate in LMIC. Thus tailoring interventions to LMIC with rigorous evaluation is increasingly being endorsed by WHO and others (Peden et al. 2004). Managing exposure to risk involves strategies aimed at reducing motor vehicle traffic, encouraging the use of safer modes of travel, and minimizing exposure to high-risk scenarios. Unfortunately, evidence of the effectiveness of many of these strategies is not yet available for LMIC.

Intervention strategies focusing on safer roads should incorporate safety awareness in planning road networks, safety features in road design, and remedial action for high-risk crash sites. Though not examined in rigorously controlled studies, many of these strategies form the basis of best practice guidelines and manuals now being used (Ross et al. 1991). Traffic calming measures are among the strategies recommended for including safety features in road design; a study conducted in Ghana suggested that speed bumps were effective in reducing traffic injuries, especially pedestrian injuries (Afukaar 2003). A recent summary of research findings also suggests that automated speed enforcement virtually eliminates speeding (ICF Consulting 2003).

Strategies focusing on safer vehicles include improving the visibility of vehicles, incorporating crash protective design into vehicles, and promoting further development of "intelligent" vehicles. However, in LMIC, strategies that simply ensure regular maintenance of older vehicles or the removal of vehicles in poor condition from roads, as well as vehicle licensing and inspection have the potential to be effective (Peden 2004). Meta-analyses of the effects of automatic daytime running lights on cars consistently show that they reduce road crashes, and studies in both Malaysia and Singapore show similar positive effects for daytime running lights on motorcycles (Elvik & Vaa 2004; Radin, Mackay & Hills 1996; Yuan 2000). Although the fitting of seat-belts – probably the most well-known and effective safer vehicle strategy – is covered by technical standards worldwide and is mandatory in most countries, evidence suggests that vehicles in many LMIC lack functioning seat-belts (Forjuoh 2003).

Intervention strategies aimed at the road user are increasingly focusing on the introduction and enforcement of relevant legislation rather than on educational efforts. Poli de Figueiredo et al. (2001) report from Brazil that increases in fines and suspension of drivers' licences reduced RTI and deaths. A large body of research, although little of it

Factors				
Phase	**Nature of intervention**	**Human**	**Vehicles and equipment**	**Environment**
Pre-crash	**Crash prevention**	Information Attitudes Impairment Police enforcement	Roadworthiness Lighting Braking Handling Speed management	Road design Road layout Speed limits Pedestrian facilities
Crash	**Injury prevention during the crash**	Use of restraints Impairment	Occupant restraints Other safety devices Crash-protective design	Forgiving roadside (for example, crash barriers)
Pre-crash	**First aid skill** **Access to medical personnel**	First aid skill Access to medical personnel	Ease of access Fire risk	Rescue facilities Congestion

Table 2: The Haddon matrix as applied to road traffic injuries

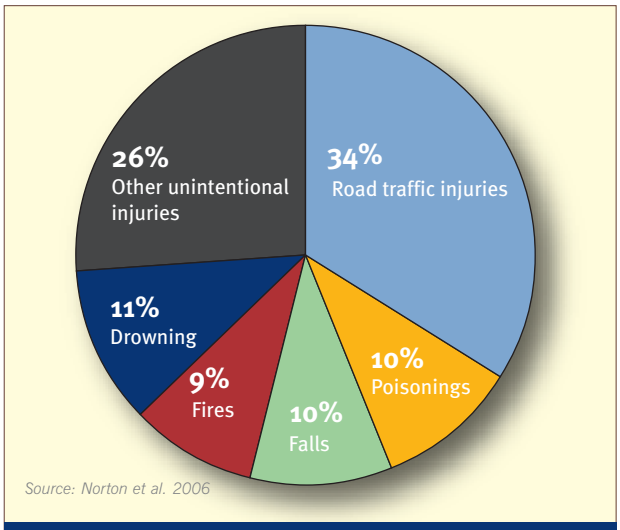

Figure 1: Distribution of unintentional injury deaths in LMIC, 2001

conducted in LMIC, shows that setting and enforcing speed limits reduces RTI by up to 34% and that setting and enforcing legal blood alcohol limits and minimum drinking-age laws, and using alcohol checkpoints aimed at reducing drinking and driving also reduce RTI by varying magnitudes (Peden et al. 2004). The introduction and enforcement of mandatory seat-belt and child restraint laws reduces occupant deaths and injuries by up to 25%; however, such laws have not been introduced in all LMIC (Peden et al. 2004). Both bicycle and motorcycle helmets reduce head injuries among riders by up to 85%. While education may be effective in increasing helmet use, the impact is greater when combined with legislation and enforcement, as demonstrated in Malaysia and Thailand (Ichikawa, Chadbunchachai & Marui 2003; Supramaniam, Belle & Sung 1984).

Benefits of intervention

Published data on the costs and economic benefits of RTI interventions are virtually non-existent. The economic evaluation of interventions and the measurement of the economic costs of injuries therefore remains a high research priority. The Disease Control Priorities project modelled the cost-effectiveness of five potential interventions to prevent unintentional injuries in LMIC (Norton et al. 2006). The cost estimates were presented in US$ (2001 exchange rates) with a time horizon of one year of sustaining the intervention (Table 3). The magnitude of the costs per DALY averted with

Intervention	Cost per Disability Adjusted Life Year (DALY)
Improved enforcement	$5.25
Speed bumps at top 25% of dangerous junctions	$8.89
Bicycle helmets	$107
Motorcycle helmets	$467

Source: Bishai et al. 2003; Norton et al. 2006

Table 3: Cost effectiveness of Road Traffic Injury interventions

these injury countermeasures suggests that they could be categorized as highly cost-effective (Norton et al. 2006; Murray et al. 2000). While these estimates provide some indicative information on the economics of RTI interventions, these findings point primarily to the lack of information about interventions and the global economic burden of RTI that could enable more comprehensive estimates.

Current investments for safety

The magnitude of government investment in road safety and the extent of RTI in a few LMIC have been estimated (Bishai et al. 2003). Pakistan spent US$ 0.07 per capita (0.015% of GDP per capita) on road safety in 1998, and Uganda spent $0.09 per capita (0.02% of GDP per capita). This type of evidence stands in stark contrast with the high burden of RTI in these countries. These findings occur in the context of public expenditure on health of 1.8% of GDP by Pakistan and 1.6% by Uganda (UNDP 1998). Per capita health spending by households in Uganda was US$ 7.70 in 1995–1996, while public spending on health at the district level was US$ 4.84 per capita in 1997–1998 (Hutchinson 1999). Thus, public spending on road safety amounts to about 1% of public spending on health in each country, and is equivalent to 0.2% of military spending in Pakistan and 1.1% of Uganda's military budget. A review of road safety initiatives in Benin, Côte d'Ivoire, Kenya, Tanzania and Zimbabwe found similar underinvestment in road safety (Assum 1998).

RTI have an inverted U-shaped relationship to economic development – injuries rise early during development, then plateau with investments in road safety, and then fall as appropriate interventions succeed (van Beeck, Borsboom & Mackenbach 2000). This relationship, based on historical records, has an important lesson for LMIC, in that they do not need to experience massive death and disability from RTI provided that they undertake safety investments now. Waiting for overall economic development prior to the implementation of specific interventions will result in the needless loss of millions of lives. As a consequence, the *World Report on Road Traffic Injuries* directs a number of recommendations at governments and communities in the hope that these will enable countries, particularly LMIC, to begin a sustainable process that will eventually lead to the adaptation and implementation of effective preventive strategies. The recommendations include:

- identifying a lead government agency to guide a national road safety effort;
- assessing the problems, policies and institutional settings relating to RTI and the capacity for preventing RTI in each country;
- preparing a national road safety strategy and plan of action;
- allocating financial and human resources to address the problem;
- implementing specific actions to prevent crashes, minimize injuries and their consequences, and evaluate the impact of these actions; and
- supporting the development of national capacity and

international cooperation.

Research agenda for RTI

Developing and prioritizing a global R&D agenda for RTI is challenging; however, a number of issues requiring research are likely to be common across a range of LMIC. Epidemiological research to describe the existing burden, causes and distribution of RTI in LMIC is still needed. Often the data are most limited for areas with the greatest burden of RTI. Assessing the loss of health and life from RTI, whom they affect, and how and under what specific circumstances is thus a continuing research agenda for LMIC. Problems of underreporting and other biases in available data also need to be addressed. The dearth of economic and policy analysis of RTI in LMIC is one of the major gaps for the global health research community. A recent review of economic analysis of road traffic interventions found a complete absence of any detailed studies from the developing world (Waters, Hyder & Phillips 2004).

The lack of intervention research in LMIC is another huge gap in global health research. Scientific trials of RTI interventions have largely not been conducted in LMIC, and existing and new interventions need to be modified, adapted and tested in these specific settings. Three broad domains that should be the foci of intervention research include:

- research to enhance the efficiency of currently available efficacious interventions, e.g. increasing the use of helmets to prevent motorcycle injuries in East Asia;
- research to enhance the cost-effectiveness of interventions that are currently not being implemented or could be used more widely, e.g. seat-belts and child restraints are known effective interventions, but if their costs were reduced, this might enhance their widescale implementation in LMIC;
- research to develop new interventions for RTI and respond to that proportion of the burden that is not currently being addressed, e.g. development of reflectors or visibility enhancement materials for the prevention of pedestrian injuries.

Developing human resources for all aspects of RTI prevention and research in the developing world should be a high priority. Individuals need to be trained and institutions supported and empowered to conduct quality scientific research in their own countries and on issues relevant to their locations that is then used within their countries. Funding is and always will be a limiting factor for research; however, the mismatch between the burden of RTI and research investments can be corrected. RTI are a major health problem: they cause preventable loss of life and health and they have major economic implications. As a result, research investments are a health and economic imperative for developing countries and donor organizations. The real concern is that such a profound loss of life can take place each year in LMIC without an outcry that would trigger sustained and effective political commitment by governments and civil society. ❑

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References

Afukaar FK 2003, 'Speed control in LMIC: issues, challenges and opportunities in reducing road traffic injuries', *Injury Control and Safety Promotion*, vol. 10, no. 1-2, pp. 77–81.

Assum T 1998, 'Road safety in Africa: appraisal of road safety initiatives in five African countries', Sub-Saharan Africa Transport Policy Program, working paper no. 33, World Bank, Washington, DC.

Bishai D, Hyder AA, Ghaffar A, Morrow RH & Kobusingye O 2003, 'Rates of public investment for road safety in developing countries: case studies of Uganda and Pakistan', *Health Policy and Planning*, vol. 18, no. 2, pp. 232–35.

Bunn F, Collier T, Frost C, Ker K, Roberts I & Wentz R 2003, 'Area-wide traffic calming for preventing traffic-related injuries', *Cochrane Database of Systematic Reviews*, vol. 1, no. CD003110.

Conrad P, Bradshaw YS, Lamsudin R, Kasniyah N & Costello C 1996, 'Helmets, injuries and cultural definitions: motorcycle injury in urban Indonesia', *Accident Analysis and Prevention*, vol. 28, pp. 193–200.

Elvik R & Vaa T 2004, *Handbook of Road Safety Measures*, Elsevier, Amsterdam.

Forjuoh SN 2003, 'Traffic-related injury prevention interventions for low-income countries', *Injury Control and Safety Promotion*, vol. 10, no. 1-2, pp. 109–18.

Ghaffar A, Hyder AA, Mastoor MI & Shaikh I 1999, 'Injuries in Pakistan: Directions for Future Health Policy', *Health Policy and Planning*, vol. 14, no. 1, pp. 11–17.

Haddon W Jr 1968, 'The changing approach to the epidemiology, prevention, and amelioration of trauma: the transition to approaches etiologically rather than descriptively based', *American Journal of Public Health and the Nation's Health*, vol. 58, no. 8, pp. 1431–38.

Hutchinson P 1999, 'Health care in Uganda', World Bank discussion paper no. 404, World Bank, Washington, DC.

ICF Consulting Ltd & Imperial College Centre for Transport Studies 2003, 'Cost-benefit analysis of road safety improvements', final report, London.

Ichikawa M, Chadbunchachai W & Marui E 2003, 'Effect of the helmet act for motorcyclists in Thailand', *Accident Analysis and Prevention*, vol. 35, no. 2, pp. 83–89.

Jacobs G, Aeron-Thomas A & Astrop A 2000, 'Estimating global road fatalities', TRL Report 445, Transport Research Laboratory, Crowthorne, UK.

Khayesi M 2003, 'Liveable streets for pedestrians in Nairobi: the challenge of road traffic accidents', in J Whitelegg & G Haq (eds), *The Earthscan reader on world transport policy and practice*, Earthscan Publications, London, pp. 35–41.

Kopits E & Cropper M 2005, 'Traffic fatalities and economic growth', *Accident Analysis and Prevention*, vol. 37, no. 1, pp. 169–78.

Kulanthayan S, Umar RS, Hariza HA, Nasir MT & Harwant S 2000, 'Compliance of proper safety helmet usage in motorcyclists', *Medical Journal of Malaysia*, vol. 55, no. 1, pp. 40–44.

Liu B, Ivers R, Norton R, Blows S & Lo SK 2004, 'Helmets for preventing injury in motorcycle riders', *Cochrane Database of Systematic Reviews*, vol. 4, no. CD004333.

Liu GF, Han S, Liang DH, Wang FZ, Shi XZ, Yu J et al. 2003, 'Driver sleepiness and risk of car crashes in Shenyang, a Chinese northeastern city: population-based case-control study', *Biomedical and Environmental Sciences*, vol. 16, no. 3, pp. 219–26.

Mock C, Amegashi J & Darteh K 1999, 'Role of commercial drivers in motor vehicle related injuries in Ghana', *Injury Prevention*, vol. 5, no. 4, pp. 268–71.

Mohan, D 2002, 'Road safety in less-motorized environments: future

References continued

concerns', *International Journal of Epidemiology*, vol. 31, no. 3, pp. 527–32.

Murray CJL, Evans DB, Acharya A & Baltussen B 2000, 'Development of WHO guidelines on generalized cost-effectiveness analysis', *Health Economics*, vol. 9, no. 3, pp. 235–51.

Nafukho FM & Khayesi M 2002, 'Livelihood, conditions of work, regulation, and road safety in the small-scale public transport sector: a case of the Matatu mode of transport in Kenya', in X Godard and I Fatonzoun (eds), Urban mobility for all. Proceedings of the 10th international CODATU conference, Lome, Togo, 12–15 November 2002, AA Balkema Publishers, Lisse, The Netherlands, pp. 241–45.

Norton R, Hyder AA, Bishai D & Pedenm M 2006, 'Unintentional injuries', in DT Jamison (ed.), *Disease Control Priorities in Developing Countries*, Oxford University Press, New York.

Odero W, Garner P & Zwi AB 1997, 'Road traffic injuries in developing countries: a comprehensive review of epidemiological studies', *Tropical Medicine and International Health*, vol. 2, no. 5, pp. 445–60.

Odero W, Khayesi M & Heda PM 2003, 'Road traffic injuries in Kenya: magnitude, causes and status of intervention', *Injury Control and Safety Promotion*, vol. 10, no. 1-2, pp. 53–61.

Peden M, Knottenbelt D, Van der Spuy J, Oodit R, Scholtz MJ & Stokol JM 1996, 'Injured pedestrians in Cape Town: the role of alcohol', *South African Medical Journal,* vol. 86, no.9, pp. 1103–05.

Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E et al. (eds) 2004, *World report on road traffic injury prevention*, World Health Organization, Geneva.

Poli de Figueiredo LF, Rasslan S, Bruscagin V, Cruz R & Rocha e Silva M 2001, 'Increases in fines and driver licence withdrawal have effectively reduced immediate deaths from trauma on brazilian roads: first-year report on the new traffic code', *Injury*, vol. 32, no. 2, pp. 91–94.

Radin Umar RS, Mackay GM & Hills BL 1996, 'Modelling of conspicuity-related motorcycle accidents in Seremban and Shah Alam, Malaysia', *Accident Analysis and Prevention*, vol. 28, no. 3, pp. 325–32.

Ross A, Baguley C, Hills V, McDonald M & Silcock D 1991, *Towards safer roads in developing countries. a guide for planners and engineers*, Transport Research Laboratory, Crowthorne, UK.

Supramaniam V, Belle V & Sung J 1984, 'Fatal motorcycle accidents and helmet laws in peninsular Malaysia', *Accident Analysis and Prevention*, vol. 16, no. 3, pp. 157–62.

Tiwari G 2000, 'Traffic flow and safety: need for new models for heterogeneous traffic', in D Mohan & G Tiwari (eds), *Injury Prevention and Control*, Taylor and Francis, London, pp. 71-88.

United Nations Development Program 1998, *Human development report* 1998, Oxford University Press, New York.

van Beeck EF, Borsboom GJ & Mackenbach JP 2000, 'Economic development and traffic accident mortality in the industrialized world, 1962–1990', *International Journal of Epidemiology*, vol. 29, no. 3, pp. 503–09.

Wang S, Chi GB, Jing CX, Dong XM, Wu CP & Li LP 2003 'Trends in road traffic crashes and associated injury and fatality in the People's Republic of China, 1951–1999', *Injury Control and Safety Promotion*, vol. 10, no. 1-2, pp. 83–87.

Waters HR, Hyder AA & Phillips TL 2004, 'Economic evaluation of interventions for reducing road traffic injuries — a review of literature with applications to low and middle-income countries', *Asia Pacific Journal of Public Health*, vol. 16, no. 1, pp. 23-31.

Yuan W 2000, 'The effectiveness of the 'ride bright' legislation for motorcycles in Singapore', *Accident Analysis and Prevention*, vol. 32, no. 4, pp. 559–63.

Zhang J, Norton R, Tang KC, Lo SK, Zhuo J & Geng W 2004, 'Motorcycle ownership and injury in China', *Injury Control and Safety Promotion*, vol. 11, no. 3, pp. 159-163.

Violence and displacement: some challenges for public health

Article by Pascale Allotey (pictured), Daniel D Reidpath, Fatima Alvarez-Castillo and Hebe Gouda

The United Nations High Commissioner for Refugees (UNHCR) estimates that at the end of 2005, there were approximately 20.8 million persons of concern worldwide (UNHCR 2006). The figure describes persons categorized as refugees[1] (40%), internally displaced persons[2] (32%) and stateless persons[3] (11%). Others include persons of concern who in spite of the need for protection, have not formally applied for asylum because of security concerns. The estimate of 20.8 million persons does not however describe the total population of displaced persons because many remain undocumented for reasons that may include poor data sources or reflect an inability or reluctance of displaced persons to access authorities (UNHCR 2006).

Violence is the major reason for displacement. The most common type of violence in this context is collective violence, which includes wars, terrorism and other political conflicts; state perpetrated genocide, repression and torture; organized crime and other complex humanitarian emergencies[4]. Over the last two decades, conflicts have occurred on almost every continent (see Table 1). Almost half of the globally reported injury-related mortality is accounted for by the trauma of collective violence. The highest rates of war-related deaths were in the African region at 32 per 100,000 (Krug et al. 2002). Adult males are the most frequently targeted. However, in conflicts in the Democratic Republic of Congo, for instance, 47% of recorded trauma deaths were among women and children below the age of 15 years (Brennan & Nandy 2001).

Attempting to quantify the effects of collective violence highlights one of the major challenges for public health in this area. Current data on related morbidity and mortality derive from multiple sources; humanitarian and human rights organizations, emergency services and the military (Krug et al. 2002) and these do not provide a complete picture. Hospital records of conflict-related trauma and mortality, for instance, particularly from resource-poor countries in sub-Saharan Africa, Asia and the Pacific, present the well-established inaccuracies. Furthermore, the effects of conflict and other forms of collective violence are much wider than direct injury-related morbidity and mortality. Resources, during civil unrest and conflict, are usually diverted from productive and supportive public goods and activities and put into military spending. There is a general increase in civil disorder, rape, murder and destruction, often with deliberate targeting of key infrastructure: power lines, telecommunications, schools and hospitals (Hoeffler & Reynal-Querol 2003). Constraints on social, environmental and physical infrastructure result in a decrease in health promotion and prevention activities such as immunization, and an inability to maintain adequate and accessible curative services. Consequently, there is an increase in severe forms of malnutrition, mental and physical disability, and morbidity and mortality from water and vector-borne infectious diseases. There has been some evidence of an increase in HIV/AIDS amongst both armed forces and civilian populations but the data are not always consistent (Mock et al. 2004).

A multicountry (Sudan, Democratic Republic of Congo, Philippines, Sri Lanka, Uganda) study on the resilience of communities and health systems under conflict and in post-conflict settings provides compelling evidence of the multiple and simultaneous effects on the resurgence of malaria, tuberculosis, sexually transmissible infections and cholera, as a direct result of instability and insecurity (Alvarez-Castillo et al., in-press). Recent conflicts have been particularly non-discriminatory in the targeting of civilian populations (Hoeffler & Reynal-Querol 2003). Given the negative impacts of collective violence, it is not surprising that the primary response of the civilian population is flight and displacement.

Forced migration and displacement also occur on a less dramatic scale, involving individuals and groups who face violence and persecution from subtler but no less aggressive sources. Cases here include women fleeing from the violence of traditional practices;[5] trafficked persons seeking asylum if they escape the circumstances of indentured labour (e.g.

1. A person who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, is outside the country of his nationality, and is unable to or, owing to such fear, is unwilling to avail himself of the protection of that country (UNHCR 1951).
2. Internally displaced persons are forced to flee their homes for the same reasons as refugees, but remain within their own country and are thus subject to the laws of that state. The international community faces greater challenges in offering support and protection to internally displaced persons.
3. A stateless person is a person who is not considered a national by any state as under the operation of its law (UNHCR 1954). This may occur when states cease to exist, their nationality is repudiated, or with ethnic minority groups to whom citizenship is denied. Individuals may also become voluntarily stateless by renouncing their citizenship.
4. Complex humanitarian emergencies refer to man-made crises characterized by political instability, armed conflict, food shortages, social disruption and collapse of public health infrastructure (Brennan RJ & Nandy R 2001).
5. A number of high profile cases in countries like the USA and France have used human rights legislation to support asylum applications of African women seeking leave to remain in order to avoid undergoing female genital cutting in their countries of origin (United States Department of Justice 1996; Brownlee & Seter 1994).

Beginning	End	Main states involved	Brief description	Estimated deaths
1948	2005+	Myanmar (Burma)	Ethnic war	100,000
1952	2005+	India	Ethnic war (northeast tribals; Assam separatists)	25,000
1965	2005+	Israel	Ethnic war (Arab Palestinians/PLO)	20,000
1972	2005+	Philippines	Ethnic warfare (Moros)	50,000
1975	2005+	Angola	Civil violence (Cabinda separatists; FLEC)	3,500
1984	2005+	Colombia	Civil violence (insurgency and drug lords)	50,000
1986	2005+	Uganda	Ethnic violence (Langi and Acholi)	12,000
1988	2005+	Somalia	Civil war	100,000
1990	2005+	India	Ethnic war (Kashmiris)	35,000
1991	2004	Algeria	Civil warfare (Islamic militants)	60,000
1993	2005	Burundi	Ethnic warfare (Tutsis against Hutus)	100,000
1996	2005+	Nepal	Civil War (UPF "People's War")	8,000
1996	2005+	Zaire	Civil War (ousting of Mobutu & aftermath)	1,500,000
1997	2005	Indonesia	Ethnic violence (Aceh; GAM militants)	3,000
1997	2005+	Nigeria	Communal violence (Delta; Ijaw, Itsekeri and others)	1,500
1998	2000	Eritrea Ethiopia	Interstate war	100,000
1998	2003	Iraq	International violence (US/UK air strikes)	1,000
1999	*	India Pakistan	International violence (Kargil clashes)	1,500
1999	*	Indonesia	Ethnic violence (East Timor independence)	3,000
1999	2002	Indonesia	Ethnic violence (Moluccas; Muslim/Christian)	3,500
1999	*	Yugoslavia	International violence (NATO air strikes)	1,000
1999	2000	Ethiopia	Ethnic war (Oromo separatists)	2,000
1998	2003	Solomon Islands	Communal violence (Malaita/Isatabu islanders)	500
1999	2005+	Russia	Ethnic war (Chechen separatists)	30,000
2000	2001	Guinea	Parrot's Beak clashes	1,000
2000	2003	Liberia	Civil violence (attacks by LURD guerrillas)	1,000
2000	2005+	Ivory Coast	Civil war (north, south, and west divisions)	3,000
2001	*	Indonesia	Communal (Dayaks vs Madurese immigrants)	1,000
2001	*	Rwanda	Ethnic war (attacks by Hutu guerrillas)	2,500
2001	*	United States	Al Qaeda attacks on New York/Washington	3,000
2001	2003	Central African Rep	Civil violence (attacks by Bozize loyalists; coup)	1,000
2001	2004	Nigeria	Ethnic violence (Christian/Muslim; Plateau, Kano regions)	55,000
2001	2005+	Afghanistan USA (NATO)	Ousting of Taliban; Hunting for al Qaeda	15,000
2001	2005+	India	Maoist insurgency (People's War Group; Maoist Communist Centre; People's Liberation Guerrilla Army)	1,500
2001	2005+	Pakistan	Sectarian violence: Sunnis, Shi'ites, and Ahmadis	2,000
2002	2003	Congo-Brazzaville	Civil violence (Ninja militants in Pool region)	500
2003	*	Thailand	Anti-drug trafficking campaign	2,500
2003	2005+	Iraq USA (UK and others)	Invasion, ousting of Hussein-Ba'athist regime and subsequent occupation	40,000
2003	2005+	Saudi Arabia	Islamic militants	700
2003	2005+	Sudan	Communal-separatist violence in Darfur	60,000
2004	2005+	Yemen	Followers of al-Huthi in Sadaa	1,000
2004	2005+	Haiti	General unrest surrounding ousting of President Aristide and his Lavalas Family ruling party	2,000
2004	2005+	Pakistan	Pashtuns in Federally Administered Tribal Areas, mainly South Waziristan and North-West Frontier Province	1,500
2004	2005+	Thailand	Malay-Muslims in southern border region (Narathiwat, Pattani, Songkhla and Yala provinces)	1,200
2004	2005+	Turkey	Kurds in southeast	1,000

Source: UNHCR 2006

Table 1: Recent conflicts

Anonymous 1999; Cwikel et al. 2003; Demleitner 2001; Morrison & Crosland 2001; Taran 2000; UNICEF 2004; USCR 2003); and families whose livelihoods are no longer viable as a result of structural violence[6], civil and tribal conflict, harassment, or development projects (Uvin 1998; Summerfield 1991; Summerfield 1997; Summerfield 1999). International protection is much harder to guarantee for these cases because they do not meet the criteria in the Refugee Convention. Persons seeking asylum in this context are often labelled as voluntary economic migrants seeking a better life and are therefore not eligible for humanitarian assistance.

Responses to violence and displacement

Prevention where possible is the obvious primary response to collective violence. Attempts have been made in some instances to restrict arms trade and provide fora for peaceful negotiation to address the inequalities that are often the root cause of civil conflicts. The international community through the United Nations has on occasion intervened through measures such as economic sanctions. However, this often has a negative impact on populations in resource-poor settings, limiting health and social infrastructure and exacerbating health outcomes for the very people the sanctions were supposed to protect (Garfield 1999).

The humanitarian response to mass displacement in complex humanitarian emergencies is often political. However, there are also established protocols for technical public health services that mitigate as much as possible the health of the displaced populations (Roberts & Hofmann 2004; Brennan & Nandy 2001). There is currently an extensive body of literature on the control of disease and provision of health services during humanitarian crises through projects such as SHERE, the Humanitarian Standards for Emergency Response (Bornemisza & Sondorp 2002). Less well documented and researched, however, are the ongoing public health challenges where temporary camps are set up in situations of protracted conflict and displacement (Griekspoor et al. 2002). There is a pressing need for research and an evidence base for the re-establishment of health systems that have the capacity to monitor, treat and prevent ongoing health problems other than emergencies, within the context of the severe inequalities and vulnerabilities that are created by collective violence and displacement.

The third major response to displacement is resettlement of displaced persons either temporarily or permanently in countries that are prepared to host them. Currently, resource-poor countries provide asylum to over 70% of the world's displaced persons. This is not surprising given the geographical proximity to conflict areas. However, resources in these countries are often stretched to the limit and this can be cause for further unrest (Morris 1998).

Humanitarian resettlement of displaced populations has become increasingly politicized, particularly in higher income countries (Allotey 2003). Global events, particularly conflicts in the Middle East and increased terrorist activity, have led to increased xenophobia (Glèlè-Ahanhanzo 2002) and questions being raised about humanitarianism, border protection, national security, population control, public health protection and immigration control.

Exploring "hidden" violence in forced migration

The declining commitment to support displaced persons who do not meet the criteria for refugee status is an indication of "humanitarian fatigue". There undoubtedly have been and continue to be abuses of the international protection system. However, the negative response to forced migration presumes that displaced persons need to demonstrate vulnerability and display the characteristics of learned helplessness to be "deserving" of humanitarian assistance. Consequently, while 40% of displaced persons are able to receive official protection as recognized refugees, a substantial number of others seeking asylum for a range of reasons, which, they argue, compel their flight, often undergo a protracted process of appeals and rejections to gain the right to remain in a host country[7]. This has (arguably) supported a growing underground market in people smuggling and trafficking, both regarded as high-return, low-risk endeavours that appeal to major, transnational organized crime (Allotey & Zwi, in-press).

The decision to leave one's place of residence, family, social ties and cultural roots is not one that is taken lightly. Violence, whether physical, emotional, psychological or structural, plays a major role. While the decision to migrate may not necessarily be as inevitable as the destruction of one's home or imminent loss of life due to armed conflict, people exposed to these forms of "hidden" violence need to weigh the risks involved in flight and forced migration against the uncertainty of future consequences of continued exposure to violence. Their agency here is critical, even if it forces choices that may not necessarily be healthy. Smugglers and sometimes traffickers may present the only opportunities individuals or families have to lift themselves out of extreme hardship (Schaeffer 2003). There is vigorous debate between protection and legislative bodies, on the one hand, and advocates for those who exercise their agency and "choose" to enter into the above arrangements, on the other (Doezema 1998). One of the largest studies of illegal immigrants seeking to remain in Israel and working in brothels showed that out of 45 women labelled as trafficked, 64% reported that they had been sold with their consent (Cwikel et al. 2003).

The lack of visibility of forced migrants who remain asylum seekers or illegal undocumented migrants raises concerns with regard to their poor access to health care. In many host countries, their lack of official status denies them a right to access public goods and services with implications not only for their own health, but also to the public health of the host population (Johnston 2003; Jones 2000). An increase in

[6] Structural violence is defined by Galtung (1974) as a form of violence in which social structures and institutions systemically hinder the ability of individuals to achieve their potential. It denotes the social structures (political, repressive, economic and exploitative) that produce poverty, inequalities and inequities, and result in death or poor quality of life.

[7] The recent UNHCR statistical report on global refugee trends provides a detailed breakdown of asylum applications and rejection rates across several regions and specific countries where data are available (UNHCR 2006).

tuberculosis in the UK for instance has been linked to recent asylum-seeking groups, many of whom are lost to follow-up when their applications for asylum are rejected (Allotey, Pickles & Johnston, in-press). In addition, the lack of recognition of the importance of structural and other forms of violence in the displacement and forced migration process makes it difficult to intervene at levels that might curtail the need for flight.

Conclusion: ongoing challenges for public health

This brief overview highlights the following issues for an ongoing public health research agenda.

1. The need to systematically and consistently quantify the range of effects of collective and other forms of violence. While aggregate data which include some of the indirect effects highlight the high burden of morbidity and mortality, consistent disaggregated data demonstrating cause-specific morbidity and mortality would provide points of intervention and ongoing monitoring of progress (Ugalde et al. 2000).

2. The need to document and monitor the types and effects not only of collective violence but other forms of violence that result in displacement. Such data will again provide points of intervention to mitigate the need for displacement and forced migration.

3. The need for systematic monitoring and evaluation of humanitarian efforts to build a body of evidence in this area of public health with a better integration with sustainable development efforts.

4. The need to explore the experience of structural violence and the moral economies that drive choices of forced migration. ❑

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References

Allotey P (ed) 2003 *The health of refugees: Public health perspectives from crisis to settlement*, Oxford University Press, Melbourne.

Allotey P, Pickles H & Johnston V (in-press) 'Duties to refugees and asylum seekers in host countries' medical systems', in Ashcroft RE, Dawson A, Draper H & Mcmillan J (eds) *Principles of health care ethics*, John Wiley, London.

Allotey P & Zwi A (in press) 'Population movements' in Kawachi I (ed) 'Globalization and health', Oxford University Press, New York.

Alvarez-Castillo F, Okounzi S, Chabikuli N, Lomoro OA & Silva KT (in-press) 'Resilience of communities and health systems in armed conflict situation in responding to infectious disease: a multi-country study', Steering Committee for Strategic Social, Economic and Behavioral Research, Geneva. UNICEF/UNDP/WORLD BANK/WHO Special Program for Research and Training in Tropical Diseases.

Anonymous 1999, 'Women as chattel: the emerging global market in trafficking', *Gender Matters Quarterly*, vol. 1, pp. 1–8.

Bornemisza O & Sondorp E 2002, *Health policy formulation in complex political emergencies and post-conflict countries. A literature review*, London, London School of Hygiene & Tropical Medicine.

Brennan RJ & Nandy R 2001, 'Complex humanitarian emergencies: A major global health challenge', *Emergency Medicine Australasia*, vol. 13, pp. 147–156.

Brownlee S & Seter J 1994, 'In the name of ritual: an unprecedented legal case focuses on genital politics', *US News and World Report*, vol. 116, pp. 56–8.

Cwikel J, Ilan K & Chudakov B 2003, 'Women brothel workers and occupational health risks', *J Epidemiol Community Health*, vol. 57, pp. 809–815.

Demleitner N 2001, 'Law at a crossroads: the construction of migrant women trafficked into prostitution', in Kyle D & Koslowksi R (eds) 'Global human smuggling: comparative perspectives', Johns Hopkins University Press, Baltimore MD.

Doezema J 1998 'Forced to choose: beyond the voluntary v. forced prostitution dichotomy' in Kempadoo K & Doezema J (eds) *Global sex workers: rights, resistance and redefinition*, Routledge, New York.

Garfield R 1999, 'Impact of economic sanctions on health and wellbeing', London, Relief and Rehabilitation Network, Overseas Development Institute.

Glèlè-Ahanhanzo M 2002, 'Racism, racial discrimination, xenophobia and all forms of discrimination: mission to Australia', United Nations Economic and Social Council, Commission on Human Rights, Geneva.

Griekspoor A, Michael M, Pavignani E, Allotey P & Zwi A 2002, 'Enhancing health in complex emergencies: the broader research agenda', Manila, developed at the TDR Steering Committee for Strategic Social, Economic and Behavioural Research (SEB) sponsored meeting: Surviving crisis: how systems and communities cope with instability, insecurity and infection.

Hoeffler A & Reynal-Querol M 2003, 'Measuring the costs of conflict'.

Johnston V 2003, 'Mobilizing the chattering classes for advocacy in Australia', *Development*, vol. 46, pp. 75–80.

Jones J 2000, 'Asylum seekers in UK receive poor health care', *BMJ*, vol. 320, p. 1492.

Krug E, Dahlberg L, Mercy J, Zwi A & Lozano R (eds) 2002, 'World report on violence and health', World Health Organization, Geneva.

Mock N, Duale S, Brown L, Mathys E, O'maonaigh H, Abul-Husn N & Elliott S 2004, 'Conflict and HIV: a framework for risk assessment to prevent HIV in conflict-affected settings in Africa', *Emerging Themes in Epidemiology*, vol. 1, p. 6.

Morris A 1998, 'Our fellow Africans make our lives hell – the lives of Congolese and Nigerians living in Johannesburg', *Ethnic and Racial Studies*, vol. 21, pp. 1116-1136.

Morrison J & Crosland B 2001, 'The trafficking and smuggling of refugees: the end game in European asylum policy', New Issues in Refugee Research, Working Paper Series, vol. 39, pp. 1–88.

Roberts L & Hofmann C 2004, 'Assessing the impact of humanitarian assistance in the health sector', *Emerging Themes in Epidemiology*, vol. 1, p. 3.

Schaeffer R K 2003, 'Understanding globalization. The social consequences of political, economic and environmental change', Lanham, Maryland, Rowman and Littlefield Publishers Inc.

Summerfield D 1991, 'The psychosocial effects of conflict in the Third World', *Development in Practice*, vol. 1, pp. 159–73.

Summerfield D 1997, 'The social, cultural and political dimensions of contemporary war', *Medicine, Conflict and Survival*, vol. 13, pp. 3–25.

References continued

Summerfield D 1999, 'Sociocultural dimensions of war, conflict and displacement' in Ager A (ed) 'Refugees: perspectives on the experience of forced migration', Pinter, London.

Taran PA 2000, "Human rights of migrants: challenges of the new decade', *International Migration*, vol. 38, pp. 7–51.

Ugalde A, Selva-Sutter E, Castillo C, Paz C & Canas S 2000, 'Conflict and health: the health costs of war: can they be measured?', Lessons from El Salvador, *BMJ*, vol. 321, pp. 169–172.

UNHCR 1951, 'Convention relating to the status of refugees', United Nations High Commissioner for Refugees, Geneva.

UNHCR 1954, 'Convention relating to the status of stateless persons', United Nations High Commissioner for Refugees, Geneva.

UNHCR 2006, '2005 Global refugee trends. Statistical overview of populations of refugees, asylum-seekers, internally displaced persons, stateless persons, and other persons of concern to UNHCR', Field Information and Coordination Support Section Division of Operational Services UNHCR, Geneva.

UNICEF 2004, 'Trafficking in human beings, especially women and children', UNICEF Innocenti Research Centre, Florence Italy.

United States Department of Justice 1996, Board of Immigration Appeals decision in re Fauziya Kasinga (female genital mutilation as a basis for asylum), (June 13, 1996), *International Legal Materials*, vol. 35, pp. 1145–58.

USCR 2003, 'Trafficking in persons: a country by country report on a contemporary form of slavery', *Refugee Reports*, vol. 24.

Uvin P 1998, 'Aiding violence: the development enterprise in Rwanda', Kumarian Press, West Hartford, CT.

Developing an evidence-based sexual assault policy in South Africa: a partnership approach

Article by Rachel K Jewkes

Researchers and policy-makers are faced with a mutual challenge. For researchers, it is to ensure that research questions are policy-relevant, and research findings and recommendations are framed in a way that is useful for policy development and service provision. For policy-makers, it is to understand the importance of, and be open to, crafting policy and developing service provision that is informed by research. Whilst the difficulties of bridging the research-policy divide have been the subject of numerous publications, this article describes a case study from South Africa of a very successful collaboration between researchers and policy-makers to develop policy and services related to sexual violence.

Putting sexual violence on the public health agenda

Rape is a highly prevalent problem in South Africa. In the 12 months between April 2004 and March 2005, 55,114 rapes and attempted rapes of women of all ages were reported to the police (CIAC 2005). These figures estimate South Africa's rate of reported rape to be 231 per 100,000 female population. This is 3.6 times higher than the rate in the United States (Department of Justice 2004). The Eighth United Nations Survey of Crime Trends and Operations of Criminal Justice Systems, for 2001–2002, reported South Africa as having the highest number of reported rape cases per 100,000 population (UN Office on Drugs & Crime 2005).

The South African government has for many years expressed the need to respond effectively to rape, whilst at the same time recognizing there are many problems with the operations of the criminal justice system. In response to the widespread reports of negative experiences faced by rape survivors when reporting rape and pursuing cases through the criminal justice system (Jewkes & Abrahams 2000), and the very low proportion (about 8%) of complaints of rape registered at police stations, that eventually result in the conviction of the perpetrator (CIAC 2002; CIAC 2005), the Department of Justice has developed a range of new initiatives including specialized rape courts and established a handful of model one-stop centres, known as Thutuzela Centres. Unfortunately, although medico-legal evidence is routinely gathered by health sector practitioners and used in prosecutions on charges of rape, the initiatives to improve the statutory response to rape initially did not involve changes in the way the health sector works.

The health sector and sexual violence services: the context

The health sector has a very specific role after rape. Victims/survivors have particular physical and mental health needs that must be met, in addition to the need to document injuries in an appropriate way for providing evidence for legal cases (WHO 2003). Like many other countries, the South African health system response to rape has been found wanting. For example, Human Rights Watch investigations (HRW 1997; HRW 1995) found a litany of problems, and noted in particular that the system was riddled with prejudice, police officers were unsympathetic, health-care professionals were untrained, doctors collected medico-legal evidence poorly and prosecutors and magistrates lacked knowledge on gender-related issues and on how to use and interpret medical evidence.

In 1999, in an effort to improve sexual violence services and enhance service integration, and in keeping with a primary health care approach (McIntyre & Klugman 2003), South Africa abolished the system of district surgeons. The Government declared that all doctors could conduct rape examinations. This undoubtedly made services more accessible and addressed some of the issues of prejudice, but it did not provide a solution in itself to the low levels of training and expertise of doctors (Suffla, Seedat & Nascimento 2001).

A further consideration at this time was HIV. Prior to 2002, South Africa had an inequitable system whereby women who used private health care after rape were able to access antiretroviral medication, but for the most part these were not available for women using the public sector. In 2002, after concerted advocacy around access to antiretroviral medication for preventive purposes, the Government agreed that all rape victims/survivors should have access to antiretroviral medications in the public sector. This created an added impetus as the Department of Health recognized that improved sexual assault services must include the capacity to deliver this new aspect of sexual assault health services.

Uncertainty remained about who was seeing women after rape, what facilities were available for this, what quality of care was provided and what specific training health workers had in

post-rape care. In 2001, the National Department of Health suggested that a group of researchers with a special interest in gender-based violence (Abrahams et al. 2004) could undertake a situation analysis and seek to answer some of these questions.

A partnership based on mutual priorities?

The most important players were the Gender Directorate and Women's Health Directorate of the National Department of Health and an organization called the South African Gender-based Violence & Health Initiative (SAGBVHI), which was a partnership of about 15 organizations and individuals working at the interface of health and gender-based violence. SAGBVHI was a source of expertise in service provision and research on rape, with funding from the Rockefeller Foundation as part of its Millennium Health Awards; and a specific remit to engage the Department of Health and develop a shared vision of how research could be used to develop policy on gender-based violence. When the Department of Health expressed the need for a situation analysis of sexual assault services that outlined what services were available, in which facilities and provided by people of what degree of training, SAGBVHI had the expertise and resources to be able to undertake the work.

In 2002 a study tour of Toronto organized by a local nongovernmental organization South African Women for Women provided a further opportunity for some members of SAGBVHI and key individuals in the Department of Health to see a completely different model of sexual assault services and begin to imagine what services in South Africa could and should look like. It also provided an important opportunity for key stakeholders to develop levels of trust that was important for their work together.

On returning from the tour, a workshop was organized to develop a shared view on where we were, where we wanted to go to, and what information we needed in order to be sure we were making the right policy decisions. It was recognized that the findings of the situation analysis were going to be of great importance, and that there were other vital gaps in our knowledge, in particular we did not know what women wanted post-rape health services to look like. Then a dual process was established of research taken forward through SAGBVHI, that would directly inform the deliberations of a committee established to consult upon and eventually write a new policy on sexual assault care for the health sector. The researchers worked hand in hand with the Department of Health in organizing consultations and drafting the new sexual assault policy and clinical management guidelines, so that the findings of the research could be translated into policy and used to influence programmes as the results became available.

A particular concern then arose about whether patients, particularly poor rural women, would find it acceptable to be asked after rape to travel to a health facility that inevitably would be further away than the nearest primary-care facility

A sexual assault policy informed by evidence

Three pieces of research were very important for the new sexual assault policy. The first was the situation analysis (Christofides et al. 2005), which highlighted the highly variable state of sexual assault services across the country. Of note were the findings that many of the services provided rape care in settings that lacked key pieces of equipment and the basic infrastructural requirement of a private room. Only a third of those providing services had ever received any training on rape management and a third of providers did not consider rape a serious medical problem. Many service providers did not routinely consider the need for pregnancy prevention and the treatment of sexually transmitted diseases after rape, and only a third could name the correct drugs for this treatment. Those who saw more rape cases provided the best care. These findings clearly indicated the need to train health care workers appropriately in post-rape care, but also suggested that better care was achieved where there was a slightly higher case-load. Both of these findings suggested that the previous policy decision to devolve post-rape health care to primary care level was probably not a good one.

A particular concern then arose about whether patients, particularly poor rural women, would find it acceptable to be asked after rape to travel to a health facility that inevitably would be further away than the nearest primary-care facility, but would provide better care. In order to determine what women really value from post-rape services a second study was undertaken (Christofides et al. 2006a). Using a discrete choice method, we were able to show that patients were willing to travel, at least one to two hours, if they were to get better quality services. Indeed we showed that, if anything, women in rural areas were more willing to travel than their urban counterparts. Women indicated that having a chance to get an HIV test and post-exposure prophylaxis was very important to them. Again this was of particular interest, as the group drafting the new Sexual Assault Policy had been concerned that asking women to have an HIV test after rape before getting post-exposure prophylaxis would result in a particularly low uptake and could be a barrier to seeking any post-rape care.

The third piece of research involved a detailed costing of sexual assault services and a desk-based review of the cost-effectiveness of post-exposure prophylaxis for HIV after rape (Christofides et al. 2006b). This confirmed the affordability of the new policy in South Africa, but the available evidence on completion of post-exposure prophylaxis indicated that specific measures needed improvement lest the number of post-rape HIV transmissions averted remain unacceptably low.

Launch of the policy and the future research agenda

In March 2005 the new Policy on Sexual Assault Care of the National Department of Health was launched by the Minister of Health. The impetus developed through the SAGBVHI

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resulted in members developing provincial training programmes for health workers providing post-rape care in several provinces. One of South Africa's major universities, the University of the Witwatersrand, also revised its undergraduate teaching on rape to medical students and now provides a week-long course that emphasizes the epidemiology and social context of rape as well as its clinical management.

A range of new research priorities related to sexual violence services has become apparent in the course of the research undertaken. These priorities include the need to develop interventions to solve some of the remaining problems with sexual assault services, including the low completion rates of antiretroviral medication; to monitor and evaluate the implementation of the new policy; and to understand what contribution of medico-legal evidence, including DNA, makes towards rape case outcomes, and the circumstances in which it is of most value.

Key elements of success

From the beginning the research priority areas were identified through the collaboration. This partnership approach to setting the research agenda ensured up front commitment from all parties to the study before it began. There was considerable sharing of certain forms of power. The Department of Health supported the need for the research and had an investment in its findings and made a commitment to include appropriate recommendations in its policy. They opened the door to researchers to participate in the processes into which the results would feed. On the other hand, the researchers agreed to be guided by the Department in their focus and committed to sharing findings informally as they became available so that the information was fed timeously into the policy process; they also committed time to the processes around policy development. Researchers and policy-makers met regularly in the course of organizing consultative meetings and drafting policy and so there was considerable time informally to develop relationships and facilitate informal sharing of information.

Work was also assisted by having a generally enabling policy environment. Rape was very high on the Government's policy agenda and shifts in government policy had necessitated a new sexual violence policy after the ending of the district surgeons, and with the introduction of HIV post-exposure prophylaxis. The Department of Health was also part of an interdepartmental team addressing rape and was under pressure from colleagues to deliver.

As a result of this, the researchers gained the satisfaction of feeling their work was of very real value and the Department gained the knowledge it needed to be sure it was developing rigorous policy. The collaboration was also made easier by the existence of SAGBVHI which brought together people with a range of research, training, advocacy and clinical expertise and the fact it also had funds for research which enabled it to respond to the Department of Health. In this way momentum was not lost by the need to engage in lengthy fund raising, or potentially destructive competition around tender procedures.

Conclusions

The collaboration of researchers and policy-makers on sexual assault in South Africa illustrates what is possible when there is openness to collaborate, commitment from both parties to participate in research and policy processes and a genuine commitment to allow research findings to influence policy. It also illustrates how a research agenda in the area of sexual violence can emerge from, and be shaped around, a policy imperative to improve post-rape health services and can grow incrementally from a basic starting point of describing what services are currently available and what their quality is.

The Sexual Violence Research Initiative (SVRI) of the Global Forum for Health Research is currently hosted by the research unit, from which the South African research was led. The SVRI (www.svri.org) aims to promote research on sexual violence against women and children and to generate empirical data that ensures that sexual violence against women and children is recognized as a legitimate public health problem. One of its priority areas is promoting research that aims to improve health services for the care and support of sexual violence victims/survivors including understanding the role of medico-legal responses. The work in South Africa provides one model for how meaningful partnerships between policy-makers and researchers can result in evidence-based policy so that we can better respond to the needs of sexual violence victims/survivors. ❑

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References

Abrahams N, Adhikari R, Bhagwat IP, Christofides N, Djibuti M, Dyalchand A et al. 2004, 'Changing the debate about health research for development. International health research awards recipients', *Journal of Public Health Policy,* vol. 25, no. 3–4, pp. 259–87.

Christofides N, Muirhead D, Jewkes R, Penn-Kekana L & Conco ND 2006(a), 'Patient experiences of post-sexual assault services and their preferences for how services should be delivered in South Africa', *BMJ,* vol. 332, no. 7535, pp. 209–23.

Christofides N, Muirhead D, Jewkes R, Penn-Kekana L, Conco N 2006(b), 'Including post-exposure prophylaxis to prevent HIV/AIDS into post-sexual assault health services in South Africa: costs and cost effectiveness of user preferred approaches to provision', Medical Research Council, Pretoria.

Christofides N, Jewkes R, Webster N, Penn-Kekana L, Abrahams N & Martin L 2005, 'Other patients are really in need of medical attention – the quality of sexual assault services in South Africa', *World Health Bulletin*, vol. 83, pp. 495–502.

Crime Information Analysis Centre (CIAC) 2005, *South African Police Service Crime Statistics*, Pretoria.

Crime Information Analysis Centre (CIAC) 2002, *South African Police Service Crime Statistics*, Pretoria.

Department of Justice Federal Bureau of Investigations 2004, Crime in the United States 2004. Retrieved July 12, 2006, from http://www.fbi.gov/ucr/cius_04/offenses_reported/violent_crime/forcible_rape.html

Human Rights Watch 1995, *Violence against women in South Africa: A state response to domestic violence and rape*, Women's Rights Division, Human Rights Watch, New York.

Human Rights Watch 1997, *Violence against women in South Africa: the state response to domestic violence and rape*, Women's Rights Division, Human Rights Watch, New York.

Jewkes R & Abrahams N 2000, *Violence against women in South Africa: rape and sexual coercion*, Crime Prevention Research Resources Centre, Centre for Scientific & Industrial Research, Pretoria.

McIntyre D & Klugman B 2003, 'The human face of decentralization and integration of health services: experiences from South Africa', *Reproductive Health Matters*, vol. 11, no. 21, pp. 108–119.

Suffla S, Seedat M & Nascimento A 2001, 'Evaluation of medico-legal services in Gauteng: implications for the development of best practices in *The after-care of rape survivors'*, Institute for Social and Health Sciences and Centre for Peace Action, University of South Africa, Pretoria.

United Nations Office on Drugs and Crime 2005, *Eighth United Nations survey of crime trends and operations of criminal justice systems*. Retrieved September 26, 2005, from http://www.unodc.org/unodc/en/crime_cicp_survey_eighth.html

World Health Organization 2003, *Guidelines for medico-legal care for victims of sexual violence*, WHO, Geneva.

Addressing global challenges

Three pillars of priority setting for health research: process, tools and values

Article by Abdul Ghaffar

The amount of funding available for health research is small and inadequate in comparison to its very large potential benefits (WHO 2004), particularly with regard to research for the health of populations in developing countries – the so-called "10/90 gap" (Global Forum for Health Research 2004a). It is therefore essential that the allocation of available resources be based on a rational priority-setting process. Sound methodology and scientific process are critical to ensure the identification of research priorities which will make the greatest contribution to people's health. One of the most important ways to address the "10/90 gap" is to change the priorities that determine how existing health research funds are used. Indeed, from the perspective of responding to largely unmet needs, priority setting is as critical as conducting the research itself.

Nevertheless, priority setting is a complex and poorly documented phenomenon, and research on methodologies to help set priorities in health research is a recent development. Attempts have been made, principally in the last 15 years (since the 1990 Report of the Commission on Health Research for Development), to systematize the approach to setting priorities in health research. Within this time, a number of approaches have emerged for developing and implementing priority setting (COHRED 2000; OECD 2003; Lomas et al. 2003; Global Forum 2004b; Fleurence & Torgerson 2004; Rudan, Arifeen & Black 2005; NIH 2006).

The objectives have been to make the process more transparent and to help decision-makers, particularly in the public sector, make more informed decisions, thus allocating limited research funds in the most productive way on a global scale. Although the various approaches tackle the problem from different angles and with different terminologies, there appears to be at least implicit consensus that the central objective is to have the greatest impact on the health of the greatest number of people in the community concerned (world or country level) for a given investment.

Three pillars of priority setting

In daily life setting priorities is not easy, but the process is much more difficult in health research, where a large number of factors and actors enter into the equation. One of the roles of health research is to ensure that the measures proposed to break the vicious cycle of ill-health and poverty are based – inasmuch as possible – on evidence, so that the resources available to finance them are used most judiciously.

In a health research priority-setting exercise, it is important to differentiate between the process of priority selection (a mechanism that involves constituencies and different stakeholders in order to decide upon research priorities), hereinafter called the first pillar; and the tools used for that purpose (instruments that enable the collection, organization and analysis of the mass of information needed to help set priorities), which form the second pillar respectively. Equally important is the subsequent stage of decision-making, or the third pillar, which takes place in a specific context and is conditioned by values.

First pillar: process of priority setting

A priority-setting exercise could take place at the organization level, country level or international level. For simplicity, here we limit our account of priority setting only to the national level. However, similar types of processes can be followed at the local and international levels to determine health research priorities. Such processes can be applied by individual institutions as well as by local and national governments and development agencies, to identify their priority areas for engagement in, or in support of, health research.

The success of any exercise, including research priority setting, depends on how well the whole process is planned. It is even more important in research priority setting because of the diverse nature of stakeholders, which renders complex and competing expertise and interests of involved individuals and institutions. Health being a public good, it is important to be transparent and inclusive while involving various groups of professionals, professional bodies, research organizations and policy planning institutes.

The Council on Health Research for Development (COHRED) has been and is a major advocate for involvement of multiple stakeholders in priority setting, because it believes "it is fundamental both for the credibility of the process and to give the best possible chance for implementation of priorities" (COHRED 2006). The Essential National Health Research principle of involving the community, civil society, researchers, health managers and policy-makers in the process of priority setting has been tried in both developing and industrialized countries to broaden ownership. A recent

publication highlights the importance of scanning the environment (COHRED 2006). This publication emphasizes that "a scan of health, research and political environment in the country should guide decisions whether the time is right to start a priority setting process, or if other parts of the health research system first need to be strengthened". Similarly, changes in a country's political situation can influence not only the priority-setting decisions but also the likely outcomes of such decisions.

The Global Forum for Health Research in the application of its priority-setting tool (the Combined Approach Matrix) at the national level has always stressed involvement of concerned stakeholders and systematic collection of needed information for proper planning (Global Forum 2004b).

Involving all concerned and interested is only one step in the right direction. Equally important is to ensure that the process of discussion and deliberation during a planning exercise is not taken over or dominated by the powerful and "more" knowledgeable. To obtain all relevant views and voices, techniques such as the "Nominal Group Process" (Dunham 1998) have been used successfully to eliminate such influences.

Second pillar: evidence-based information gathering – application of a tool

For information gathering, synthesis and interpretation of priorities one needs to identify a tool which is not only valid but provides reliable output.

Information gathering

At the national level, the first step would be to estimate the burden for each of the main diseases and risk factors in the country and to engage with all institutions and stakeholders with particular knowledge of that disease. Each institution would then feed the information at its disposal, and gradually one would incorporate the best available information regarding a specific disease or risk factor. In many cases, a good tool reveals how little information is available to make rational, cost-efficient and effective decisions in the fight against specific diseases or causative factors. However, the absence of a particular type of data does not undermine the priority-setting process. These information gaps become, in fact, candidates for research.

Synthesis

The second step is to identify which knowledge, tools or processes that might result from research would have the largest impact on the problem in question. This may be a time-consuming and iterative process, as it is likely that various stakeholders have different opinions as to the most important factor(s) to be studied to reduce the burden of that particular problem.

Interpretation

Where prioritization involves making choices between diseases, a further process may be required that takes account, among other factors, of those research topics likely to have the greatest impact in reducing the burden of disease for a given country. This overall list of national research priorities may then need to be allocated among the country's various research institutions based on their respective comparative advantages.

Third pillar: context and values

Any rational and practical priority-setting cycle should be able to gather all the interested stakeholders, and assist in summarizing information, evidence and synthesis of ideas about possible effectiveness of an approach. However, it should not lead automatically to a priority list, especially if one of the purposes is to promote equity and minimize biases.

Thus, a logical last step requires decision-making in a specific context (e.g. the nature of the institution or body setting the priorities; the nature and amount of human and financial resources available, the external demands, the timescale for results, political pressures) and conditioned by values (the ethos of the institution and the research goals, which might be needed, for example, to achieve the most cost-effective solution, or the most socially equitable one).

Combined Approach Matrix – an example of a feasible and reliable tool

The Global Forum for Health Research has focused particular attention on further developing methods and instruments which can be used for evidence-informed priority setting in health research. In 1999, the Global Forum presented a research priority setting tool called the Combined Approach Matrix or CAM (Global Forum 2004b). Since its development, the CAM has been successfully applied to set research priorities for diseases, conditions and programmes at global, regional and national levels.

The CAM incorporates the criteria and principles for priority setting defined in the Essential National Health Research approach (Commission on Health Research for Development 1990), the Visual Health Information Profile proposed by the WHO Advisory Committee on Health Research (WHO 1996) and the Five-Step Process of the WHO Ad Hoc Committee on Health Research (WHO 1996). The CAM is a tool (1) to help classify, organize and present the large body of information which enters into the priority-setting process; (2) to recognize gaps in health research; and, on this basis, (3) to identify health research priorities, based on a process which should include the main stakeholders in health and health research.

The five steps (public health dimension) are linked to four broad groups of actors and factors (institutional dimensions) determining the health status of a population to form a matrix for priority setting. The "institutional" approach argues that the health status of a population depends on actors and factors outside the health sector just as much as on the health system itself. Table 1 indicates the matrix for this priority-setting approach with an explanation of the information required in each component of the matrix.

In summary, the CAM:

- brings together in a systematic framework all information (current knowledge) related to a particular disease or risk factor;

- identifies gaps in knowledge and future challenges;
- relates the Five-Step Process in priority setting (public health axis) with actors and factors (institutional axis) determining the health status of a population;
- permits the identification of "common factors" by looking across the diseases or risk factors;
- is applicable to priority setting on the regional, national and global level for problems pertaining to diseases, risk factors and determinants of health;
- permits the linkage of priorities in the fields of health and health research;
- permits the integration of various factors outside the health sector which have an important impact on people's health.

Selected examples of CAM applications

The feasibility and usefulness of the CAM has been demonstrated over a period of several years, by its successful application in a range of settings including global programmes and national plans; communicable and noncommunicable diseases; risk factors and vulnerable groups. Here, we will describe only three examples, one each from a global programme, a national application and a disease, to further illustrate and explain the use of the tool.

(a) TDR research priorities

The UNICEF/WHO/World Bank/UNDP Special Program for Research and Training in Tropical Diseases (TDR) is an international research programme for which WHO is the executing agency. A formal priority-setting process was undertaken in 2002–2003 to realign TDR's strategic focus in research to address the disease control priorities of the next five years (Global Forum for Health Research 2002).

The first step in the prioritization process was to bring together the TDR Disease Research Coordinators, TDR staff, disease control experts from within WHO, country programme managers and disease experts (disease reference groups and scientific working groups) to analyse rationally and transparently the current situation of each disease.

The TDR prioritization strategy led to the following results: a transparent and objective prioritization process, the active participation of partners from both health research and disease control, a direct link between strategic emphases and the research needs of disease control, an efficient mechanism to communicate TDR's strategic choices to its partners, and a continuous monitoring system for incorporating new priority needs.

(b) The example of diarrhoeal disease research in India

During 2002–2003, the Indian Council of Medical Research (ICMR) and the National Institute of Cholera and Enteric Diseases (NICED), Kolkata, applied the CAM to set diarrhoeal disease research priorities in India (Global Forum for Health Research 2004b). An expert group of scientists drawn from various disciplines was established to conduct the task.

The expert group was charged to summarize the current knowledge to fill the cells of the matrix. The available data from different sources (research studies, surveys and government and donor reports) was systematically reviewed.

The exercise revealed that the main reason for the persistence of the burden of disease was that the majority of health-care providers, especially those who were working as private practitioners, were not consistently applying the standard guidelines for management of diarrhoeal diseases. Misconceptions about infant and child feeding were widely

	Global / national/ local	Individual household and community	Ministry of health and other health institutions	Sectors other than health	Macro-economic policies
1. Disease burden					
2. Determinants					
3. Present level of knowledge					
4. Predicted cost and effectiveness of new interventions					
5. Resource flows					

Table 1: The Global Forum Combined Approach Matrix for health research priority setting (In most instances, information is not available for cells that have been shaded)

prevalent, and often it was actually the physician who provided inappropriate suggestions. The CAM application highlighted the need for better understanding of socio-cultural norms and for improved training of health-care providers.

(c) The example of schizophrenia

In this example, desk reviews were carried out by a senior epidemiologist who was familiar with the application of CAM methodology (Global Forum for Health Research 2004b). The reviews were based on peer reviewed publications, mostly prepared by WHO, and other similarly authoritative international monographs and reports.

The matrix analysis revealed a need for further research on:

- the concept of burden as it reaches beyond the individual affected by a neuropsychiatric disease;
- cost-effectiveness issues: the effectiveness of many interventions is largely unknown, and good measurements of cost-effectiveness are scarce. Cost-effectiveness research needs to consider the burden issues described above;
- bridging the treatment gap: in developing countries, about 85% of people with schizophrenia do not benefit from the available medicines and treatment methods. This could be reduced by effective health education messages targeting communities, families, individuals and health-care providers.

As illustrated by the above examples, it becomes evident that the strength of the CAM lies in its flexibility and diversity of application. Depending on the resources, area of research and availability of needed information, it may be applied either by an individual researcher, a group of experts, by interested stakeholders or a combination of individuals and groups.

Discussion

Involvement of all stakeholders, selection of appropriate and relevant groups and use of transparent techniques for planning is a critical step. Training of experts and allocation of budget for this component of priority setting should therefore be considered essential.

While a tool may provide a sound base for assembling the relevant information, it requires adaptation to the particular needs of the programme or organization. The users may have to modify and adapt specific questions while applying a tool and also flexibly apply the outcome of results according to their organizational needs. Two excellent examples in this regard are the use of CAM by TDR and by the Pakistan Medical Research Council for perinatal and neonatal care in Pakistan. This adaptation needs to be ongoing as the debate on priorities moves forward (Global Forum for Health Research, 2004b).

Although a tool may summarize the evidence base for priority setting in health research, it should not be misunderstood as an algorithm for priority setting per se. It can hardly be expected that a procedure or an algorithm would automatically come up with research priorities once the evidence base was fed into the process. One would hope, however, that standardized guidelines would become available to facilitate priority selection on the basis of a good tool.

Review of available tools reveals that almost all tools are constructed on three main pillars – magnitude of the problem, cost-effectiveness of interventions and response to issues of social justice, such as equity. However, in our view, two additional factors should be integral components of any priority-setting equation: context (such as resource availability) and values or interests. For example, despite the recognized importance of HIV/AIDS, progress in reducing its impact has not been adequately prioritized, and hence hampered, due to a lack of resources in countries where the problem is most severe. The problem here is, of course, circular, since a principal purpose of priority setting is to justify the shift of resources into areas where they are most needed. As long as priorities are set independently of agencies providing the resources, congruence between resources and priorities is unlikely to materialize. For example, the need for better vaccines that receive high societal priority might not be acted upon by those that pursue more profitable lines of pharmaceutical research and development.

The level of interest (values) in a field of research is related to the availability of resources (context) and the importance of research, but again congruence is not guaranteed. Individual researchers might hone their technical skills and pursue interests in areas that are more prestigious, intellectually challenging, or professionally rewarding than responsive to societal needs. Nobel prizes are offered in medicine, chemistry and physics, not in public health per se.

In summary, prevailing contextual factors, as well as personal and organizational values, need to be singled out for attention in addition to the usual consideration of problem magnitude, impact, vulnerability and cost in an effort to ensure that resources and interest are directed to subjects of greatest research need.

Conclusion

Priority setting in health research is a dynamic process and remains as much art as science. This is true in large part because it involves a number of factors that are not readily measured, institutional perspectives and subjective views, for example, which can be neither ignored nor relied on entirely. Analytical tools are increasingly being applied to these seemingly immeasurable factors, and we should become better acquainted with both the strengths and limitations of these tools, the surrounding environment and any related planning processes. ❑

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References

COHRED 2000, 'Priority setting for health research: lessons from developing countries', The Working Group on Priority Setting, *Health Policy Planning* vol. 15, no. 2, pp. 130-36.

COHRED 2006, 'Priority setting for health research: towards a management process for low and middle income countries', Working Paper 1, ISBN 92-9226-008-1.

Commission on Health Research for Development 1990, 'Health research, essential link to equity in development'.

Dunham B Randall 1998, 'Nominal Group Technique: A user's guide', University of Wisconsin, USA.

Flueurence RL & Torgerson DJ 2004, 'Setting priorities for research', *Health Policy* vol. 69, no. 1, pp. 1-10.

Global Forum for Health Research 2004(a), 'The 10/90 report on health research 2003–2004'.

Global Forum for Health Research 2004(b), 'The Combined Approach Matrix – a priority-setting tool for health research'.

Global Forum for Health Research 2002, 'The 10/90 report on health research 2001–2002'.

Lomas J, Fulop N, Gagnon D & Allen P 2003, 'On being a good listener: setting priorities for applied health services research', *Milbank Q* vol. 81, no. 3, pp. 363-88.

NIH 2006, 'Setting research priorities at the National Institute of Health', US National Institute of Health (www.nih.gov/about/researchpriorities.htm) Accessed 29 March 2006.

OECD 2003, 'Priority setting: issues and recent trends in governance of public research, towards better practices' pp. 61–75.

Rudan I, El Arifeen S & Black RE 2005, 'New methodology for systematic priority setting in global child health research'.

World Health Organization 1996, Ad Hoc Committee on Health Research Relating to Future Intervention Options, 'Investing in health research and development'.

World Health Organization 2004, Report from the Ministerial Summit on Health Research, 'Identify challenges, inform actions, correct inequities'. Mexico City, 16–20 November.

Corruption: an obstacle to health

Article by David Nussbaum

When Transparency International's national chapter in Morocco decided to research the extent of corruption in health, they suspected some surprising results. They found that out of every five people they interviewed, four described corruption in the public health system as "common to very common" and two admitted to paying a bribe for a service that had been supposedly free. "When my wife went to the hospital they examined her and prescribed some pills", one respondent said, "they said that none were available there, but if we paid 20 to 30 dirhams (US$ 2–3), someone could provide the 'free medication'. The problem is we can't afford the drugs."

A growing body of evidence collected in *Transparency International's Global Corruption Report 2006* suggests that this is not a rare incident of corruption posing an obstacle to health care. Yet we do not have a global figure for how much corruption in health care costs, in financial terms or in terms of lives lost or harmed. We know the manifestations of corruption are varied, and by nature corruption is hidden and so difficult to measure. Through the efforts of research institutes, state statistics agencies and civil society organizations, we are building up an intricate patchwork of knowledge about the problem around the world. We know, for example, that in Kyrgyzstan, one in three patients reported borrowing money for in-patient care, and in rural areas, 45% of in-patients sold produce or livestock to cover the costs of supposedly free health care (Lewis 2000). We know that in countries including Mexico and Kenya, health policy has been swayed in favour of the pet projects of politicians, in contravention of official health policy (Hofbauer 2006; Tanui & Ng'ang'a 2006). We have evidence that in the Philippines there is a direct, negative correlation between corruption levels and immunization rates (Azfar & Gurgur 2006).

In its sum, the evidence meticulously gathered by tracking resources from central health budgets to the rural clinics of destination; by conducting surveys of patients and health professionals; and by investigating individual cases, demonstrates that tackling corruption must be a central concern of health professionals and policy-makers. But there are gaps in our collective knowledge, which are vital to fill if we are to accurately assess the respective vulnerabilities to corruption of different types of health systems. Corruption is still missing from important research agendas. The Chair of the Global Forum for Health Research Foundation Council, Pramilla Senanayake, recently highlighted it as a gap in the Disease Control Priorities project (DCP2) (Senanayake 2006). Without due attention to corruption, the failure of high levels of health spending to translate into improved health status will continue.

The nature of the problem

Corruption is not exclusive to any type of health system, though there is evidence that it affects the poor most, since the poor cannot afford private alternatives and bribes paid for public services that should be free weigh more heavily on family incomes. It takes place in well and poorly funded systems; in publicly or privately funded systems and systems with mixed funding; in systems that are sophisticated and systems that are simple.

The manifestations of corruption, however, may differ according to the type of system. For example, in systems that are funded through taxes, corruption risks tend to include large-scale diversions of public funds at the ministerial level; a high risk of informal or illegal payments, and abuses that undermine the quality of services, such as absenteeism, unnecessary referrals to private practice or the illicit use of public facilities for private practice (Transparencia por Colombia 2006). Examples of the diversion of public funds include the estimated 5–10% of Cambodia's health budget that vanishes even before leaving the finance ministry, according to health workers interviewed in 2005 (Prevenslik-Takeda 2006). Another example is the US$ 490,000 of a UK development grant that was used for inflated salaries that senior employees of the Kenyan national AIDS Control Council awarded themselves in 2003 (Tanui & Ng'ang'a 2006).

In systems that are funded through social or private insurance schemes, the most common abuses include excessive medical treatment, fraud in billing and diversion of funds. For example, the largest US public health-care programmes, Medicaid and Medicare, estimate loss rates to fraud of 5–10%. In Colombia, a shift in the early 1990s from fragmented health-care provision dominated by large public institutions to a universal health insurance scheme saw a concomitant shift in the types of corruption registered. Prior to the reform, bribe taking, theft and absenteeism were common problems. After the reform, the level of irregularities in public

hospitals fell, but a new problem arose: insurance fraud. In the mid-1990s, the Bogotá Secretariat of Health found that 114,000 new affiliates were receiving benefits far beyond the increase that could be expected through the extension of universal coverage (Di Tella & Savedoff 2001).

In all systems, corruption in procurement is a big problem. Some cases of corruption in procurement have involved vast sums of money and very senior public officials, such as the 20% "commission" skimmed off a US$ 40 million Finnish development loan by the heads of the Costa Rican public health-care system in 2004. The loan was made conditional on Costa Rica buying state-of-the-art equipment from Finnish companies, much of which is still languishing unused.

Corruption on a less dramatic scale can be equally detrimental to health provision, when hospitals continuously overpay for basic equipment. In Latin America, for example, researchers found evidence of wide disparities in what hospitals paid for basic supplies such as saline solution, gauze or penicillin. The ratio of highest-to-lowest price paid for these goods ranged from 3:1 to 36:1 (in the case of prices paid for cotton gauze in Bolivia) (Di Tella & Savedoff 2001). They found no variables (quality, quantity, credit terms, purchase and expiration date or hospital size, for example) to explain the wastage, other than gross mismanagement or corruption. Hospitals may not have adequate systems for recording receipt and use of drug orders, so they may pay for orders that are never received.

Some key causes of corruption in health care

William Savedoff and Karen Hussman write in the *Global Corruption Report 2006*, that there are several features specific to the health sector that make it particularly vulnerable to corruption (Savedoff & Hussman 2006). One is that so much money, public and private, is involved, making it an attractive target for individuals and organizations seeking to profit from corruption. Another is the large number of dispersed actors involved (government regulators, different types of payers, health-care providers, drug and equipment suppliers and patients) which multiplies the number and kinds of interests that might encourage corrupt behaviour.

A third factor is the level of uncertainty that exists, regarding who will fall ill, when illness will occur, what kinds of illnesses people get and how effective treatments are. This makes it difficult for medical care service markets and health insurance markets to function efficiently, or for public health-care services to plan accurately for provision.

This is compounded by the fourth systemic feature of the health sector that makes it vulnerable to corruption: an asymmetry of information. Health-care providers know more about the technical features of diagnosis and treatment than patients; pharmaceutical companies know more about their products than doctors; individuals can withhold information about their health from health professionals or insurers; and health insurers and providers may know more about health risks faced by certain groups of individuals than the individuals themselves. The gaps in information make it more difficult for the various actors to monitor each other and hold each other accountable.

The World Bank's Public Expenditure Tracking Surveys are groundbreaking in that they show how powerful information can be in the hands of people who are directly affected by corruption in the health and education sector

Research into the causes and effects of corruption, when widely publicized and made available to patients, health professionals and policy-makers, can help rebalance some of these information asymmetries. The World Bank's Public Expenditure Tracking Surveys are groundbreaking in that they show how powerful information can be in the hands of people who are directly affected by corruption in the health and education sector. They aim to answer the question: "Does public money spent on health and education actually reach front-line health facilities and schools?" and have been conducted in 24 countries. The results are striking: leakage of recurrent non-salary expenditures at 200 health facilities in 40 districts in Ghana was estimated at 80%, and at 36 facilities in Tanzania was estimated at 40%; leakage of specific drugs and supplies at 155 government and private non-profit facilities in Uganda was estimated at 70% (Lindelow, Kushnarova & Kaiser 2006).

Armed with information stemming from such research, front-line service providers – and users of these clinics and schools – can demand improvements. In Uganda, for example, where the surveys were piloted in 1995, the percentage of money that "leaked" between the central government and schools decreased from 80% to 20% when the government started publicizing data on money transfers of capitation grants in newspapers and on the radio (Reinikka & Svensson 2004). Similar campaigns built on more research evidence in this area could prove quite effective in increasing accountability.

Another notable effort to harness the power of information was taken by the Buenos Aires state government, which adopted a strategy for monitoring how much hospitals were paying for medical supplies and disseminated this information among them. Purchase prices for the monitored items immediately fell by an average of 12%. Prices eventually began to rise again, but stayed below the baseline purchase prices for the entire time the policy was in place.

Corruption and the pharmaceutical sector

Pharmaceutical companies are key components of the health sector, and there are many points in the pharmaceutical development and supply chain that are vulnerable to corruption. OECD countries spend an annual average of US$ 239 on drugs per person (the main source of income for pharmaceutical companies which spend some US$ 16 billion per year marketing to physicians in the United States alone). In developing countries, the figure is lower, US$ 20 on average and US$ 6 in sub-Saharan Africa, but still represents the largest public health expenditure after personnel costs in most low-income states, and often the

largest household health expenditure overall.

A key point of vulnerability to corruption is the registration process: if regulators are subject to pressure from commercial groups, health objectives can be compromised. In 2004, for example, in the Indian state of Karnakata, the Office of the Drug Controller authorized the use of substandard drugs because the drug manufacturers had paid bribes.

Corruption also takes place in the drug selection process. In June 2004, for example, the pharmaceutical company Schering-Plough agreed with the US Securities and Exchange Commission (SEC) to pay a fine of US$ 500,000 for violations of the Foreign Corruption Practices Act. The company had made payments to a Polish charity headed by the director of a regional state-run Polish health authority. The SEC alleged that these payments were made to induce the director to buy Schering-Plough products for his health fund.

More transparency in the procurement supply chain can help reduce the risk of corruption. Transparency International's national chapter in Guatemala, for example, monitored procurement processes and generated information to show that medicine importers were unduly influencing the selection process, resulting in brand name medicines being bought in favour of cheaper generic drugs. This research was used to influence the development of the medicines procurement policy in Guatemala.

Conclusion

Failure to address corruption reduces the effectiveness of efforts by health professionals, governments, nongovernmental organizations (NGOs) and international organizations to improve health status around the world. Corruption affects all health systems, in rich and poor countries alike, but the effects of corruption vary across income and development levels. Wealthy men and women do not have to sell livestock or forgo a meal or a school book for their child if asked to pay a bribe for drugs or medical attention that should be free. And if the public health clinic is depleted because of corruption, a wealthy man or woman can seek private alternatives.

But while the evidence exists to show that corruption harms health, more evidence is needed to show exactly how urgent the problem is, and how much more effective health programmes would be if corruption-prevention strategies were made an integral part of them. As some of the examples highlighted above show, building research evidence in corruption and health can directly impact on accountability structures. When information based on such research evidence is put into the hands of civil society organizations, media/journalists, health-service providers or private companies, it supports transparency and accountability.

Corruption is seeping into the agendas of some health agencies. The WHO is devising ways to increase transparency in its medicines procurement programmes, and the Global Fund has pledged to devote more resources to analysing corruption risks in the countries with which it is engaged, rather than being forced to suspend programmes after-the-fact. But lessons are being learned slowly, and there are still uncharted areas of research. Research should be extended geographically, since the picture of corruption in health is still patchy; and through time, since only with repeated assessments of an area can we understand the effectiveness of specific anti-corruption measures. ❑

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References

Azfar O & Gurgur T 2006, 'Local-level corruption hits health service delivery in the Philippines', in Transparency International's *Global Corruption Report 2006* (Pluto Press, London) 'Who is paying for health care in Eastern Europe and Central Asia?, World Bank, Washington, DC.

Di Tella R & Savedoff W 2001, 'Diagnosis corruption: fraud in Latin America's public hospitals: Inter-American Development Bank, Washington, DC.

Hofbauer H 2006, 'Citizens' audit in Mexico reveals paper trail of corruption', Transparency International's *Global Corruption Report 2006* (Pluto Press, London), pp. 43–45. (In Mexico, the president of the congressional budget committee unilaterally sent instruction to the Ministry of Health, ordering money to be reallocated from HIV/AIDS public health campaigns to a NGO that campaigns against abortion, and was later found to have misspent the money).

Lewis M 2000, 'Who is paying for health care in Eastern Europe and Central Asia?', World Bank, Washington, DC.

Lindelow M, Kushnarova I & Kaiser K 2006, 'Measuring corruption in the health sector: what can we learn from public expenditure tracking and service delivery surveys in developing countries?' Transparency International's *Global Corruption Report 2006* (Pluto Press, London), pp. 29–37.

Prevenslik-Takeda L 2006, 'Corruption in Cambodia's health sector', Transparency International's *Global Corruption Report 2006* (Pluto Press, London), pp. 22–24.

Reinikka R & Svensson J 2004, 'The power of information: evidence from public expenditure tracking surveys' Transparency International's *Global Corruption Report 2004* (Pluto Press, London), pp. 326–329.

Savedoff W & Hussman K 2006, 'Why are health systems prone to corruption',Transparency International's *Global Corruption Report 2006* (Pluto Press, London), pp. 4–15.

Senanayake P 2006, interview with Pramilla Senanayake and 'Evidence, empowerment and education', retrieved from www.globalforumhealth.org/realhealthnews/interviews/may06_pram.php

Tanui K & Ng'ang'a N 2006, 'Corruption in Kenya's National AIDS Control Council', Transparency International's *Global Corruption Report 2006* (Pluto Press, London), pp. 112–115. (Investigators probing the Kenyan National Aids Control Council scandal found that several of the NGOs to which money had been channelled were so-called 'briefcase' organizations that existed in name only and were linked to NACC staff members).

Transparencia por Colombia 2006, 'Integrity index for public institutions: evaluating Colombia's health sector', Transparency International's *Global Corruption Report 2006* (Pluto Press, London), pp. 339–341.

The neglected problems of stillbirths and neonatal deaths

Article by Dean T Jamison

In low- and middle-income countries a remarkably large number of deaths occur near the time of birth. Every year, four million deaths occur during the first 28 days of life (the neonatal period) and another 3.3 million are estimated to occur in the third trimester of pregnancy or during childbirth (stillbirths). This annual total of 7.3 million deaths noticeably exceeds the 6.5 million deaths that occur after 28 days of age but under age 5. Despite the large numbers, relatively little policy attention has been directed to this age group. Interventions to reduce stillbirth and most interventions to reduce neonatal death involve prevention, a major theme of this volume.

This article draws heavily on a recent effort to incorporate deaths near the time of birth into the global burden of disease (GBD) framework (Jamison et al. 2006). Its purpose is to draw attention to this neglected age group by documenting its magnitude in the context of the GBD. In this effort it follows the work of Institute of Medicine (2003) and of Lawn and colleagues (Lawn, Cousens & Zupan 2005; Lawn et al. 2006; Zupan 2005). Secondly, and more briefly, the article points to the relevant priorities for intervention and for R&D.

Stillbirths and neonatal mortality in the context of the global burden of disease

This section first introduces the nomenclature used throughout the article. It then provides estimates of deaths and death rates that highlight stillbirths and neonatal deaths and discusses deaths by cause at different ages.

Nomenclature

In its nomenclature this article follows standard usage where possible, but extends or tightens it as needed. Stillbirth refers to the birth of a dead fetus weighing more than 1,000 grams up to 0.25 years (13 weeks) prior to the expected time of birth (corresponding to 27 weeks of gestational age). Total births are the sum of the number of live births and of stillbirths. Stillbirths are conventionally divided into two categories, antepartum stillbirths, when a fetus dies before the onset of labour, and intrapartum stillbirths, when fetal death occurs during labour. The term fresh stillbirths denotes fetuses born dead but with intact skin, which are assumed to have died less than 12 hours before birth and serve as an observable, surrogate measure for intrapartum stillbirths. Individuals younger than 28 days are in the neonatal period and younger than one year are infants. The neonatal period is divided into the early neonatal period, which refers to birth to less than seven days old, and the remaining late neonatal period. The postneonatal period extends from 28 days to less than one year. Child in this article refers to an individual from age one year to under five years. (In some other usage, however, child refers to all individuals under the age of five years.)

Numbers of deaths and death rates

In 2001, approximately 10.6 million children born alive died before their fifth birthday (8.2% of births). Of these deaths, 3.9 million occurred during the neonatal period, that is, under the age of 28 days. Another 3.3 million stillborn children remained outside the vital registration systems of most countries (WHO 2005a). When stillbirths are included among deaths, about half of all deaths of children under five occur under the age of 28 days.

Table 1 provides estimates of the numbers of stillbirths in 2001, with numbers broken down by World Bank income categories. The stillbirth numbers in the table come from rates estimated by the World Health Organization (WHO) (WHO 2005a) applied to the birth numbers reported in the table. Table 1 shows that in 2001, high-income countries (those with a gross national income per capita of more than US$ 9,076 in 2002) had 11.37 million live births and low- and middle-income countries had 118.51 million live births.

Table 2 provides an age breakdown of deaths among children under five years, again with a breakdown by World Bank income category. Early neonatal deaths account for 75% of all neonatal deaths. The eight-day period encompassing intrapartum stillbirths and early neonatal deaths accounts for

Thousands

Region	Population (mid-2001)	Live births	Stillbirths	Total births
Low- and middle-income countries	5,221,572	118,505	3,228	121,733
High-income countries	928,660	11,371	45	11,416
World	6,150,232	129,876	3,273	133,149

Sources: Population is calculated from United Nations Population Division 2003, table 1. Live births are calculated from population totals and crude birth rates in World Bank 2003. *Stillbirths are calculated from live births, using rates from WHO 2005.*

Table 1: Population totals and numbers of births, 2001

Thousands

	Stillbirths			Neonatal deaths			Deaths ages 28 days to < 1 year	Infant deaths (0 ≤ age < 1 year)	Child deaths (1 ≤ age < 5 years)	After live birth (0 ≤ age < 5 years)	Deaths under age 5 Including stillbirth
	Antepartum	Intrapartum	Total c	Early [a]	Late [a]	Total f		h		j	k
Region	a	b	(a + b)	d	e	(d + e)	g	(f + g)	i	(h + l)	(j + c)
Low- and middle-income countries	2,152	1,077	3,229	2,889	965	3,854	3,745	7,599	2,935	10,530	13,758
High-income countries	40	5	45	32	9	41	18	59	13	73	119
World	2,192	1,082	3,274	2,921	974	3,895	3,763	7,658	2,948	10,603	13,877

Source: Jamison et al. (2006), Table 6.2.
Note: See text for definitions of age groups.

Table 2: Age distribution of deaths under age 5 years, 2001

almost 30% of the 13.9 million deaths occurring under the age of five years.

Three recent studies provide extensive literature reviews and model-based estimates of the number of stillbirths and neonatal deaths that extend the WHO estimates used here (WHO 2005a). Lawn, Shibuya and Stein (2005, tables A-J) focus on intrapartum stillbirths and intrapartum-related neonatal deaths. Stanton et al. (2006) provide estimates of the number of stillbirths for 190 countries and Hill (forthcoming) provides estimates for neonatal deaths. The midpoints of their fairly wide confidence intervals accord with the numbers we use.

Deaths by cause

Estimates of the total number of deaths in different age groups provide a starting point for breaking those totals down into deaths by cause. This task inevitably involves some degree of arbitrariness because of problems with classifying multiple causes of death or underlying versus proximal causes. That said, available data from vital registration, sentinel surveillance, and verbal autopsy can provide reasonable approximations for most causes. Mathers, Murray & Lopez (2006) provides background on how this was done and generates the death by cause estimates used for the 2001 GBD. The published GBD 2001 numbers for deaths by cause provide only totals for under age 5 years although unpublished estimates were made available that divide the under-five age group into above and below age one year.

The aggregate numbers for neonatal deaths and for stillbirths come from WHO (2005a) as reported in table 2 (see also WHO 2005b, pp. 170–171). Table 3 breaks down neonatal deaths into six causes: diarrhoeal diseases, tetanus, respiratory infections, low birth weight (essentially preterm birth), birth asphyxia and birth trauma, and congenital anomalies. Separate estimates by cause were generated for the GBD and for WHO's Child Health Epidemiology Reference Group (CHERG) (Bryce, Boschi-Pinto & Shibuya 2005). Table 3 also provides the only comparison of GBD and CHERG estimates for under age five deaths as a whole.

For the most part, the neonatal death categories and numbers used by CHERG align with the categories used by the GBD assessment. However, note the following exceptions:

- CHERG has a pneumonia and sepsis category, which accounts for 26% of neonatal deaths globally and 27% in low- and middle-income countries. GBD categories include respiratory infections, which account for 1.945 million deaths worldwide in the 0–4 years group.
- CHERG's percentage of neonatal deaths due to tetanus (7%) far exceeds the GBD estimate for all infant deaths from tetanus.
- The GBD work uses the category low birth weight, which is an outcome of either preterm birth or intrauterine growth retardation. Preterm birth is a major cause of neonatal

Cause	Total deaths		Neonatal deaths	
	GBD	CHERG/WHO	GBD	CHERG/WHO
HIV/AIDS	340	318		
Diarrheal Disease	1,600	1,920	116	117
Measles	557	424		
Tetanus	187	273	187	273
Malaria	1,087	848		
Respiratory infection (and sepsis)	1,945	3,028	1,013	1,013
Low birth weight	1,301	1,091	1,098	1,091
Birth asphyxia and birth trauma	739	896	739	896
Congenital anomalies	439	312	321	312
Injuries	310	318		
Other	2101	1,178	446	194
TOTAL	**10,600**	**10,600**	**3,900**	**3,900**

Sources: For discussions of GBD and CHERG/WHO data and the methods used to generate comparable numbers from the two data sets see Jamison et al. (2006, pp. 430-431 and 461), which also reports the neonatal numbers. The numbers for total deaths from the two groups were calculated for this article using the same approach. Death totals are rounded.

Table 3: Causes of under age 5 mortality, worldwide in 2001, estimates from the GBD and CHERG/WHO (in thousands)

death. In the spirit of remaining within the GBD framework, we allocate preterm births to the low birth weight GBD category. This should not cause confusion as long as it is understood that, for neonatal deaths, low birth weight refers almost entirely to preterm birth.

We are not aware of any effort to aggregate data on causes of stillbirths that parallels the CHERG effort for neonatal deaths. This task remains a research priority.

In summary, previous assessments of the GBD have not included stillbirths or sufficiently emphasized the important causes of neonatal death. This was understandable given the intended focus of these studies. In addition, the inclusion of stillbirths would have highlighted issues about how to weight deaths at different ages that would have been difficult to incorporate into the disability adjusted life years DALY metrics being used to assess the GBD. Data on the numbers of stillbirths and neonatal deaths has improved, and a recent major effort by CHERG now provides a better picture than before of the causes of neonatal death. This article reports on incorporation of these findings into the GBD framework. The article's results point to the neglected significance of events near the time of birth and to the importance of advancing an agenda to understand and redress these problems.

Implications for intervention and research

We draw the following conclusions from this exercise:

- The numbers of stillbirths and of neonatal deaths are large. This underscores the importance of implementing tools and policies for addressing them. A number of recent publications points to directions for policy (Darmstadt et al. 2005; Institute of Medicine 2003; Lawn et al. 2006; Martines et al. 2005; Stoll & Measham 2001; Tinker et al. 2005; WHO 2005b; Zupan 2005).
- The inclusion of stillbirths within the standard GBD framework is now feasible, and future assessments of the GBD could consider doing so.
- The GBD cause structure would need relatively minor modifications to incorporate deaths at early ages. Birth asphyxia and preterm births could be separate subcategories, and sepsis and pneumonia could also be included as a separate category. Rather than reporting a single burden estimate for the under-five age group, more fine-grained age breakdowns could be used.
- The databases on numbers and causes of stillbirths and neonatal deaths require major investments so that they may be improved. The Demographic and Health Survey (DHS) network provides a natural vehicle for doing so. A review of the existing literature to improve understanding of the causes of stillbirths is also a priority. ❑

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References

Bryce J, Boschi-Pinto C, Shibuya K, Black RE & the World Health Organization Child Health Epidemiology Reference Group 2005, 'WHO estimates of the causes of death in children', *The Lancet,* vol. 365, no. 9465, pp. 1147–52.

Darmstadt GL, Bhutta ZA, Cousens SN, Adam T, de Bernis L & Walker N 2005, 'Evidence-based, cost-effective interventions that matter: how many newborns can we save and at what cost?' *The Lancet,* vol. 365, no. 9363, pp. 977-88.

Ezzati M, Lopez AD, Rodgers A & Murray CJL 2006, 'Comparative quantification of mortality and burden of disease attributable to selected risk factors', in Lopez AD, Mathers CD, Ezzati M, Jamison DT and Murray CJL (eds), '*Global burden of disease and injuries*', Oxford University Press, Oxford and New York.

Fishman SM, Caulfied LE, de Onis M, Blossner M, Hyder AA, Mullany L & Black RE 2004. 'Childhood and maternal underweight, in 'Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors', vol. I, M Ezzati, AD Lopez, A Rodgers & CJL Murray (eds), pp. 39–161, World Health Organization, Geneva.

Hill K (forthcoming), 'Estimates of the numbers of neonatal deaths'.

Institute of Medicine 2003, 'Improving birth outcomes: meeting the challenge of the developing world, National Institutes of Science, Washington, DC.

Jamison DT, Shahid-Salles S, Jamison J, Lawn J and Zupan J. 'Incorporating deaths near the time of birth into estimates of the global burden of disease', in A Lopez, C Mathers, M Ezzati, D Jamison & C Murray (eds) '*Global burden of disease and risk factors*, Oxford University Press 2006, pp. 427–463, Oxford and New York.

Lawn JE, Cousens S & Zupan J 2005, '4 million neonatal deaths: when? where? why?' *The Lancet*, vol. 365, no. 9462, pp. 891–900.

Lawn JE, Shibuya K & Stein C 2005. 'No cry at birth: global estimates of intrapartum stillbirths and intrapartum-related neonatal deaths', *Bulletin of the World Health Organization*, vol. 83, no. 6, pp. 409–16.

Lawn JE, Zupan J, Begkoyian G & Knippenberg R 2006, 'Newborn Survival', in DT Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills & P Musgrove (eds), '*Disease control priorities in developing countries*', 2nd edition, Oxford University Press, Oxford and New York, pp. 531–549.

Lopez AD & Murray CC 1998, 'The global burden of disease, 1990–2020', *Nat Med.*, vol. 4, no. 11, pp. 1241–3.

Martines J, Paul V, Bhutta Z, Koblinsky M, Soucat A, Walker N, Bahl R, Fogstad H & Costello A 2005, 'Neonatal survival: a call for action', vol. 365, no. 9465, pp. 1189–1197.

Mathers, CD, Murray CJL, and Lopez AD 2006. 'The burden of disease and mortality by condition: data, methods and results for the year 2001', in '*Global burden of disease and risk factors*', A Lopez, C Mathers, M Ezzati, D Jamison & C Murray (eds), Oxford University Press 2006, New York.

Stanton C, Lawn JE, Rahman H, Wilczynska-Ketende K & Hill K 2006, 'Stillbirth rates: delivering estimates in 190 countries', vol. 367, no. 9521, pp.1487–94.

Stoll BJ, & Measham AR 2001, 'Children can't wait: improving the future for the world's poorest infants', *Journal of Pediatrics* vol. 139, no. 5, pp. 729-33.

Tinker AP, ten Hoope-Bende P, Azfar S, Bustreo F, & Bell R 2005, 'A continuum of care to save newborn lives', *The Lancet* vol. 365, no. 9462, pp. 822-25.

WHO (World Health Organization) 2005a, 'Neonatal and perinatal mortality. Country, regional and global estimates', draft, WHO, Geneva.

WHO (World Health Organization) 2005b, '*World health report: make every mother and child count*', WHO, Geneva.

Zupan J 2005, 'Perinatal mortality in developing countries', *New England Journal of Medicine* vol. 352, no. 20, pp. 2047-48.

Research for maternal, neonatal and child health partnerships

Article by Andres de Francisco

One of the most striking expressions of health and development inequities is seen in the different rates of mortality and morbidity of mothers and children between countries. This contrast is seen not only between low-, middle- and high-income countries, but also within countries at any stage of development. There are 10.8 million deaths in children under five years old every year, four million neonatal deaths and half a million deaths in pregnant women (WHO 2005). Most of these deaths occur in low- and middle-income countries (LMIC), mostly in poor populations.

After a waning of the 1980s drive to reduce mortality and improve health of mothers and children, a new focus is emerging in the public health arena. In this drive, international treaties, country action and health partnerships have been promoted in recent years to help increase advocacy and action, and to improve the health of mothers and children in LMIC. As a recognition that maternal, neonatal and child health have been relatively neglected areas, two of the eight UN Millennium Development Goals focus specifically on mothers and children (UN 2001).

The argument that attention to these symptoms of poverty is expensive or unaffordable is being proved wrong. Child survival, for example, has been shown to be good value for money (World Development Report 1993). Even in relation to the cost of public-health initiatives, the application of what we know has been reported to have the potential to reduce child mortality by up to two-thirds (Jones et al. 2003). The question that needs to be posed is to what extent do we have all responses needed, and whether more research on maternal and child health programmes is required to improve the application and adaptation of interventions. We do have cost-effective tools to reduce child mortality. However, an important consideration in this debate is that we do not have most of the tools, models and mechanisms to decrease maternal and neonatal mortality.

The present article reviews international action undertaken through health partnerships, and argues for the need for research on child and maternal health to provide further essential evidence and to develop programmes to improve health and reduce mortality.

The magnitude of the problem and its causes

Mothers

Maternal health and safe pregnancy require by definition working health systems and referral mechanisms. This touches upon the health services and also upon the communities where the woman lives. Frequently the identification of complications during pregnancy does not occur, and the referral, if needed, does not happen.

Figures on maternal ill-health are compelling. Some eight million of the 210 million women who become pregnant each year suffer life-threatening complications of pregnancy leading to long-term morbidity (AbouZahr & Wardlaw 2003). There are wide differences within and between countries and population sub-groups in the 529,000 mothers who die every year. A woman's lifetime risk of dying from pregnancy-related causes ranges from one in six or seven in countries such as Afghanistan, Malawi and Niger, for example, to one in 1,300 or more in Mauritius, Uruguay and Cuba. Proportions of adults aged 15–49 living with HIV/AIDS range from under 1% up to 35% or even more within sub-Saharan Africa (UN Department of Economic and Social Affairs 2004).

Results from epidemiologic and anthropologic research have shown that a large proportion of maternal deaths occur during or around labour and delivery, and that most women in LMIC deliver at home or far from a health service facility (see Table 1). Research is, therefore, required to develop and test strategies through which maternal programmes can act at the household level. This needs involvement of the communities where these events occur. Global Safe Motherhood initiatives and the Making Pregnancy Safer strategy of WHO have contributed substantially to reductions in pregnancy-related deaths in some parts of the developing world, especially in middle-income countries that have good primary health systems (WHO 2005). However, little progress has been achieved in poor countries which lack health systems capacity.

Children and neonates

Figures compiled for 2003 by the UN indicate that childhood mortality rates are now dropping throughout LMIC (Editorial, *The Lancet* 2005). The problem is that they are not dropping fast enough to meet the 2015 target and it is now understood that research can help accelerate that progress. Yet, most epidemiological and clinical neonatal research around the world focuses on the 1% of deaths in rich countries, while most neonatal deaths occur in LMIC (Lawn et al. 2004).

Neonatal deaths are closely related to maternal complications, and the descriptions of safe motherhood interventions also apply to the reduction of neonatal mortality.

Timing	Conditions	%
Pre-existing conditions	Poor nutritional status, anaemia, malaria, diabetes, STI-HIV	19
Events occurring early in pregnancy	Complications of unsafe abortions and ectopic pregnancies	21
Events occurring later in pregnancy	Hypertensive disorders, eclampsia	12
Complications of delivery	Prolonged or obstructed labour, retained placenta, lacerations, uterine rupture or inversion	8
Complications within hours or days of postpartum	Postpartum haemorrhage	25
Later postpartum	Puerperal sepsis	15

Table 1: Timing and conditions accounting for maternal deaths (de Francisco et al. 2006)

Most neonatal deaths are avertable with existing, cost-effective interventions, as these include pneumonias (19%), diarrhoeas (17%), malaria (8%), HIV/AIDS (3%) and others including noncommunicable diseases and injuries (13%) (Black et al. 2003). Further, every year an estimated four million babies die in the first four weeks of life (the neonatal period), and a similar number are stillborn (*The Lancet* 2005). Three-quarters of neonatal deaths happen in the first week – the highest risk of death is on the first day of life, and almost all (99%) neonatal deaths arise in LMIC. The main causes are preterm birth (28%), severe infections (26%) and asphyxia (23%).

However, while we know "what" to target in mortality reduction, we have too little knowledge on "how" to do it.

Global action

To redress the inequalities described above, a series of global advocacy activities was established. The Programme of Action at the International Conference on Population and Development (ICPD) in Cairo in September 1994 was reaffirmed in a number of international forums such as the Fourth World Conference on Women held in Beijing in 1995; (Report of the International Conference on Population and Development 1994) and in the adoption of a global Reproductive Health Strategy by the World Health Assembly in 2004 (World Health Assembly 2004).

In the field of child and neonatal health, a group of stakeholders met under the Rockefeller Foundation's auspices to discuss "Knowledge into action: improving equity in child health" at Bellagio, Italy, in February 2003. Their outputs, captured in two special issues of *The Lancet* (*The Lancet* 2003), reviewed research evidence on the current status of child and neonatal health and possible future courses of action. The group identified gaps in action as follows:

- **leadership:** no institution or individual is out in front pioneering responses to failures and needs, influencing technical and political agendas, directing investments, and producing credible evidence that child mortality is decreasing as a result of specific actions;
- **strong health systems:** the longer-term goal must be systems of public health capable of defining needs, generating resources, managing programmes and people, delivering cost-effective services, and gathering and using data to improve the effect of their efforts;
- **adequate and targeted resources:** the Commission on Macroeconomics and Health calculated the yearly costs of scaling-up child health interventions would be about US$ 1 billion for vaccinations, US$ 4 billion for treatment of childhood illnesses, and an additional US$ 2.5 billion for malaria prevention and treatment for all age groups combined (Sachs 2001).
- **awareness and commitment to action:** in order to mobilize the general community to demand services for maternal and child health, in particular for the poorest sections of the population. This includes the availability of information extracted from research studies.

In relation to the lack of research promotion on child health, a group of stakeholders initiated and established the Child Health and Nutrition Research Initiative (CHNRI)[1]. CHNRI has now worked with priority-setting tools to maintain the focus and identify research gaps and priorities in the field of child health and nutrition.

The continuum of care – mothers and children

In the process of improving health, the realization that maternal and child health programmes need to go hand in hand due to the close interlinkages which exist between them becomes important. It is now understood that the MDGs will not be achieved if there is no focus on both mothers and their children. This realization increased the interest and the funding of international funding organizations both from governments and from the private not-for-profit sector. The Bill and Melinda Gates Foundation, for example, has increased dramatically its investment in mothers and children in LMIC[2].

The most recent effort to link the health of mothers and children was the establishment of the Maternal, Neonatal and Child Health Partnership (PMNCH) hosted by the World Health Organization (WHO) in Geneva. PMNCH has over 75 members of whom 12 are governments and has at its core WHO and UNICEF. It resulted from a merger of three world-leading partnerships: the Partnership for Safe Motherhood and Newborn Health (emerging from the merger of the Safe Motherhood Initiative and the Safe Motherhood Interagency Group in 2003); the Healthy Newborn Initiative established in 2000; and the Child Survival Partnership established in 2004[3].

The resulting PMNCH makes sense given the close relations between mothers, neonates and children and the consequences for either which follow if the health of the other is affected. It works on the "continuum of care" principle, which has two meanings:

- a continuum that spans life's beginnings, from before

[1] http://www.chnri.org/index.html accessed on 20 July 2006.
[2] http://www.gatesfoundation.org/ accessed on 24 July 2006.
[3] http://pmnch.org, accessed on 28 June 2006.

conception through pregnancy, childbirth and infancy to childhood;
- a continuum that goes from the home, through the health centre and, when needed, the end referral facility.

The role of research for action

Extensive research over the years has contributed to the knowledge base on cost-effective interventions; it is their implementation that poses the greatest challenge. Information on ways to scale up programmes, to target populations, to improve cost-effectiveness and ensure equity are of paramount importance and these can be informed by the results of research. It is important to remember that most of the design of programmes used by these partnerships is the result of research studies. We look below at the various types of research areas which can help partnerships to improve the effectiveness of their action. It is important to state that this research does not necessarily need to be undertaken or supported by the partnership itself.

Research for programme development: health systems issues

As described above, one of the most important challenges currently for health systems is not "what" to do, but "how" to do it. While we have considerable information on the way to reduce maternal mortality and improve maternal health, it is often difficult to operationalize this to the level of expanding the interventions throughout a region or a country. Research often provides policy-makers with the results of "proof of principle", or the efficacy of an intervention undertaken under controlled systems. The information often missing is that of the way in which these interventions could work in "real life", using the government systems of health (with all their faults). This is a key research gap that needs to be addressed in a variety of contexts.

An example of the information missing was the identification that oral antibiotics are as effective as parenteral antibiotics for severe pneumonia in children

An example of the information missing was the identification that oral antibiotics are as effective as parenteral antibiotics for severe pneumonia in children (Campbell et al. 1988; de Francisco & Chakraborty 1998). This was a very important finding which shaped the pneumonia control programmes. Before this information was available, mothers and children were required to attend health facilities five days in a row for the child to receive an injection every day. With the results of these studies, mothers were able to provide the antibiotics at home to their children, thereby saving time and money.

Important research was undertaken recently on the cost-effectiveness of scaling up strategies for maternal, neonatal and child health in LMIC. The investigators evaluated the requirements to scale up interventions, and worked using a system called "the expansion path" to identify a selection of interventions which could have the highest effect for a specific cost for maternal and neonatal health (Ahmed et al. 2005). A similar study was undertaken for child health interventions (Tan-Torres Edejer 2005). In these two publications investigators looked, within various WHO defined regions, for the most likely combination of interventions which would reduce most deaths according to the epidemiologic patterns of the populations.

One additional relation between the partnerships and the results of research is the potential impact that research can have on the effectiveness of the partnership. Frequently, local adaptation of programmes is required, and a rigorous evaluation of the effectiveness and implementation can help not only to decide the best interventions, but also to provide policy-makers with arguments to promote maternal and child health programmes. Further, operations research can also identify bottlenecks to implement programmes, and the generic elements required to scale up interventions.

Research can also help to identify and overcome obstacles within health systems such as retaining qualified staff; recruitment; training and the adoption and scaling up of best practices and obstacles within families and communities that impede women's capacity to go through pregnancy safely and to have a safe delivery; the relation of the health system with sectors other than the traditional health sector; the relation with civil society (for example, transporting women to a health facility); issues of health education through the health services; the interaction with the private sector and the traditional health care system; and the interactions between maternal, neonatal and child health programmes.

Research for tool development

Most of the tools used currently in maternal, neonatal and child health programmes derive from the results of research. Medicines, diagnostic tools and vaccines all went through a rigorous test to lead to their design and production. This is frequently not appreciated and therefore research is not supported nor seen as part of programme development.

There are large numbers of such tools which could improve child and maternal programmes. For mothers, tools which would be easily applied at the home level to avoid postpartum haemorrhage or haemorrhage due to placental retention, while the woman is waiting to be referred to the health facility, would be important to reduce mortality. Similarly, easily applicable methods to screen for pre-eclampsia or for asymptomatic bacteriuria during pregnancy could have an important impact for safe motherhood programmes. Easily applicable drugs, usable at the home level when a woman is referred as a potential pre-eclamptic patient, would be extremely useful. Further, neonatal interventions which reduce mortality are needed, and these include ways to identify at the home level early signs of hypoglycaemia and hypothermia. These tools could have an immense potential to identify neonates at risk of death. Efficacy studies on the components of the neonatal package are required to improve its potential impact when used. Studies on impregnated bed nets have been shown to significantly reduce malaria mortality in children and

Studies are required to document the role and the potential of community participation both in the definition of the question to be addressed with research but also on the improvement of programmes when the community is mobilized

pregnant women (Alonso et al. 1991).

WHO estimates that about 1.6 million people, including up to one million children under five years old, die every year of pneumococcal pneumonia, meningitis and sepsis (Kabra et al. 2006). Serotypes of pneumococci which are prevalent in developed countries do not necessarily match lethal serotypes prevalent in developing countries. This is important because it is frequently more lucrative to develop vaccines which act against serotypes that predominantly cause otitis media in developed countries than those which kill developing country children due to pneumonia. Research on these rather neglected health problems in LMIC is required.

Nevertheless, there is now great interest from the private sector to invest in vaccines and medicines which affect developing countries. Examples of these interactions include work by the pharmaceutical industry on Haemophilus influenzae type b (Hib), Streptococcus pneumoniae, Neisseria meningitidis and Rotavirus. Similarly, there are large trials ongoing in LMIC (Bangladesh, Gambia) with vaccines which will most likely reduce causes of specific mortality and morbidity. This is particularly important for trials supported by the private sector.

Research for and by communities

Interactions between health, health promotion and risk factors are essential to improve maternal, neonatal and child health. There have been useful results from studies on how to promote maternal health, including the number of antenatal visits required during pregnancy.

Studies are required to document the role and the potential of community participation both in the definition of the question to be addressed with research but also on the improvement of programmes when the community is mobilized. This is important in the light of primary health-care programmes (de Francisco et al. 1994). Further, information on how best to promote health of mothers and children at the community level is of paramount importance to ensure the application of international treaties on health promotion. A recent study indicated that the prioritization of interventions using a Cochrane database could be very instrumental in identifying research gaps in health promotion (Doyle et al. 2005).

Further, it is increasingly recognized that studies on sectors beyond the Ministry of Health activity are necessary. The work of the new WHO Commission on Social Determinants of Health will contribute greatly to this widening of the health agenda. Recent studies in Bangladesh show the close interrelation between flood protection programmes and health status (Myaux et al. 1997). These interactions between the environment and health of mothers and children need to be better documented for partnerships to provide guidance on these relationships.

Conclusions

It is now understood that the MDGs will not be achieved unless there is a focus both on mothers and their children. It is often forgotten that many of the tools we have currently to reduce maternal and child mortality are the result of past research and development efforts. To keep up with the pace of progress we need to invest in research for the future.

We do have enough information to achieve the MDGs, but have not yet committed all the resources necessary to achieve them. There is a place for research on health to improve programme development and implementation; to enhance the availability of information and monitoring of progress; to cross-fertilize scaling up experiences; to provide policy-makers with arguments and tools to leverage funds and political commitment; to improve effectiveness and reduce costs of similar interventions; and to inform the public as a whole. These key functions to help partnerships working on mothers and children can enhance their effectiveness and, ultimately, their impact. ❑

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References

AbouZahr C & Tessa Wardlaw 2003, 'Maternal mortality in 2000: Estimates developed by WHO, UNICEF and UNFPA' (Geneva: WHO), http://www.who.int/reproductive-health.

Ahmed T, et al. 2005, 'Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries', *BMJ*, pp. 1107-17.

Alonso PL et al. 1991, 'The effect of insecticide-treated bed nets on mortality of Gambian children', *The Lancet*, Jun 22; vol. 337, no. 8756, pp. 1499-502.

Black RE, Morris SS 2003, Bryce J, 'Where and why are ten million children dying every year?' vol. 4, no. 361, pp. 2226-2234.

Campbell H, et al. 1998, 'Trial of co-trimoxazole versus procaine penicillin with ampicillin in treatment of community-acquired pneumonia in young Gambian children', *The Lancet*, Nov 19; vol. 2, no. 8621, pp. 1182-4.

De Francisco A et al. 1994, 'Comparison of mortality between villages with and without primary health care workers in Upper River Division, The Gambia', *J Trop Med Hyg*. Apr; vol. 97, no. 2, pp. 69-74.

De Francisco A & Chakraborty J 1998, 'Adherence to cotrimoxazole treatment for acute lower respiratory tract infections in rural Bangladeshi children', *Ann Trop Paediatr*. Mar, vol. 18, no. 1, pp. 17-21.

De Francisco A, Dixon-Mueller R & Catherine d'Arcanges 2006, 'Research Issues in sexual and reproductive health for low- and middle-income countries', forthcoming discussion paper.

Doyle J et al. 2005, 'Global priority setting for Cochrane systematic

References continued

reviews of health promotion and public health research', *J Epidemiol Community Health*, Mar, vol. 59, no. 3, pp. 193-7.

Jones G, Stekettee RW, Black RE, Bhutta ZA & Morris SS; The Bellagio . Child Survival Study Group 2003, 'How many child deaths can we prevent this year?', *The Lancet*, vol. 362, pp. 65-71.

Kabra S et al 2006, Cochrane Database Syst Rev, Jul 19, 3:CD004874.

Lawn JE et al, '4 million neonatal deaths: When? Where? Why?', *The Lancet* 2004, vol. 364, pp. 399-401.

Myaux J et al 1997, 'Flood control embankments contribute to the improvement of the health status of children in rural Bangladesh', *Bull World Health Organ*, vol. 75, no. 6, pp. 533-9.

Report of the International Conference on Population and Development, Cairo, 5-13 September 1994 (New York: United Nations); Adrienne Germain and Rachel Kyte, 'The Cairo Consensus: The Right Agenda for the Right Time' (New York: International Women's Health Coalition, 1995).

Sachs JD 2001, 'Macroeconomics and health: investing in health for human development', World Health Organization, Geneva.

Tan-Torres Edejer T et al. 2005, 'Cost effectiveness analysis of strategies for child health in developing countries', *BMJ*, vol. 331, pp. 1177-87.

The Lancet 2003, 'Knowledge into action for child survival', vol. 362, pp. 323-327.

The Lancet 2005, vol. 365, pp. 977-988.

The Lancet 2005, 'An open gate to newborn and child survival', vol. 366, pp. 1984.

United Nations Department of Economic and Social Affairs 2004 (see note 8): Table A12.

United Nations, General Assembly, 56th session 2001, 'Road map towards the implementation of the United Nations millennium declaration: Report of the Secretary-General', United Nations, New York, UN document number A/56/326.

World Development Report 1993: 'Investing in health', Oxford University Press for the World Bank 1993, Washington, DC.

World Health Assembly 2004, Reproductive Health Strategy to Accelerate Progress towards the Attainment of International Development Goals and Targets, adopted by the 57th World Health Assembly, May 2004, WHO/RHR/04.8 (Geneva: WHO 2004), http://www.who.int/reproductive-health/publications/strategy.pdf.

World Health Organization, 2005, *World Health Report – making every mother and child count*, Geneva.

Research for future health systems

Article by David H Peters (pictured), Gerry Bloom, M Hafizur Rahman, Abbas Bhuiya, Barun Kanjilal, Oladimeji Oladepo, George Pariyo, Zhang Zhenzhong and Sandhya Sundaram

How should health systems in developing countries be organized? Can research provide some answers to this question? The decades old tension between two broad approaches to developing health systems seems to have increased, with one side positing that it is better to concentrate on a few priority programmes for specific diseases, and the other to more generally strengthen health systems (Mills 2005). A new set of actors and global health initiatives have brought more funding and attention to particular disease programmes, particularly for AIDS, tuberculosis, malaria and child vaccinations, while at the same time calling for more attention to strengthen the underlying health systems and harmonize development assistance, including advocating for Sector Wide Approaches (SWAps) and more general budget support to country's strategies based on sound policy commitments (High-Level Forum 2005). There remain significant constraints to improving the delivery of health services in developing countries, but there is a growing consensus that both specific programme and health systems approaches depend on the other to overcome them (Stillman & Bennett 2005; High-Level Forum 2005). Some have advocated for large infusions of money as the main means to improve health systems (Sachs 2004). We argue against assuming that simply providing funding or packaging interventions to deal with constraints will provide predictable results across low-income countries. What is needed is better research, monitoring and evaluation to capture the benefits that could come from the new attention and funding for future health systems.

In this article, we briefly review the types of constraints faced by health systems in developing countries, and point to the types of information and research needed by decision-makers to address these constraints. Future health systems in developing countries will not meet their goals by simply "cutting and pasting" interventions developed and tested elsewhere. Instead, influencing how future health systems actually work will depend on understanding the increasingly complex and unpredictable interactions of local, national and international actors and trends. For health systems to better serve the poor and vulnerable populations, a central goal of most health systems, these realities raise particular challenges that can only be met by continuing assessment of how the interests of the poor are being met.

Constraints to strengthening health services

A number of recent papers have examined approaches to strengthening health systems in low-income countries by examining the constraints to providing effective health services (Hanson et al. 2003; Oliveira-Cruz, Hanson & Mills 2003; Ranson et al. 2003; Travis et al. 2004); the findings are summarized in Table 1.

Each of the analysts identifies limited financial and human resources as common constraints to improved health systems in low-income countries; highlights problems with lack of demand for appropriate health services, deficiencies in how health services are managed, and weaknesses in public bureaucracy and governance; and offers suggestions for how to address some of these constraints. For example, more financing may be more effective for some types of constraints, such as poor supply of drugs and equipment, and possibly improving demand for services (Hanson et al. 2003). Oliveira-Cruz, Hanson & Mills (2003) point to a review by Johnston and Stout (1999) to suggest that it is the continuous commitment to improvement, the analysis of constraints, flexible implementation, and positive macroeconomic and governance environments that are most useful in strengthening health services.

Unfortunately, there is very little strong evidence to indicate which constraints are most important, or what strategies are most effective in overcoming these constraints. The reason for this is that the constituent studies that comprise the evidence basis for the reviews are mostly of limited scientific value, caused by flaws in study design that do not well define the particular strategies under investigation or that can attribute change to strategies pursued.[1]

With the growth of disease-specific programmes, another argument is that these programmes should be able to strengthen health systems in a variety of ways (Buve, Kalibaba

[1] The common deficiencies in research design include: (1) lack of specificity in describing the strategies or intervention that are being pursued, so it is hard to determine what the intervention actually consists of or whether it was implemented, and very different strategies are often given the same label; (2) many strategies involve multiple components that are not specified, nor studied in a way that would indicate which component is essential, or where there are synergies between components; (3) most studies do little to examine factors beyond the health system or the intervention itself that may influence the results being examined; (4) there are limited attempts to design studies that can actually attribute results to the strategy, including use of time series or before-after data, or use of comparison groups and randomization.

& McIntyre 2003; Melgaard et al. 1999). While there is much appeal to these notions, evidence is usually not available to demonstrate that these spillover effects actually occur. Some studies note that while large disease control programmes can be effective in addressing the specific problems on which they focus, there are also potentially harmful effects on the general health systems, such as duplicated and uncoordinated systems, replacement of local priorities with those of donor interests and distortions in salary structures (Stillman & Bennett 2005; High-Level Forum 2005). In reviewing studies that examine ways of strengthening specific programmes and studies that attempt to strengthen a range of health services, Ovretveit (2006) concludes that there is little evidence for or against the view that specific programmes distort overall health services away from local needs. Nonetheless, he notes that some strategies to deliver particular services can reduce motivation to provide others (e.g. special payments to provide immunizations may reduce delivery of other services).

The consequence of this weak research base is that policy-makers and managers are unable to inform their choices with conclusive evidence about what strategies work best. Researchers of future health systems must produce better evidence, and incorporate this evidence into the decisions that are made about health services delivery. Another big challenge will be to provide information about the growing number of innovative strategies that are being pursued.

Innovations in health services

The time has come to consider innovations in health care beyond those of simple technological invention, such as a new drug or equipment. Innovation is increasingly viewed as a process of generation and implementation of new ideas, products, services, practices and policies. Morel and colleagues (2005) argue that developing countries must be able to undertake innovation if they are to address the huge health problems that they face. In health systems, developing countries are pursuing a wide range of new ideas, including contracting strategies, performance related incentives, decentralization of authorities and resources, social marketing of health products, public-private partnerships, new forms of health insurance, and new approaches to engaging and empowering communities. Despite the growing numbers of these types of innovations, we still do not know how well these new approaches contribute to improved performance of health systems, or whether it is the act of being innovative that can improve health systems performance.

A recent review of the experience with innovations in contracting services with non-state entities has shown promising results, particularly in increasing coverage of primary care services across a range of settings (Loevinsohn & Harding 2005). But large-scale contracting on a sustained basis has yet to be evaluated. An analysis of new community financing schemes suggested that they would be able to increase access to health care and provide some financial protection, but were likely to be sustainable only if the insurance pools were large enough and well managed, and if the financing schemes were linked to strong provider networks; these are all high requirements for most low-income countries (Preker et al. 2002). The use of community-directed treatment in the Africa Onchocerciasis Control Programme demonstrated on a large scale how approaches that empowered communities were more effective in distributing treatment than traditional approaches through health workers (World Health Organization 1996).

In an effort to examine innovations that have not appeared in published literature, an exploratory study was conducted to examine which innovative health delivery strategies were adopted, developed and implemented in 12 low-income countries (Janovsky & Peters 2006). They found that although many countries were intending to adopt new innovations, there was a large gap between plans and implementation. Whereas social marketing has been implemented successfully across many countries, adoption and implementation of approaches such as decentralizing public services or community engagement have been more difficult to design and implement, with success in implementation being dependent on contextual factors and the influence of local stakeholders. There was indication that adopting innovative strategies is related to improving trends in general primary care service delivery in these countries, though the evidence is far from conclusive. Also of concern is the finding that there are many apparently successful innovations which fail to scale up to cover larger populations, primarily because they are not adequately designed or tested.

Several models for scaling up innovations have been proposed, including those described as expansion, replication

Types of constraints	Examples
Individuals & communities	lack of demand; lack of financial resources; social and physical barriers to care; participation of communities
Health service providers	limited staff; weak motivation; inadequate drugs, equipment and buildings; poor technical guidance, supervision and management systems
Health sector policy	inadequate vision; inappropriate planning and regulatory systems; limited accountability; reliance on donors and donor priorities; poor collaboration with NGO and private sector stakeholders
Cross-sectoral policy	inefficient, non-responsive and rigid government bureaucracies; confused or insufficiently supported decentralization strategies; poor roads and communications infrastructure; low emphasis on education
Country context and global influences	corruption and poor governance; insecure or unstable social and political environment; macroeconomic instability; trade and migration pressures; poor physical environment

Table 1: Health systems constraints in low-income countries

or collaboration (Cooley & Kohl 2005). While simple growth of a programme is the most common form of expansion, innovative models can also be expanded through franchising and spinning off parts to act independently. The most common form of replication is simple policy adoption (adopting a pilot project as a policy for a larger programme), followed by grafting of a component of a model into another method of service delivery. Diffusion and spillover are other methods of replication by which models spread spontaneously through informal networks. Collaborative approaches to scaling up may involve formal partnerships, joint ventures and strategic alliances, or more complex use of networks and coalitions (Cooley & Kohl 2005). We propose that future pilot projects incorporate these types of considerations of scaling up into their design.

Although there have been a large number of innovative strategies proposed in the organization of health services, there remains a wide gap in understanding which strategies work best. Scaling up strategies that focus on equity seems to be a particular challenge. This may be because "scaling up is not exclusively a technical and managerial undertaking unaffected by the outside world. It is influenced by persistent gender inequality and other cultural factors, the extent of poverty in a country, the capacity of the national health sector and its bureaucratic institutions, historical legacies, and the nature of the political system" (WHO 2006). To bridge these gaps in knowledge and to formulate flexible and culture-specific strategies, there is a need for health systems research and evaluation that can incorporate these factors and models of how they can be scaled up.

Role of institutions

A health system's performance is strongly influenced by its institutional arrangements and the social context within which it is embedded. These arrangements include formal and informal rules and associated beliefs and behavioural norms. The health systems of the advanced market economies depend on the existence of a strong state, a complex web of interrelated organizations and deeply entrenched value systems, which make their operation relatively predictable. There is evidence that when institutions from these countries are transferred to other contexts they perform quite differently (Pritchett & Woolcock 2004).

There is a large gap between the health system's formal rules and how things actually work in many countries. For example, government health workers may get very low salaries, which they supplement from a variety of sources. This introduces market relationships into public health systems and strongly influences the performance of service providers and the ability of the poor to obtain services. Health interventions that do not take this reality into account are likely to have unintended outcomes. There is a growing body of research that recognizes the pluralistic nature of the health systems of many low-income and transitional countries (Bloom & Standing 2001; Leonard 2000). They have documented a proliferation of private providers of goods and services and a breakdown of boundaries between public and private sector. They argue that we must pay more attention to the incentives health sector actors face and the institutional arrangements within which they function.

One issue that has come to the fore is the character of the relationship between the population, providers of services, the state and other health sector actors. The effective functioning of a health system requires high levels of trust (Gilson 2003; Mackintosh & Tibandebage 2002). People need to trust health workers to use their expertise in the interest of their clients and they need to trust insurance schemes to operate according to their rules. In the absence of trust, people face great difficulty in deciding whom to consult when a problem arises and how to obtain good quality drugs. In consequence, they waste a lot of money on ineffective treatment and do not feel confident that they can find help when they need it.

One of the greatest challenges for health policy-makers is to find ways to foster the development of trust-based institutional arrangements (Bloom, Lloyd & Standing 2006). There is no agreed recipe and there are many knowledge gaps. We need to understand how people in countries with weak states choose health providers and where they obtain health-related knowledge. We need to help them cope with the wide variety of providers of health services and sources of information. Effective health systems usually involve partnerships between government (central and local), market organizations (providers of both goods and services) and civil society bodies representing a variety of stakeholders. We need increased understanding of how health sector actors work together to achieve agreed social goals. We also need to understand how stakeholder interests influence health service delivery and regulation. The creation of effective institutions is essentially a political process. There has been a growth in political demands for better health services in recent years. We need to understand more about how societies build a consensus in favour of health system development that can support the creation of complex trust-based institutional arrangements.

What is the role of research in future health systems?

Many key questions about how to improve health systems need to be answered, particularly about how to address the problem of implementation. More systematic review of past experience of various strategies to improve health systems, including review of implementation experience and the role of key institutions, would provide useful contributions to the knowledge base for future health systems.

Another critical step is to improve the design and execution of research and evaluation of emerging health services strategies. Overcoming these research deficiencies poses considerable methodological challenges, but some simple research and evaluation principles could be demanded by decision-makers and funders to improve the quality of information:

- define what strategy or intervention is being pursued in sufficient detail, identifying the objectives, clearly specifying the elements of the intervention, and the intensity, duration and coverage of the intervention, and the context in which it occurs;
- identify and explain how factors outside the control of the

programme may influence the results;
- gather data systematically on results, whether from surveys, interviews, or observations, but using and describing reproducible methods with sufficient sample sizes to draw conclusions;
- use study design techniques and collect data that measure and deal with causes of potential change beyond the strategy that can bias the results; analyse how these factors influence the results; gather data at different points in time during implementation of a programme, preferably using comparison groups to reduce bias in attributing changes to the strategy;
- use the analysis of data to draw conclusions, and do not rely solely on the intended effects of the strategy or the prior opinions of the researchers or key stakeholders.

Even with more "scientific" research, experience shows that the nature of health systems is such that the results of any particular intervention are unlikely to be predicted, even for simple strategies repeated in the same country. This lack of precise predictability may be due to the complexity of the strategies or the context in which they are implemented, but also because people and institutions are not mechanical in nature, but are organic and adaptive. We therefore propose that other types of research are also needed. Such approaches are not strictly dependent on mechanistic or stochastic models, but can examine how social arrangements actually work. This may involve in-depth study of innovative approaches, careful studies of the incentives people face, prediction of unintended consequences of interventions, and testing new ways to build effective partnerships for health development. The plans for substantially increasing financial flows to health systems represent a major social experiment, and we should anticipate unexpected outcomes. Research can help anticipate these outcomes and test strategies for mitigating them.

In addition to producing better quality and different types of evidence, it is important that the content of research addresses the right questions. This is best done through local processes that define the research agenda. Nonetheless, we see a consistent pattern that neglects the interests of the poor and other vulnerable groups – those most in need of health services. In the interests of meeting the needs of the poor, we propose three priority research areas where research should be conducted on health systems in developing countries.

1. Research that identifies and tests innovative strategies to improve access by excluded segments of the population to competent public or private health services, recognizing that relationships between providers, government, civil society and users are changing rapidly. Questions should address: what factors influence the behaviour of health service providers and users? What innovative strategies enable poor people to make better use of available medical knowledge and health-related commodities (e.g. new types of regulatory partnerships, empowering citizens, and new ways to identify good performers through franchising and information technology)?

2. Research that identifies and tests options for health financing that account for patterns of poverty and vulnerability and new approaches to social protection. Specific research should examine how different types of health-related shocks affect households in terms of access to health services and impact on livelihoods. How do alternative institutional arrangements and financing mechanisms perform in helping the poor to cope with these shocks?

3. Research that examines new ways to link research to policy processes at local, national and global levels to benefit the poor. How do local, national and international actors interact to formulate policy responses to new challenges and opportunities? How do power relationships between actors influence the uptake of research and the translation of policies into changes in health system performance, and with what implications for the poor?

We are engaged as a research programme consortium to investigate these questions over the next few years across a number of developing countries. Taking advantage of recent interest in the performance of health systems and current knowledge of research methods, we hope to make this kind of research more useful in informing decision-making on future health systems. ❑

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References

Bloom G & Standing H 2001, 'Pluralism and marketisation in the health sector: meeting health needs in contexts of social change in low and middle-income countries', IDS Working Paper No. 136, Institute of Development Studies, Brighton.

Bloom G, Lloyd R & Standing H 2006, 'Rethinking future health systems', Institute of Development Studies, unpublished paper.

Buve A, Kalibala S & McIntyre J 2003, 'Stronger health systems for more effective HIV/AIDS prevention and care', *Int J Health Plan Mgmt,* vol. 18, pp. S41–S51.

Cooley L & Kohl R 2005, 'Scaling up – from vision to large-scale change – a management framework for practitioners', Management Systems International.

Gilson L 2003, 'Trust and the development of health care as a social institution', *Social Science and Medicine*, vol. 56, no. 7, pp. 1453–1468.

Hanson K, Ranson K, Oliveira-Cruz V & Mills A 2003, 'Expanding access to priority health interventions: a framework for understanding the constraints to scaling-up', *J Int Development*, vol. 15, pp. 1-14.

High-level forum on the health MDGs 2005, Working Group on Global Health Partnerships, available at: http://www.hlfhealthmdgs.org/ReportGHPWorkingGroup28Sep05.doc

Janovsky K & Peters DH 2006, 'Improving health services and strengthening health systems: adopting and implementing innovative strategies – an exploratory review in twelve countries', World Health Organization, Department of Health Policy, Development and Services Evidence and Information for Policy, 'Making health systems work: working paper no. 5', WHO/EIP/healthsystems/2006.2

Johnston T & Stoudt S 1999, *Investing in health: development effectiveness in the health, nutrition, and population sector*. The World Bank, Washington.

Leonard DK 2000, 'Lessons from the new institutional economics for the structural reform of health services in Africa', in Leonard DK (eds) *Africa's changing markets for health and veterinary services: the new institutional issues*, Macmillan Press Ltd, Basingstoke.

Loevinsohn B, Harding A 2005, 'Buying results: contracting for health services delivery in developing countries', *The Lancet*, vol. 366, pp. 676-81.

Mackintosh M & Tibandebage P 2002, 'Inclusion by design? Rethinking health care market regulation in the Tanzanian context', *The Journal of Development Studies*, vol. 39, no. 1, pp. 1-20.

Melgaard B, Creese A, Aylward B, Olive J-M, Maher C, Okwo-Bele JM & Lee JW 1999, 'Disease eradication and health systems development'. MMWR 31 December 1999 / 48(SU01);28-35. Available at: http://www.cdc.gov/mmwR/preview/mmwrhtml/su48a8.htm

Mills A 2005, 'Mass campaigns versus general health services: what have we learnt in 40 years about vertical versus horizontal approaches?' *Bulletin of the World Health Organization*, vol. 83, no. 4, pp. 325-30.

Morel CM, Acharya T, Broun D, Dangi A, Elias C, Ganguly NK et al. 2005, 'Health innovation networks to help developing countries address neglected diseases', *Science*, vol. 309, no. 5733, pp. 401-4.

Oliveira-Cruz V, Hanson K & Mills A 2003, 'Approaches to overcoming constraints to effective health service delivery: a review of the evidence', *Journal of International Development,* vol. 15, pp. 41-65.

Ovretveit J 2006, 'Strengthening health services in low income countries: a review of research on implementation and results', Karolinska Institutet Medical Management Centre, Draft Mimeo, 1 June.

Preker AS, Carrin G, Dror D, Jakab M, Hsiao W, Arhin-Tenkorang D 2002, 'Effectiveness of community health financing in meeting the cost of illness', *Bulletin of the World Health Organization,* vol. 80, pp. 143–50.

Pritchett L, & Woolcock M 2004, 'Solutions when the solution is the problem: arraying the disarray in development', *World Development,* vol. 32, no. 2, pp. 191-212.

Sachs J 2004, 'Doing the sums on Africa: small amounts spent on promoting Africa's economy can save billions and make the West more secure: by invitation: developing Africa's economy', *The Economist*, pp. 21-23.

Stillman K, & Bennett S 2005, *Systemwide effects of the global fund: interim findings from three country studies*, Bethesda, MD: The Partners for Health Reformplus Project, Abt Associates Inc.

Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, Pielemeier NR, Mills A, & Evans T 2004, 'Overcoming health-systems constraints to achieve the Millennium Development Goals', *The Lancet,* vol. 364, pp. 900-06.

World Health Organization 1996, 'Report of a multicountry study on community directed treatment with Ivermection'. Document TDR/AFR/RP/96.1, WHO, Geneva.

World Health Organization 2006, 'Scaling-up health service delivery: from pilot innovations to policies and programs', World Health Organization, forthcoming, Geneva.

The effect of health insurance on health: how good is our evidence?


Article by Helen Levy and David O Meltzer

A key argument for policies to subsidize or mandate health insurance coverage is that health insurance improves health. But what is the evidence that supports this argument? That is, what do we really know about how health insurance affects health? In earlier work, we reviewed the literature on health insurance and health with particular attention to the quality of the evidence supporting the assertion that health insurance improves health (Levy & Meltzer 2004).[1] We concluded that while there are literally hundreds of studies documenting the fact that the uninsured have worse health outcomes than do the insured, very few of these studies establish a causal relationship between health insurance and health. Most studies fail to do so because variation in health insurance status is almost never random, so that the insured and the uninsured almost certainly differ in many ways in addition to the difference in their health. These differences, which may be unobserved by the researcher, make it impossible to conclude that differences in health status between the insured and uninsured are because of the difference in their insurance coverage. Moreover, the causal relationship between health insurance and health is likely to run in both directions; health status determines insurance coverage at the same time that insurance affects health. This makes it difficult to determine whether a correlation between health insurance and health status reflects the effect of health insurance on health, the effect of health on health insurance, or the effect of some other attribute, such as socioeconomic status, on both health insurance and health status.

The goal of this essay is to recap why we believe it is not possible to draw any causal inference about the effect of health insurance on health from studies that rely on non-random variation in health insurance coverage. We also review very briefly the results of the small number of studies that we believe do provide good evidence on the causal effect of health insurance on health. Finally, we close with a discussion of how our conclusions about the value of different research designs and about the answer to the substantive question at hand – how does health insurance effect health? – should inform both research and public policy in the future.

The endogeneity of health insurance and its implications for research design

The reason it is difficult to know how health insurance affects health is that an individual's health insurance coverage is almost always endogenous: that is, determined by at least some of the same factors that determine health status.[2] As a result, simple comparisons of outcomes for insured and uninsured individuals may reflect either a causal effect of health insurance or other differences between individuals with and without health insurance. These other differences may or may not be observed by the researcher. Causation may also run in the other direction, with an individual's health status affecting his or her access to insurance coverage. A number of different approaches have been developed to address the problem of endogeneity. Most studies in the literature simply ignore the endogeneity of health insurance; some attempt to address it using a variety of techniques. We categorize the literature into three groups based on the extent to which they address this problem.

Group I: Observational studies

Studies in the first group, which we call "observational studies", do little or nothing to address the endogeneity problem. There are literally hundreds of studies in this group; see Brown, Bindman & Lurie (1998) for a review. Most of these simply compare health outcomes for the insured to outcomes for the uninsured. Some use regression analyses to control for covariates such as income, age, gender, race, health behaviours like smoking, and comorbidities. These studies, which represent the vast majority of the studies of the association between health insurance and health, are confounded by both observable and unobservable differences between patients who do and do not have health insurance that can also affect health outcomes directly. This implies that these studies cannot provide much insight into the causal effect of health insurance on health.

The vast majority of these studies suggest a positive correlation between health insurance status and health. This suggests either a true positive effect of health insurance on health or a dominant tendency for some other factors

[1] Our review was limited to studies published in English.

[2] The Merriam-Webster online dictionary offers the following definition of "endogenous" in this context: "caused by factors inside the organism or system".

The findings of these observational studies may also provide valuable preliminary data that can help identify areas where investments in more rigorous study designs might be most promising

such as income or education to be positively correlated with both health and health insurance. However, there may also be important factors such as underlying illness that produce a downward (negative) bias on the observed relationship between having health insurance and health status. For example, consider the landmark study by Ayanian et al. (1993) documenting lower survival rates, conditional on stage of diagnosis, for uninsured women with breast cancer compared to women with private health insurance. This would seem to suggest that health insurance improves outcomes. The same study, however, documents even lower survival rates for women covered by Medicaid than for those without any health insurance. Are we to conclude from this that Medicaid is bad for health outcomes? Presumably not; there may be other factors influencing health that have been omitted from the analysis. In the same way, we cannot rule out the possibility that omitted factors might explain the positive relationship observed between private health insurance and health outcomes, as discussed by Ayanian et al. (1993).

We do not mean to suggest that we think observational studies are uninteresting or without value. On the contrary, observational studies documenting differences in medical care use and health outcomes between insured and uninsured populations provide information that is essential both to researchers and to policy-makers because they illustrate disparities in health care utilization and health outcomes among identifiable groups that suggest the need to better understand and ultimately address these disparities. The findings of these observational studies may also provide valuable preliminary data that can help identify areas where investments in more rigorous study designs might be most promising. But we do not believe that it is possible to draw any causal inference about the impact of insurance coverage on health from these studies.

Group II: Natural experiments

The second group consists of "natural experiments", also sometimes called "quasi-experiments". These analyses rely on a policy change or some other exogenous event to introduce variation in health insurance coverage that is plausibly unrelated to health and other underlying determinants of health insurance coverage. These situations offer an opportunity to estimate the causal effect of insurance on health. Some natural experiments are quite small in scale: for example, the cancellation of veterans' health care benefits for a small group of individuals. Other natural experiments are much broader in scale, such as the passage of Medicare in the United States, or of Canada's National Health Insurance plan. Table 1 lists every such study of which we are aware and summarizes their results very briefly; readers interested in more detail are referred to our earlier work (Levy & Meltzer 2004) for more detailed summaries or, preferably, to the original papers cited in our bibliography.

Brook et al. 1983; Keeler et al. 1985: Persons randomized to health insurance policies that provide free care versus only catastrophic coverage experience no change in health outcomes, except for reductions in blood pressure for low-income persons with hypertension, and small improvements in corrected vision.

Card, Dobkin & Maestas 2004: slight improvements in self-reported health associated with Medicare eligibility at age 65; no effect on mortality.

Currie & Gruber 1996a: expansions of Medicaid among children associated with declines in child mortality.

Currie & Gruber 1996b: significant decline in infant mortality associated with expansions of Medicaid to pregnant women; smaller decline in the incidence of low birth weight.

Currie & Gruber 1997: expansion of Medicaid to low-income pregnant women had positive effect for those living close to neonatal intensive care units; procedure use (e.g. fetal monitors) increased for high-risk mothers (low education) and decreased for more educated mothers, but relative birth outcomes did not change.

Fihn & Wicher 1988: cancellation of VA outpatient benefits associated with significant increases in blood pressure.

Goldman et al. 2001: more generous state-level policies to increase access to effective HIV therapies reduce mortality among HIV+ individuals.

Haas, Udvarhelyi & Epstein 1993(a); Haas, Udvarhelyi & Epstein 1993(b): expansions of Healthy Start in Massachusetts to women between 100 and 185% of poverty; no effect on birth outcomes relative to privately or publicly insured women.

Hanratty 1996: Canadian National Health Insurance; improvements in infant mortality and smaller improvements in the incidence of low birth weight.

Lichtenberg 2006: improvements in mortality among 65-year olds associated with the passage of Medicare in 1965.

Lurie et al. 1984; Lurie et al. 1986: termination of Medi-Cal benefits associated with significant increases in blood pressure, especially among persons with lower incomes.

Table 1: Experimental and quasi-experimental studies: what do they find about how health insurance affects health?

We believe these studies yield some valuable insights into the causal impact of health insurance on health. Most, but not all, of these studies find that expansions of health insurance result in improvements in health. The fact that most of these studies find an effect while a few do not is itself instructive: it illustrates an important limitation of this type of study, which is that each quasi-experimental study yields results that are relevant only to the population that was the subject of the quasi-experiment. So, for example, we learn from Fihn & Wicher (1988) that the cancellation of veterans' health-care benefits resulted in worse health for veterans, but from Card, Dobkin & Maestas (2004) that the transition onto Medicare at age 65 does not, on average, reduce mortality at that age. One study shows health insurance affects health but the other does not. These results are not necessarily contradictory, however, since they apply to different populations: veterans eligible for public insurance coverage are, for the most part, old, sick, and poor, while self-employed workers are younger, healthier and better off financially. It is not really surprising that insurance coverage might have different effects in these two populations. But these differences underscore the fact that the question "how does health insurance affect health?" is a complicated one and that the answer will depend on (among other things) what we mean by health insurance and whose health is being considered.

Group III: Experimental studies

The third group consists of true social experiments in which health insurance coverage is randomly assigned to individuals and subsequent health outcomes are compared across experimental groups. This group corresponds to randomized clinical trials in the field of medicine, the gold standard of biomedical evidence. Only the RAND health insurance experiment falls into this category (Newhouse et al. 1994). The RAND experiment found no significant effects on a wide range of measures of health status for the average patient, with quite narrow confidence intervals (Brook et al. 1983, Newhouse et al. 1994).[3] Health benefits were found, however, for persons with poor vision and for persons with elevated blood pressure. This suggests again that the answer to the question "how does health insurance affect health?" depends very much on the population being studied.

Implications for research and policy

Our main methodological point is that observational studies do not allow us to draw causal inference about the effect of health insurance on health. That is, by definition, they cannot answer the question "how does health insurance affect health?" As discussed above, this does not mean that these studies are without value. It does imply, however, that if we want to know how health insurance affects health, we need to devote resources to conducting social experiments or at least quasi-experiments. A good quasi-experiment is hard to find but this does not always have to be the case; any policy that affects health insurance coverage has the potential to provide good quasi-experimental evidence as long as the policy is designed with programme evaluation in mind. True social experiments are difficult but not impossible to implement. Health policy analysts should look to the example of those who study welfare and labour market policies, who have been much more active in carrying out experiments; see Gueron (2000) for a discussion of the challenge of implementing these experiments.

Our main substantive point is that once we restrict our attention to studies with a design that addresses the problem of endogeneity and therefore provide credible evidence on the causal relationship between health insurance and health, the majority of these studies suggest that for vulnerable subpopulations – the poor, the sick, infants and children – health insurance improves health. Health insurance may not improve health on average, as suggested by the RAND experiment; but for policy purposes, the average effect may not be what we want. Many policies to expand health insurance target precisely the subpopulations whose health would be improved by coverage. Thus, even though we reject many studies that conclude that health insurance improves health on the grounds that their methods are flawed, in the end we do reach the conclusion that health insurance improves health – for some. ❑

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[3] The study was not powered to be able to detect effects on mortality because the cost of such a large sample would have been prohibitive.

References

Ayanian J, Kohler B, Abe T & Epstein A 1993, 'The relation between health insurance and clinical outcomes among women with breast cancer', *New England Journal of Medecine*, vol. 329, no. 5, pp. 326–31.

Brook RH et al. 1983, 'Does free care improve adults' health? Results from a randomized controlled trial', *New England Journal of Medecine*, vol. 309, no. 23, pp. 1426–34.

Brown M, Bindman A & Lurie N 1998, 'Monitoring the consequences of uninsurance: a review of methodologies', *Medical Care Research and Review*, vol. 55, no. 2, pp. 177–210.

Card D, Dobkin C & Maestas N 2004, 'The impact of nearly universal insurance coverage on health care utilization and health: evidence from Medicare,' National Bureau of Economic Research working paper 10365.

Currie J & Gruber J 1997, 'The technology of birth: health insurance, medical interventions and infant health', National Bureau of Economic Research working paper 5985.

Currie J & Gruber J 1996(a), 'Health insurance eligibility, utilization of medical care and child health', *Quarterly Journal of Economics*, vol. CXI, pp. 431–66.

Currie J & Gruber J 1996(b), 'Saving babies: the efficacy and cost of recent changes in the Medicaid eligibility of pregnant women', *Journal of Political Economy*, vol. 104, no. 6, pp. 1263–96.

Fihn, SD & John B. Wicher 1988, 'Withdrawing routine outpatient medical services: effects on access and health', *Journal of General Internal Medicine,* vol. 3, no. 4, pp. 356–62.

Goldman DP, Bhattacharya J, McCaffrey DF, Duan N, Leibowitz AA, Joyce GF & Morton SC 2001, 'The effect of insurance on mortality in an HIV+ population in care', *Journal of the American Statistical Association*, vol. 96, no. 455, pp. 883–94.

Gueron J 2000, 'The politics of random assignment: implementing studies and impacting policy', Manpower Demonstration Research Corporation (MDRC) working paper. Available at http://www.mdrc.org/publications/45/workpaper.html

Haas JS, Udvarhelyi S & Epstein AM 1993(a), 'The effect of providing health coverage to poor uninsured pregnant women in Massachusetts', *Journal of the American Medical Association*, vol. 269, pp. 87–91.

Haas JS, Udvarhelyi S & Epstein AM 1993(b), 'The effect of health coverage for uninsured pregnant women on maternal health and the use of cesarean section', *Journal of the American Medical Association*, vol. 270, no. 1, pp. 61–64.

Hanratty M 1996, 'Canadian national health insurance and infant health', *The American Economic Review*, vol. 86, no. 1, pp. 276–84.

Keeler E 1985, 'How free care reduced hypertension in the health insurance experiment', *Journal of the American Medical Association*, vol. 254, pp. 1926–31.

Levy H & Meltzer D 2004, 'What do we really know about whether health insurance affects health?' in C McLaughlin (ed.), *Health policy and the uninsured: setting the agenda*, Urban Institute Press, Washington, DC.

Lichtenberg FR 2006, 'The effects of Medicare on health care utilization and outcomes', Forum for Health Economics & Policy, *Forum: Frontiers in Health Policy Research*, vol. 5, art. 3.

Lurie N, Ward NB, Shapiro MF, Gallego C, Vaghaiwalla R & Brook RH 1986, 'Termination of Medi-Cal benefits. A follow-up study one year later', *New England Journal of Medecine*, vol. 314, no. 19, pp. 1266–8.

Lurie N, Ward NB, Shapiro MF & Brook RH 1984, 'Termination from Medi-Cal – does it affect health?' *New England Journal of Medicine*, vol. 311, no. 7, pp. 480–4.

Newhouse JP & the Insurance Experiment Group 1994, Free for All? *Lessons from the RAND Health Insurance Experiment*, RAND.

Ownership and performance of health service organizations: evidence from hospitals

Article by Karen Eggleston and Yu-Chu Shen

Understanding whether profit status or public-private control impacts access, quality and cost has many important policy implications. Since economic analysis largely assumes firms maximize profits, whether or not health care providers act "as if" maximizing profits critically shapes policies governing the health-care industry. For example, in the US, ownership's effect on behaviour is at the heart of the broader controversy over whether health care should be a "mission-driven public good" or a "market-based service industry" – with far-reaching implications for how to structure public programmes such as Medicare and the Veterans' Administration hospital system or how to guarantee access for the currently uninsured.

In many countries, policy governing for-profit status and conversions often presume that government-owned and private non-profit providers differ from for-profits in policy-relevant ways, such as providing greater access and more uncompensated care. Suppose US policy-makers wished to know the probable effect of eliminating tax exemption from all non-profit hospitals, converting or closing government-run hospitals, and then using the billions of dollars of saved "tax expenditures" to finance insurance for the uninsured. Anyone setting out to assess the impact of such a policy change would immediately find that the voluminous literature on non-profit, for-profit and public hospitals gives frustratingly unclear and contradictory evidence, inviting subjective and selective reference to studies that support the analysts' views. The controversy and policy debate continues.

This debate is especially relevant for developing and transitional economies (moving from planning to markets), where systemic changes in the overall economy, as well as demographic and epidemiologic transitions, present challenges for guaranteeing access, safety and quality at reasonable cost. The merits of privatization, competition and financial incentives are widely debated.

In this paper we review recent evidence on ownership and performance based on studies of the US hospital market since 1990 (albeit with brief mention of some evidence from China as well). After a short conceptual background, we summarize results from recent quantitative reviews and discuss policy implications.

Conceptual background

Health care delivery in most established market economies includes a mixture of government and private ownership. Among US community hospitals, 71% of inpatient beds are private not-for-profit, 13.4% are for-profit, and 15.9% are government-owned (AHA 2002, 2–5). European health sectors typically feature a larger share of government control; nevertheless, on average more than one in five hospitals in the EU are privately owned, and in several countries a substantial fraction of total beds (including long-term care beds) are investor-owned (Eggleston, Wang & Rao 2006).

Economic theorists have long debated whether ownership of health-care providers matters for how patients are treated and for the overall performance of the health sector. In particular, should government use public financing to "make" health services in public clinics and hospitals, or "buy" health services from the private sector? This "make or buy" decision has no clear theoretical answer (Shleifer 1998; Eggleston & Zeckhauser 2002; Cutler 2002). Government can use monopsony to counteract the power of the medical profession and purchase services at lower prices. Yet private provision avoids bureaucratic monopolies that become inefficient and unresponsive to patients.

According to the property rights theory of ownership, the "make or buy" decision depends upon how well governments can write, monitor and enforce contracts (Hart, Shleifer & Vishny 1997). A well-written and enforceable contract can harness private efficiency while proscribing quality distortions and selective treatment of profitable patients. In practice, however, contracts can never specify all the details about treatment for every patient. In developing and transitional economies, contracts are even less likely to be comprehensive and enforceable, so that perverse incentives for providers to skimp on noncontractible quality are even more of a concern. Health sector institutions such as the Hippocratic oath of medical ethics or the prevalence of non-profit providers can be seen as responses to these concerns (Arrow 1963; Cutler 2002).

The majority of health care financing in most developed countries flows through government programmes. What fraction of services should be produced by the government directly, by the for-profit sector, and the non-profit sector? Taking as given these three fractions, which services should be in which sector? The first question is one of which ownership form delivers health services most effectively. This

absolute advantage issue generates the most intense political debate. The second question is one of the comparative advantage of different ownership structures for different health-care services (Eggleston & Zeckhauser 2002). Generally, private providers have a comparative advantage for services in which rapid technological innovation and/or quick response to changing market incentives is vital. By contrast, the comparative advantage of government providers lies in services for which skimping on quality is a great concern, as well as services for which guaranteed access and/or population health relevance matter more than rapid innovation. Eggleston & Zeckhauser (2002) also argue that just as important as ownership per se are such factors as competition, payment incentives and budget constraints.

Hospital ownership and performance: synthesis of empirical evidence

Whether the policy debates are about the comparative or absolute advantages of different ownership forms for health care delivery, it is imperative to inform the debates with empirical evidence on ownership. We focus here on the US literature, since the US is one of the few countries with a substantial share of private for-profit as well as private non-profit and government-owned hospitals competing in local markets.

The empirical literature has studied ownership and hospital performance through three general approaches. Some studies estimate the direct effect of ownership status on hospital performance using between-hospital (i.e. cross-sectional) comparisons, such as Keeler et al. (1992), Sloan et al. (2001) and Shen (2002). Other studies assess the effect of ownership conversion on a hospital's staffing, profits, provision of uncompensated care or patient outcomes (Picone, Chou & Sloan 2002; Shen 2002; Shen 2003). A third approach focuses on the spill-over effect of ownership, i.e. the effect of ownership market shares on care for poor patients, hospital revenues and patient outcomes (Kessler & McClellan 2002).

In all strands of the literature, conflicting results abound. For example, the empirical evidence on uncompensated care so far has been mixed. Thorpe, Florence & Seiber (2001) found that conversion from non-profit to for-profit ownership is associated with a decreasing amount of uncompensated care, but several other studies found no change in the level of uncompensated care in California, Florida and Texas (Young, Desai & Van Deusen Lukas 1997; Needleman, Lamphere & Chollet 1999; Desai, Van Deusen Lukas & Young 2000). Similarly, several studies found that ownership affects patient outcomes (Keeler et al. 1992; Shen 2002) while others found no such effect (Sloan et al. 2001).

These contradictory findings partly stem from differences in sample size and methodology. Without doing a quantitative review, analysts and policy-makers have difficulty drawing inferences from the literature as a whole about the significance of ownership for hospital performance and the magnitude of that effect.

We conducted a systematic review of the literature since 1990 comparing financial performance, quality and uncompensated care or other measures of community benefits provided by US for-profit, not-for-profit and government-owned general acute hospitals (Shen et al. 2005; Eggleston, Shen et al. 2005). The primary goal was to understand what factors account for the wide variation in study results.

We hypothesized that several factors might account for a substantial fraction of between-study variation in findings. First, studies vary in analytic methods and how well they control for confounding factors, especially patient case-mix (i.e., nonrandom allocation of patients across hospitals) and hospital market characteristics such as competition and nonrandom entry. Second, studies analyzing different hospital- or patient-level outcomes may find different results. We also hypothesized that findings may differ systematically according to the years or regions covered in a study's data.

From quantitative analysis of over 100 empirical papers on this topic (Shen et al. 2005; Eggleston, Shen et al. 2005), we found that the diverse results in the hospital ownership and performance literature derive largely from differences in data and analytic methods.

For the studies of financial performance, weaker methods and functional forms tend to predict larger differences between not-for-profits and for-profits. Studies that control for a wider range of confounding factors – including at the patient, hospital and market levels – find smaller differences in financial performance between for-profit and not-for-profit hospitals. There appears to be little difference in cost among all three types of hospital ownership. For-profit hospitals tend to generate more revenue and greater profits than not-for-profit hospitals, although the difference is only of modest economic significance. There is less clear evidence of any difference in revenue or net revenue between government and private not-for-profit hospitals.

In areas of patient outcomes, studies tend to find much smaller ownership effect than those in areas of financial performance. For studies of patient outcomes, study features that can explain most of the variation in study results include (1) analytic methods (type of disease or outcome studied, whether or not the study adjusted for patient co-morbidities) and (2) data sources.

Patient outcomes do not statistically differ across all three ownership forms when analyses are done at the patient level, whereas hospital-level and combined-level analyses find the highest rates of mortality and other adverse events at government hospitals, lower rates at for-profits, and the lowest rates at private non-profit hospitals. Studies that do not adjust for co-morbidities (usually those using Medicare claims) tend to find a bigger gap between private not-for-profits and for-profits. Including co-morbidities reduces estimates of the quality gap among private hospitals, while maintaining (or widening) the government-private non-profit quality gap. Studies of data from the 1980s (or spanning both the '80's and '90s) find more of a quality difference among hospitals of different ownership form than studies using more recent data.

In terms of charity care, studies either find no difference across ownership types, or for-profit hospitals providing less

Overall, ownership appears to play a less important role in influencing hospital performance than other hospital characteristics such as size, urban/rural location or teaching status. Moreover, there appears to be as much, if not more, heterogeneity among hospitals of the same ownership form as across ownership forms

charity care and government hospitals providing more than non-profit hospitals. For charity care, analytic methodology explains a large share of study heterogeneity for government-private comparisons, but not among private hospitals. Studies examining nationally representative samples, and of Florida in particular, tend to find for-profits providing less charity care, whereas for-profit hospitals in California seem to be providing comparable amounts as their private non-profit counterparts.

Overall, ownership appears to play a less important role in influencing hospital performance than other hospital characteristics such as size, urban/rural location or teaching status. Moreover, there appears to be as much, if not more, heterogeneity among hospitals of the same ownership form as across ownership forms. Future research can be most fruitful for policy if it goes beyond the standard administrative data sets to explain this wide variation in performance.

The US inpatient market is relatively highly regulated, and hospitals face pressure from active purchasers such as managed care organizations, employer coalitions and public insurers with significant market power on behalf of groups of patients. Wider ownership differences might emerge in less regulated or competitive environments. More evidence from middle- and lower-income countries would be useful (Preker & Harding 2003).

China is one interesting case. Several analysts have investigated the growing private delivery sector in China, primarily for ambulatory services (Meng, Liu & Shi 2000; Lim et al. 2004; Blumenthal & Hsiao 2005; Liu et al. 2006). Eggleston & Yip (2004) calibrate a simulation model of the impact of China's recent ownership and pricing reforms on cost, quality and access. In a recent study of hospitals in southern China, Eggleston, Lu et al. (2005) find that government and private delivery can play complementary roles. Entry of private hospitals in Guangdong's urban areas seems to have helped to fill some market "niches" for which government investment fell short, for one reason or another, such as proportionally higher presence in mental health services. Private hospitals in this area of China have entered on the periphery, tending to be smaller, speciality hospitals, and less likely to receive contracts with social insurance bureaus. Yet even in the relatively short span of five years, convergence towards more direct competition seems evident. The challenge for China's policy-makers is to harness the potential innovation, efficiency and responsiveness of private providers, while enhancing capacity to regulate and monitor competition to assure equitable access and avoid unhealthy market segmentation (Eggleston, Lu et al. 2005).

Conclusion

As we have noted, theory does not dictate what the appropriate mix of public and private ownership is, and international experience provides mixed results. Systematic quantitative review for service delivery issues can be just as critical as for policy-making as it is for clinical medicine. Synthesizing evidence can be challenging. Often focusing on research with the most scientifically valid designs is more useful, and coherent, than giving equal weight to all previous related studies. Yet policy-makers also should not fall prey to disingenuous, albeit often well-intentioned, advisers who selectively cite only studies upholding their own opinions.

Most established market economies have moved towards public financing and pluralistic delivery (Cutler 2002), and many middle- and lower-income countries are also moving in a similar direction. An important government role in such a system is providing prudent regulation of a pluralistic delivery system.

The interaction of ownership mix, payment incentives and competitive pressures, with regulatory scrutiny and appropriate accountability, shapes the system incentives facing health-service providers. These combined forces often matter more than ownership per se in shaping provider behaviour and thus health-care system outcomes.

If there is one relatively consistent finding of the international literature on ownership, it is that private providers – especially for-profit firms – are generally (though not universally) more responsive to incentives than their government-controlled counterparts. Therefore, a growing private market presence, such as in many developing and transitional economy inpatient markets, is not a remedy for dysfunctional system incentives; to the contrary, it will almost surely exacerbate problems from dysfunctional incentives (just as much as it would reinforce benefits of well-structured incentives). Entrepreneurial activity often provides a litmus test, revealing weaknesses and loopholes. Private providers' alacrity in finding and seizing opportunities brings policy challenges as much as solutions, particularly for services plagued by market failures such as inpatient health-care delivery. The challenge for policy is to manage the evolution of health-service delivery so that unhealthy market segmentation–with private providers cream-skimming the wealthy, healthy patients and/or the most skilled clinicians–does not take root. Vital to this effort is improving evidence-based evaluation of new policies and evolving market structures. Policies need to strengthen the complementary pieces of the puzzle: active purchasing, appropriate payment incentives, well-functioning markets for managerial talent and support services, appropriate accreditation and antitrust policies, and so on. Response to this challenge in developing countries will shape the equity and efficiency of their health-care systems for decades to come. ❑

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References

Arrow KJ 1963, 'Uncertainty and the welfare economics of medical care', *American Economic Review*, vol. 53, no. 5, pp. 941–73.

Blumenthal D & Hsiao W 2005, 'Privatization and its discontents – the evolving Chinese health care system', *The New England Journal of Medicine*, vol. 353, no. 11, pp. 1165–1170.

Cutler DM 2002, 'Equality, efficiency, and market fundamentals: the dynamics of international medical care reform', *Journal of Economic Literature*, vol. 40, no. 3, pp. 881–906.

Desai KR, Van Deusen Lukas C & Young GJ 2000, 'Public hospitals: privatization and uncompensated care', *Health Affairs*, vol. 19, no. 2, pp. 167–72.

Eggleston K, Wang J & Rao K 2006, 'From plan to market in the health sector? China's experience', forthcoming in S La Croix, PI Iboshi & J Kea (eds), *Miracles and Mirages in East Asian Economic Development*, University of Hawaii Press, Honolulu.

Eggleston K, Lu M, Li C, Wang J, Yang Z & Zhang J 2005, 'Comparing public and private hospitals in China: evidence from Guangdong', report to the World Bank China health sector AAA, December 2005.

Eggleston K, Shen Y, Lau J, Schmidt C & Chan J 2005, 'Hospital ownership and quality of care: what explains the different results in the literature?' Working paper December 2005.

Eggleston K & Yip W 2004, 'Hospital competition under regulated prices: application to urban health sector reforms in China', *International Journal of Health Care Finance and Economics*, vol. 4, no. 4, pp. 343–68.

Eggleston K & Zeckhauser RJ 2002, 'Government contracting for health care', in JD Donahue & JS Nye Jr (eds), *Market-based governance: supply side, demand side, upside and downside*, Brookings Institute, Washington, DC, pp. 29–65.

Hart O, Shleifer A & Vishny RW 1997, 'The proper scope of government: theory and an application to prisons', *Quarterly Journal of Economics*, vol. 112, no. 4, pp. 1127–161.

Keeler EB, Rubenstein LV, Kahn KL, Draper D, Harrison ER, McGinty MJ, Rogers WH & Brook RH 1992, 'Hospital characteristics and quality of care', *Journal of the American Medical Association*, vol. 268, pp. 1709–1715.

Kessler DP & McClellan MB 2002, 'The effects of hospital ownership on medical productivity', *Rand Journal of Economics*, vol. 33, no. 3, pp. 488–506.

Lim MK, Yang H, Zhang T, Zhou Z, Feng W & Chen Y 2004, 'China's evolving health care market: how doctors feel and what they think', *Health Policy*, vol. 69, no. 3, pp. 329–337.

Liu Y, Berman P, Yip W, Liang H, Meng Q, Qu J & Li Z 2006, 'Health care in China: the role of non-government providers', forthcoming in Health Policy.

Meng Q, Liu X & Shi J 2000, 'Comparing the services and quality of private and public clinics in rural China', *Health Policy and Planning*, vol. 15, no. 4, pp. 349–356.

Needleman J, Lamphere J & Chollet DJ 1999, 'Uncompensated care and hospital conversions in Florida', *Health Affairs*, vol. 18, no. 4, pp. 125–33.

Picone G, Chou S & Sloan F 2002. 'Are for-profit hospital conversions harmful to patients and to Medicare? *Rand Journal of Economics*, vol. 33, no. 3, pp. 507–523.

Preker AS & Harding A (eds) 2003, Private participation in health services, World Bank, Washington, DC.

Shen Y, Eggleston K, Lau J & Schmidt C 2005, 'Hospital ownership and financial performance: a quantitative research review', NBER Working Paper 11662, September 2005.

Shen Y 2003, 'Changes in hospital performance after ownership conversions', Inquiry, vol. 40, no. 3, pp. 217–234.

Shen Y 2002, 'The effect of hospital ownership choice on patient outcomes after treatment for acute myocardial infarction', *Journal of Health Economics*, vol. 21, no. 5, pp. 901–922.

Shleifer A 1998, 'State versus private ownership', *Journal of Economic Perspectives*, vol. 12, no. 4, pp. 133–150.

Sloan F, Picone GA, Taylor DH Jr & Chou SY 2001, 'Hospital ownership and cost and quality of care: Is there a dime's worth of difference?' *Journal of Health Economics*, vol. 20, no. 1, pp. 1–21.

Thorpe KC, Florence CS & Seiber EE 2001, 'Hospital conversions, margins, and the provision of uncompensated care', *Health Affairs*, vol. 19, no. 6, pp. 187–194.

Young GJ, Desai KR & Van Deusen Lukas C 1997, 'Does the sale of nonprofit hospitals threaten health care for the poor?' *Health Affairs*, vol. 16, no. 1, pp. 137–41.

Research priorities in poor countries

Article by Finn Schleimann

The issue of setting priorities is always important. In the context of research related to poor countries, the appalling scarcity of resources to address the huge amounts of human suffering makes it absolutely crucial. Yet priorities are mostly ill-defined and the institutional setting characterized by gross lack of coordination and alignment.

Before discussing research priorities it is important to consider how essential research is for decision-making, and how important it should be. Not attempting an in-depth analysis of these complex questions, four important considerations will, however, be mentioned:

- there is scope for considerable progress towards bettering health status if existing knowledge is used optimally, i.e. much progress is possible even without further research;
- the context of development in the health sector in poor countries, as in their societies at large, is very dynamic, and being further augmented by the huge investments currently being made in specific interventions; thus, research priorities need constant adjustment;
- issues are many and complex and the necessity of action is compelling; it is not possible to research all issues and use scientific analysis as the basis for solving all problems, but rather the vast majority of decisions must take the form of political decision-making, hopefully based on common sense and the available knowledge;
- political processes are not by default much influenced neither by scientific evidence nor by researchers (this is the case in Denmark and certainly in poor developing countries); therefore, the need to communicate with politicians and bureaucrats may be as big a research priority as research itself.

Financing and decision-making

In 1990, The Commission on Health Research for Development recommended that donors spend 5% and governments 2% of health sector budgets on research. In a time of increasingly joint government-donor effort (Sector Wide Approach – SWAp), this distinction does not make much sense, and the suggested government figure, i.e. 2%, could be taken as the common target. However, the justification for a fixed figure is obscure, and it may be more appropriate to identify key research opportunities and secure funding for those through the SWAp process.

In principle, research priorities in countries should be the domain of local stakeholders. First of all the government, but also major private service providers, e.g. faith-based health organizations (FBO), civil service organizations (CSO) and organizations advocating services for the poor. The nongovernment institutions are often very important change agents, and change is the most important justification for research. But while many developing countries have specific research policies (Health Research Unit 1997), some with well articulated priorities, in reality a very large part of the research agenda is determined by foreign research institutions and financiers. Although this may not mean that priorities are wrong, it is still far from optimal, and governments and donors should work towards a common framework for priority setting and financing within research led by the government. The SWAp modality is well suited for this but has unfortunately not been utilized in the research context (Schleimann 2004). Important points to address are:

- a national policy for research, including an operational set of priorities;
- enabling major national stakeholders to be competent "purchasers" of research;
- establishing and financing modalities or institutions that can secure innovative basic research, as well as operational/implementation research, and ensure quality as well as transparency (in particular prevent corruption and nepotism).

On the international scene as well, the lack of coordination and alignment is glaring. The WHO has not been able to provide clear and strong leadership in this field, and this, together with a rise in the number of powerful private financiers, has led to a multitude of different research-related organizations. Some of them, e.g. the Global Forum for Health Research, are trying to fill the void. This situation should be changed, and it would have been better if, for example, an institution like the Global Fund to Fight AIDS, Tuberculosis and Malaria had been designed to fund international global goods like research in priority diseases, rather than to finance disease- and country-specific service interventions that inevitably interfere in country processes. In general, some global agreement on priorities and alignment should be established, however difficult.

One very important research issue has emerged recently by

the scaling up of antiretroviral treatment (ARV) in poor countries. This could easily be considered one of the biggest investments ever in unproven medical technology. The political imperative did not make it possible to properly pilot this global intervention, but it is crucial that it be closely followed by high quality research, to be able to quickly learn from mistakes and thus minimize the otherwise likely massive waste of money. This has been pointed out already, for example by Sara Bennett et al. who in relation to the global initiatives describe huge unmet research needs and a fast closing window of opportunity (Bennett, Boerma & Brugha 2006). Nevertheless, little has been done.

This regrettable state of affairs may not be a major problem for the research community, as the prevailing policy vacuum leaves quite some room for researchers to follow their specific interests. The losers are poor people, whose legitimate research needs are not only grossly underfinanced but also suffer severe lack of coordination and proper priority setting. Responsibility lies with the governments in poor countries, international institutions and donors alike.

Specific priorities

A useful albeit sometimes artificial distinction of types of research is biomedical, disease-specific and systems research, with the latter two often merged into operational and implementation research. In addition, prioritization between basic and more targeted research is important. While a prioritization between the different types of research is difficult to generalize, it may be of more relevance when looking at the issue of capacity building in poor countries. Much biomedical research is far less country-specific than health systems research. Furthermore, health systems research may be far more important in terms of influencing local policy-making. Consequently, it should be a higher priority to have strong capacity in health systems research than biomedical research within poor countries. Unfortunately, capacity building is characterized by "fragmentation, incompleteness, overlapping, selectivity and gaps", as pointed out by Yvo Nuyens (Nuyens 2005).

A basic framework for identifying specific research priorities, as inspired by the five-step approach proposed by the Ad Hoc Committee on Health Research in 1996 (Global Forum for Health Research 2002; World Health Organization 1996), could be the following:

- What is the magnitude of the problem (e.g. DALYs lost or systemic bottlenecks)?
- What do we know already?
- What do we need to know in order to effect change? And is there a political window of opportunity for this change to happen?
- What would be the likely cost of effecting the changes/interventions emerging from the research? Is it likely to result in cost-effective interventions and is it possible to secure adequate financing?

Eventually, such a framework should be included in the agreed priorities and secured financing.

As mentioned already, there is an overwhelming necessity to look at the scaling up of ARV both in terms of actual effect (e.g. cost-effectiveness) on AIDS patients; as well as the effect on the rest of the health system, where the competition for the very scarce resource of skilled health workers combined with the low cost-effectiveness of ARV could easily lead to, for example, an increase in child mortality.

Furthermore, health systems research may be far more important in terms of influencing local policy-making. Consequently, it should be a higher priority to have strong capacity in health systems research than biomedical research within poor countries

The huge investments in immunization led by the Global Alliance for Vaccines and Immunization (GAVI), however, should also be closely followed, particularly regarding unexpected effects.

One of the least developed areas of research in Africa, for example, is organizational research. While it is well documented that how we most efficiently organize our institutions is very culturally dependent, we still keep exporting organizational models that have been developed in the USA and Western Europe. The huge challenges which face systems and institutions in the health sector of poor countries, not only in terms of service delivery but also, for example, in the organizational consequences of decentralization, seem to justify much larger investments and capacity building in organizational research.

One very important example is human resource management. The global community seems to believe that global priority setting will do the trick; however, global priorities mean nothing to underpaid and under-resourced staff in developing countries. Unless and until we can motivate these key front-line workers to perform well, we can forget the MDGs and targets dreamt up in nice air-conditioned conference facilities. The question of how to motivate these key people on a large scale remains unanswered, further compounding the issue.

Another important area which many countries are desperately grappling with is financing of the health sector, and how to ensure access for the poor. Much research has been done in the area of health economics, but more is needed and consolidation of existing findings – not least in country capacity building – is also very much lacking.

Other obvious needs are prevention of HIV/AIDS, controlling the major diseases like malaria and tuberculosis, and the neglected diseases still affecting so many poor people (Daar et al. 2006).

Use of research

Closely linked to prioritization is the use of research. There are many important aspects in this field, but only two will be mentioned here.

It is common sense that research requested by decision-makers would have a greater chance of being used. However, surprisingly this is not confirmed by decision-makers themselves (Ghana 1996).

The importance of proper dissemination is also widely recognized, although most often not successfully addressed. When targeting decision-makers it is essential that researchers discard their role of "insulted wise man" to whom nobody listens, and take seriously and respectfully the reality of the decision-makers, politicians and top bureaucrats. There are at least two fundamental elements of this reality:

- **Time.** Most decision-makers are pressed for time, and researchers need to be brief when presenting findings and analysis. This can be difficult for a scientist focused on uncovering increasingly complex layers of reality, because it will be at the expense of the full "truth".
- **Complexity.** Decision-makers are, even without input from researchers, faced with so great a complexity that they cannot cope meaningfully with it; they therefore reduce it in order to take decisions, a process often labelled "bounded rationality". While this is seen as unacceptable by many researchers, most organizational scientists will concede that it is an inevitable product of reality and not due to particularly mean or unintelligent personalities among decision-makers. Things need to be presented simply, and exposing decision-makers excessively to the customary disagreements between researchers is not helpful. Consensus reports, although not very scientifically meriting, may be very useful tools.

Conclusion

The following are key issues to take forward:

- setting proper priorities, nationally as well as internationally, and subsequently financing and aligning with the chosen priorities;
- urgently addressing the research needs imposed by the emerging global initiatives;
- building relevant research capacity in countries utilizing SWAp modalities to ensure coordination; and
- communicating research findings in a way that is compatible with the situation and reality of decision-makers, rather than with the preferences of researchers. ❑

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References

Bennett S, Boerma JT & Brugha R 2006, 'Scaling up HIV/AIDS evaluation', *The Lancet*, vol. 367, no. 9504, pp. 79–82.

Daar A et al. 2006, *Fourth independent review of the Special Programme for Research and Training in Tropical Diseases (TDR) – towards evolution and growth*, TDR/WHO, Geneva.

Ghana 1996, in Adibo M, Misra R & Bengzon A (eds) *How can research influence health policy? Reports from policy makers in three countries*, IHPP, Washington.

Global Forum for Health Research 2002, *The 10/90 report on health research 2001–2002*, p. 55, Geneva.

Health Research Unit 1997, *Policy guidelines for strengthening research to support the medium-term health strategy in Ghana*, HRU, Ministry of Health, Accra.

Nuyens Y 2005, *No development without research – a challenge for research capacity strengthening*, Global Forum for Health Research, Geneva.

Schleimann F 2004, 'Role of research in a SWAp/SPS context' on http://enrecahealth.ku.dk/research_news_en/schleimann/

World Health Organization 1996, 'Investing in health research and development. Report of the Ad Hoc Committee on health research relating to future intervention options', Geneva, p. 7.

A Global Health Innovation System (GHIS)


Article by Richard T Mahoney (left) and Carlos M Morel

This paper describes a Global Health Innovation System (GHIS) based on research in innovations systems theory. This system would define how concerned countries and institutions could more effectively contribute to health care innovations, especially for the poor in developing countries. Such a system is needed because of the very rapid recent changes in global health innovation. Since the turn of the millennium, the "Era of Partnerships" has emerged. This era is characterized by the rise of product-development public-private partnerships and is also marked by increased networking, a trend that would benefit from greater coordination and the adoption of a range of best practices. With a comprehensive and compelling GHIS current resources could be allocated more efficiently and additional resources could be mobilized more readily.

By integrating innovation with health systems and widened perspectives, the GHIS would help overcome a set of critical health failures: failures of science, failures of the market and failures of public health systems. It would do so by providing valuable guidance in the planning and management of innovation at the global, regional, national, institutional and sector levels. The paper concludes by demonstrating how a GHIS could address the health failures by applying the lessons of innovation studies in a structured framework.

Introduction

There is a growing consensus about the need to develop and deliver new health technologies for diseases affecting the poor in developing countries. New funds, new organizations and new approaches are revitalizing the public sector. Spurred by a better understanding of the market and its limitations when addressing the needs of the poor, there is a greater awareness of the public sector's essential role in promoting access to health technologies. This revitalization is relatively young, but in some areas it is moving very quickly. For example, global procurement mechanisms for vaccines, drugs, and other materials have been set up, and public-private product development partnerships (PDPs) in developed countries and some developing countries have been established.

No global model, however, has yet been put forward to plan, coordinate, conduct and support efforts. Now is the time to construct such a global model. How do the new parts relate to each other? How do the new components relate to the old parts? And how do they relate to things occurring outside health? We must consider the big picture to determine how all of the parts can work together most effectively. Funds are limited but there is the prospect and need for more, so it is essential to find cost effective policies and strategies that can mobilize those funds. What are those policies and strategies and how do we develop them? To answer these questions, we need a global model or system. The problem has been succinctly summarized by Professor Barry Bloom, "There've been lots of creative ideas and lots of new people, but there's one missing piece. There's no architecture of global health" (Cohen 2005).

Fortunately, existing research can guide our pursuit of the answers to these questions. Having carefully studied how new technologies reach markets, innovation systems theory has already contributed greatly to our understanding of the architecture of global health. Our quest to improve health care innovation should therefore include the work of scholars of innovation, and in this paper we build on innovation theory to address the health problems of the poor in developing countries. Based on widely accepted scholarship that clearly lays out how all the players in health innovation – firms, governments, research institutes, nongovernmental organizations (NGOs), citizens and donors – can work together most effectively to assure access to urgently needed health technologies in developing countries, we argue for the creation of a Global Health Innovation System (GHIS) – the missing architecture.

The history of health innovation

Health innovation includes not only technologies but also better systems and policies. Since Schumpeter's analysis (Schumpeter 1943), scholars have argued that advances in human health and well-being are determined both by technological innovation and by how institutions handle new technologies. Understanding the history of health care innovation, therefore, requires us to consider both technologies and policies.

Since the 19th century, we see four major periods of health technology innovation: the era of the public sector, the era of the private sector, the era of public sector reawakening and the era of partnerships. Our analysis is based in part on the work of Stokes (1997), which we have adapted to the field of health technology innovation. The era of the public sector is the period from the mid-19th century to World War I. The era of the private sector is the period from World War I to the fall of the Berlin Wall. The years from the fall of the Berlin Wall to the

dawn of the 21st century, we refer to as the era of public sector reawakening. The birth of the 21st century marks the beginning of the era of partnerships. The transitions from era to era take place in response to broader world changes, particularly the struggle between capitalism and socialism and the emergence of globalization.

The era of the public sector is epitomized by the work of Pasteur. Working within the university, he was able to develop a number of human and animal health technologies that were widely adopted and greatly improved medical practice. His initial discoveries and technological innovations, such as disproving spontaneous generation and developing the rabies vaccine, were made possible largely by public sector institutions, such as l'Ecole Normale in Paris. The explosive demand for rabies vaccination led Pasteur in 1888 to create the Pasteur Institute in Paris, a private, state-approved institute recognized by the President of France. In 1891, Pasteur dispatched Albert Calmette to Saigon, (today Ho Chi Minh City), Vietnam, where he founded the first Institute outside France. Other disciples set up establishments modelled on the Paris Institute in several developing countries. Invariably, these were public institutions closely associated with national governments. Of course, Pasteur had no choice: no private sector pharmaceutical or vaccine industry existed in the second half of the 19th century, so he had to create production facilities and structures himself (Marchand 2005).

The era of the private sector emerged in Germany when chemical companies applied their manufacturing skills to medicines (Chandler 2005). They soon recognized the high investment returns of these technologies and established research capabilities to create new and even more profitable products. During this era, the public sector became less involved in activities that brought new medicines and vaccines into wider use. To some degree, this was due to less support for science in the Socialist east and to the shift to funding "basic" research in the capitalist West, which left it to industry to translate such research into products. This was the established "linear paradigm" described in Vanevar Bush's report to the President of the United States at the end of World War II: "Science the Endless Frontier" (Bush 1945).

The era of public sector reawakening began in the 1970s, when several development organizations (foundations and governments) established after World War II became concerned about health in developing countries, especially the absence of health technologies. Around this time, the World Health Organization (WHO) established its Special Programmes: the Human Reproduction Programme (HRP), the Tropical Disease Research and Training Programme (TDR), and the Diarrheal Disease Control Program (CDD). Each of these programmes sought to develop or apply new technologies and strategies for the pressing health needs of people in developing countries. With support from the Ford and Rockefeller Foundations, The Population Council in New York and the Program for Appropriate Technology in Health (PATH) in Seattle also created programmes to begin product research and development to address health needs in developing countries. The United States government dramatically increased funding for the NIH, which led to the unprecedented growth of biomedical research there and in collaborating centres around the world. But in the health field, collaboration between the public and private sectors during this period was uncommon and viewed with suspicion. In other fields, particularly in engineering schools and land grant colleges, a tradition of public-private collaboration went back to the late 19th century, especially in the United States (Mowery et al. 2004). In health research and development, however, neither sector understood the other, and collaboration was difficult, at best. For example, private-sector representatives were excluded from almost all WHO meetings, and universities and companies rarely interacted, in part because no clear legal framework allowed public institutions to manage IP rights.

The passage of such legislation as the Bayh-Dole Act in the US in 1980 (Passman et al. 2005), the fall of the Berlin Wall on 9 November 1989 and the collapse of the Soviet Union on Christmas Day 1991, made it possible to view the relationship between the public and private sectors more objectively. It became more acceptable for academics in the West to work closely with pharmaceutical companies; conversely, pharmaceutical companies saw the benefits of closer collaboration with universities and nonprofit research centres. Beginning in the 1990s and flowering in the early part of the 21st century, a number of new initiatives were launched that have since become known as product-development public-private partnerships (PDPs) (Gardner & Gardner 2005; Nwaka & Ridley 2003). They seek to accelerate the development of health products for use in developing countries. Examples include the founding of the International AIDS Vaccine Initiative (IAVI) in 1996, the Aeras Foundation in 1997 to develop TB vaccines, and the Medicines for Malaria Venture in 1999 (MMV) (Nwaka & Ridley 2003).

These developments led to the current era of partnerships. It began to be understood that for-profit pharmaceutical companies in wealthy industrialized countries would not address the needs of the poor in developing countries without incentives from government or other public sector agencies. On the other hand, the private sector had certain skills and abilities that the public sector lacked, including the ability to make large numbers of products to very high standards.

The era of partnerships

We are in the very first years of the new era of partnerships, and, among many issues, we need to understand better how the public and private sectors can partner most effectively. Ignorance is mutual. While the public sector faces such challenges as managing IP rights for the public's benefit, IP management practices are well established in the private sector (Mahoney et al. 2004). The private sector, on the other hand, is eager to learn how to handle the special needs of poor populations in both developed and developing countries (Moran et al. 2005). The ground is moving under everyone's feet: a number of developing countries are beginning to reap the fruits of substantial investments in biotechnology over the last 25 years. These countries, such as Brazil, China, India, South Africa and others, are now known as Innovative Developing Countries (IDCs) (Morel et al. 2005a; Morel et al. 2005b). India is becoming a global

centre for both vaccine and drug production and is also rapidly increasing its capability to undertake research and development. It already has extensive capabilities in clinical assessment (Saha & Gardner 2004). China is also very rapidly expanding its research capabilities (Zhou & Leysdesdorff 2006).

Early evidence collected and analyzed by Mary Moran and other investigators shows that PDPs have the promise to develop and introduce new health technologies for developing countries (Moran et al. 2005). Numerous questions, however, still need answers. Certainly, the new era of partnerships has seen a range of proposals to encourage or create initiatives promoting health technology innovation for the poor. These include double-bottom-line venture capital funds (where both profits and social benefit are measured); France's airline solidarity contribution (Anoymous 2006a); humanitarian licensing practices at research universities (Brewster et al. 2005); fast-track regulatory approval vouchers (Moran et al. 2005); global procurement funds such as GAVI and the Global Fund to Fight AIDS, TB, and Malaria; advance market commitments (Barder & Levine 2005); and others. We do not know, however, which of these are most cost effective, which are synergistic, and which may cross-react to produce unwanted side-effects (Lob Levyt & Affolder 2006).

The era of partnerships is structured by technological innovation, the legacy of the geopolitical struggle between capitalism and socialism, and globalization. This last factor has affected many aspects of health worldwide. Jet travel can transmit diseases from one part of the world to another in hours. Pharmaceutical firms are now global companies, marketing their products to over 100 countries. Because of the very large profits they have made from critically needed health products – especially by the poor – these companies have been admired and criticized. Globalization has led university investigators to collaborate through worldwide research systems, making science a global undertaking. All of these aspects of globalization are profoundly affecting how knowledge is produced and how health technology innovation occurs (Gibbons et al. 1994; Krimsky 2003).

We do not yet know how this new era of partnerships can operate most effectively in the field of health innovation. Insistent questions have arisen about how to best regulate new drugs and vaccines, how to manage patents and other forms of IP for new health applications, and how to fund research in academia and industry. Many more such questions will continue to arise as we learn more about the new structure, limitations and possibilities of the new era of partnerships.

We do know one thing for certain: this new era requires a global perspective. The WHO Commission on Intellectual Property Rights and Innovation has recently called for a global plan to make the most of this new era (Commission on Intellectual Property Rights 2006):

> It is important that all the contributions of all stakeholders are taken into account so that their respective energies can be mobilized towards the achievement of a common goal… For this purpose, the need is to develop a Global Plan of Action which would provide a medium term framework for action by these partners, including the setting of clear objectives and priorities and a realistic estimation of funding needs if these are to be achieved. … Viewed across the field, there are few or no available mechanisms at present to advise on appropriate priorities for resource allocation between R&D on different diseases, the balance between resources needed for R&D and delivery for each disease or the means to monitor and evaluate the impact of resources devoted to treatment and delivery. Such a Plan would also provide an important basis for measuring progress towards the achievement of these goals.

If health technology innovation is to contribute to alleviating death and disease among the poor worldwide, its operations must be global. It must be able to identify the nature and causes of so-called "health failures" and to propose strategies to cope with them. And these strategies must involve all countries – from industrialized to least developed countries. In short, the Global Plan of Action called for by the WHO Commission should be a part of a Global Health Innovation System (GHIS).

The GHIS as a response to "health failures"

A Global Health Innovation System is warranted because of a number of "health failures". We identify three kinds of these: science failures, market failures and public health failures.

Science failures occur when we lack the knowledge to make tools or mechanisms to address health problems. For example, we do not know how to make safe and effective drugs or vaccines against such important diseases as dengue, avian flu, tuberculosis and all parasitic diseases (malaria, leishmaniases, and trypanosomiases, etc.). To address this failure globally, we need more basic and applied research, which requires not only increased funding but also enhanced strategies for developing new products that will be accessible to the poor in developing countries. Some of the most promising strategies involve PDPs and funding agencies in industrialized countries to address scientific issues of interest to developing countries (e.g., the genome projects for tropical pathogens and their vectors (Ash & Jasny 2005; Morel et al. 2002)).

Market failures occur when the costs of vaccines, drugs, or other health interventions bar the poor from access, when the cost of developing or producing new drugs is very high, or when their delivery requires costly structures, such as sophisticated tertiary health care units. Examples of these kinds of products are antiretrovirals, combination therapies against malaria, and regimens for fighting drug-resistant tuberculosis. To address these failures, we must either provide much greater funding for such mechanisms as the Global Fund to Fight AIDS, Tuberculosis and Malaria, or we need to find more efficient ways to produce these products and lower their cost to consumers. We can address such market failures by several means, including procurement funds and funding PDPs. Other options include increasing the health budgets of national governments or stretching health expenditures through government negotiations with

drug suppliers to reduce the costs of pharmaceuticals. One example of an innovative financing system is the Provisional Contribution on Financial Movement (CPMF) that Brazil established in the 1990s to finance health care, which generated revenue of 1.5% GDP for several years and helped deliver antiretrovirals to millions (Anonymous 2006b; Ryan 2006).

Public health failures occur when good governance or sound priorities are lacking. Corruption, crises, war or cultural and religious factors can block access to cheap and readily available interventions. Resistance to immunization by religious or cultural factors, for example, has made polio eradication more difficult. Obesity and tobacco consumption are other examples. To address these public health failures, we need more education, better leadership within civil society and the strengthening of human rights. Recent innovations that are helping to address these public health failures include National Immunization Days (Olive et al. 1997), the WHO Tobacco Convention, educational TV campaigns and better management and budgeting practices, as in the Tanzania Essential Health Interventions Project, TEHIP (de Savigny 2004).

These failures point to a broad based "failure of policy": the global, national and institutional policies needed to effectively address these failures are lacking. A sound GHIS would fill this need, and we believe that innovation systems studies can provide valuable guidance about how to make it work most effectively.

What we can learn from innovation systems studies

Over the last three decades, innovation studies have taught us much about the essential elements of effective innovation systems. We highlight four: the role of the firm, the role of governments, the value of networks and the need for adequate and sustained financing.

1. The role of the firm. Private firms are the key actors in innovation. While historically some innovation, such as the development and production of early vaccines, took place through state-owned or parastatal organizations, they are of less importance today (Freeman 1987). A new technology has very little chance to reach the market without the sponsorship or partnership of a firm. This insight helps us to understand from another point of view why public-private partnerships are necessary. Lall has examined this issue with respect to developing countries and shows that firms are also essential there (Lall 1992).

2. The role of government and the public sector. After the fall of the Soviet Union, some argued that the government should not be involved in directing or stimulating innovation (this was a component of the "Washington Consensus" (Anonymous 2006c)). A number of economists, however, have demonstrated that the government is in fact a necessary and essential partner in innovation. Korea is often cited as the prime example (Lall 1998). We believe that while the government cannot determine innovation, it does have an essential role to play in setting ground rules and providing funding and other incentives.

3. The value of networks. Innovation studies show that the most effective firms and organizations are those with the most dynamic networks. Whether in the public or private sector, these organizations reach out to actors in the key areas in which they work. They build collaborative partnerships or exchange information. Conversely, organizations operating within limited networks are less innovative and successful (Wagner et al. 2001).

4. Adequate and sustained financing. Acquiring innovation capabilities is a long-term process of 10–30 years that requires long-term funding at high levels. By contrast, the pace of technological innovation is very rapid (Mytelka 2000), imposing extra challenges to developing countries.

While most innovation studies focus on developed countries, innovation in developing countries has also received some attention. One focus has been on whether or not developing countries can innovate. Viotti argues that developing countries do not innovate but learn, and he divides them into two categories: active learning and passive learning (Viotti 2002). Defining innovation as the development and commercialization of truly new technologies, he argues, by that definition, developing countries are not currently capable of innovation. But it seems that some developing countries – the IDCs – may be poised to make truly innovative contributions. India, for example, has already moved into the first frontier of innovation in information technology. Nevertheless, the vast majority of the world's innovators are in developed countries. Developing countries must therefore devote a larger proportion of their innovation activities to learning from others. And given the four major lessons described above, developing countries should also work to stimulate innovative firms, provide long-term sustained funding to develop innovation capabilities, and promote the establishment of networks not only among themselves but also with leading centres in developed countries (Rangel 2003).

In sum, a GHIS should help to involve firms and government, create and sustain networks, and mobilize and maintain adequate financing. It must also facilitate networks with nodes in both developed and developing countries.

Promising developments

As documented by the work of DiMasi (2003) and Towse (2004), the resources necessary to develop new drugs and vaccines are substantial: between $400 and $1,285 million (in year 2000 dollars). As Towse and Glickman (Glickman et al. 2006) point out, the funds available to current PDPs are insufficient to develop a range of new technologies successfully. Every effort must therefore be made to achieve the highest level of cost effectiveness when allocating resources to develop new and improved health technologies. But where can guidance for such efforts be found? The GHIS would help to meet this need.

Certain types of health innovation systems are already emerging. For example, PDPs are setting up global systems to promote the development of new drugs or vaccines. With both public and private sector collaborators in developed and developing countries, they are addressing all of the issues

Actions by national innovation systems		Health failures		
		Science failure (knowledge/learning gap)	Market failure (resources gap)	Public health failure (best practices gap)
	Industrialized countries	Public funding of R&D of interest to developing countries (e.g. NIH genome projects of tropical pathogens)	Drug procurement mechanisms (e.g. Stop TB Partnership Global Drug Facility, GDF)	Drug donation programs (e.g. Merck Mectizan); Donor support to health systems (e.g. Rotary International & poliomyelitis vaccination)
		Private sector participation at PDPs; Big Pharma institutes dedicated to neglected diseases (e.g. Novartis Institute for Tropical Diseases, Singapore; GSK drug discovery unit in Tres Cantos, Spain)	Differential drug pricing (e.g. Novartis' antimalarial Coartem® in endemic countries sells as Riamet® in industrialized countries)	Actions through Global Conventions (e.g. Tobacco Convention against smoking; UN Framework Convention on Climate Change to monitor impact of climate changes on insect-borne diseases)
	Innovative developing countries	Health innovation networks (e.g. South/South: WHO Developing Countries Vaccine Regulators Network; e.g. North/South: genomics/ bioinformatics networks for the study of tropical pathogens)	Innovative financing systems (e.g. Provisional Contribution on Financial Movement, or CPMF taxation, imposed by Brazil to buy antiretrovirals)	Pressure from health sector and civil society (e.g. Brazil Constitution's "Health is the citizen's right and the State's obligation and responsibility")
		"Bayh-Dole" – like laws to foster academia-industry partnerships (e.g. Innovation Law, Brazil)	Negotiating price reductions (e.g. Brazil/Abbott deal to lower price on antiretroviral drug Kaletra)	National Immunization Days; cash transfer programmes to reduce poverty and inequality (e.g. The Bolsa Familia Project in Brazil)
	Least developed countries	South/South networking with IDCs (e.g. collaboration between Brazil and lusophone Africa in the strengthening of public health schools and R&D institutes)	Funding mechanisms (e.g. The Global Fund to Fight AIDS, Tuberculosis and Malaria; The Global Alliance for Vaccines and Immunization)	Better priority setting (e.g. The Tanzania Essential Health Interventions Project, TEHIP)
		Participation at clinical trial platforms (e.g. European & Developing Countries Clinical Trials Partnership, EDCTP)	Regional production of generic drugs; Popular Pharmacies ("Boticas Populares") that sell generic and essential drugs at a reduced price to poor people	Innovative approaches in relation to educational campaigns, empowerment of women, fighting corruption
		New products, methods	**New processes**	**New strategies or policies**
		Health innovations needed		

Table 1: Coping with health failures: An example of a Health Innovation – Country Category matrix

associated with developing and introducing new technologies. This includes research and development, market development in individual developing countries, international trade issues, manufacturing issues, intellectual property rights and regulatory matters (Garner 2005).

In addition, several developing countries are beginning to build collaboration networks. For example, Brazil, China, Cuba, India, Nigeria, Russia, South Africa, Thailand and Ukraine have formed a network to boost production of antiretrovirals and other health products (Morel et al. 2005b). These networks must address all the issues related to the development and introduction of new technologies, including the critical area of intellectual property rights. It is not clear whether these networks will succeed: they are in very early stages of development.

Within some developing countries, such as Brazil, India and South Africa, networks have been created to facilitate the development and introduction of new health technologies that meet their citizen's needs. All of these countries strongly emphasize forming and promoting public-private partnerships.

In Brazil, for example, it used to be very difficult to partner with private companies. Due to the Law on Innovation enacted in December 2004, a new, enabling environment strongly encourages such partnerships (Vereu 2004).

Other efforts to develop focused global health innovation systems include the Bill and Melinda Gates Foundation's promotion of an HIV Enterprise, which will provide a worldwide coordinated strategy to address the need for new HIV vaccines (Klausner et al. 2003), and Dr Gerald Keusch has proposed the formation of a network to link medical research councils and universities around the world in concerted strategies to develop new health technologies (Keusch 2003).

Each of these initiatives (PDPs, developing country health innovation programmes, and international networks) are either relatively new or have yet to be fully launched. Unfortunately, there is little if any cross learning among these various initiatives, and there is a lot of repetition and duplication. One initiative addressing the need for cross links is the Centre for the Management of IP in Health R&D in Oxford, England (MIHR). MIHR is attempting to identify and disseminate best practices for IP management in order to insure access to new health technologies by the poor in developing countries (www.mihr.org). WHO is promoting another cross-linking initiative, the WHO Developing Countries' Vaccine Regulators Network, created in September 2004. Including Brazil, China, Cuba, India, Indonesia, Russia, South Africa, South Korea and Thailand, it brings together national regulatory authorities to prepare standard approaches for the review and approval of vaccines and drugs needed in developing countries (Chocarro 2006). Brazil and Kenya have proposed to the World Health Assembly a treaty concerning health R&D. The proposed treaty would result in the establishment of a global mechanism for priority setting in health R&D. It would also set non-enforceable targets based on GNP for support of health R&D in priority areas for the poor. The treaty would allow member states to modify laws and policies concerning intellectual property in ways that would enhance access by the poor. Finally, the treaty would establish various operating institutions (possibly within WHO) for the management of priority setting, oversight of financial contributions, monitoring of activities under the treaty and other matters. This treaty and a resolution concerning it will be considered at the World Health Assembly in May 2006. If the resolution is approved, the treaty might take effect in 2009 after preparatory work (Anonymous 2005). Representing potentially important contributions to the creation of a GHIS, these valuable efforts should be promoted.

A framework for a GHIS

We propose a framework for the GHIS based largely on the work of Lall (2003). The framework identifies six components of health technology innovation (Mahoney et al. 2005):

- Development and expansion of national health delivery systems, including an attractive, domestic, private-sector market for health products.
- Development of manufacturing capability for health products.
- The drug and vaccine regulatory system.
- The IP regulatory system.
- Development of R&D capability by the public and private sectors.
- Development of international trade systems for health products, including global procurement funds.

Because these innovation components are dynamically linked, successfully developing and introducing new technologies requires concerted attention to each of the six components (Lee & Lim 2001). Progress in one requires progress in all, and failure in one may impede progress in all. National innovation policies and the crafting of global policy interventions and norms must be considered. And to create strategies for product development and introduction, we must also attend to the roles of the public and private sectors in each of the six components. These roles of the public and private sectors for any given technology development will necessarily be inadequate if they are considered independently of one another. For national policies, moreover, the relative emphasis given to the components will differ according to the kind of country: developed, IDC or low-income.

The framework can be used to develop not only strategies for particular technology innovation initiatives but also strategies for national health innovation. Indeed, the value of such a framework is readily apparent. When a country wishes to accelerate progress in science and technology, its strategy must encompass all six components. Likewise, if it wants to develop comprehensive financing strategies or capacity building strategies, it must address all six components. The ministry of science and technology, for example, cannot develop a comprehensive innovation strategy on its own. It must work with the ministry of health, the ministry of industry and the ministry of trade.

The framework applies equally to the operation of international networks, such as the HIV Enterprise. Such enterprises will have to address issues with respect to each of the six components, as will PDPs.

Using the innovation components to address the health failures

By focusing on the six components of innovation, effective innovation policies can be developed. But different actors and different countries have different roles to play in accelerating health innovations and addressing health failures. We have therefore mapped the six components of health innovation against the three kinds of health failure (i.e., science failures, market failures and public health failures). Science failures can be addressed primarily through considering drug regulation, IP, and research and development issues. Market failures are primarily addressed by working on the components of innovation for domestic markets and international markets. Public health failures can also be addressed by looking at why domestic markets, which include national health service delivery systems and the private sector's delivery of health services, do not work efficiently. Understanding how international markets work, such as those for tobacco (an example where we want to innovate by reducing the use of the

technology and tobacco consumption), will also move us towards solutions. We argue, however, that addressing science failures, market failures, and public health failures requires addressing all six components of innovation. This health innovation assessment and the identification of the three areas of health failure lead us to propose a comprehensive matrix to illustrate how various countries and institutions within those countries can contribute to addressing health failures through innovation. There are roles for industrialized countries, for IDCs, and for the least-developed countries. Table 1 provides this matrix and illustrates how different agencies and organizations in both the public and private sectors in different kinds of countries can be brought together to help address health failures. The matrix of Table 1 articulates two dimensions:

(i) The vertical (column) "diagnostics/therapeutics" axis:

- *Diagnostics:* lists the three kinds of **failures** (interventions do not exist, interventions exist but are too costly, cost-effective interventions exist but do not reach the poor).
- *Therapeutics:* lists the appropriate type of **innovation** required to cope with each kind of failure (new products, new processes, new strategies/policies).

(ii) The horizontal (row) player axis:

- *Players:* displays the three categories of **countries** whose national innovation systems are responsible for the development and implementation of the innovations and interventions (industrialized, IDCs, Least-Developed Countries).

The cells of the matrix display examples of health actions, where each country category intervenes appropriately to cope with each kind of health failure. For these actions to occur, the countries and institutions will need to address the four elements of an effective innovation system: the role of the firm, the role of the public sector, the value of networks and sustained funding.

Developing the GHIS

The new millennium continues to bring major changes to the world. In health the changes – new funds, new organizations and new opportunities to develop the health technologies needed in developing countries – have helped give birth to the era of partnerships for health innovation. Most of the partnerships, however, have focused missions and concentrate their activities on developing specific products or interventions. Although an important component of a future GHIS, their compartmentalized mandates are no substitute for the global architecture called for by Professor Bloom. We believe that a new architecture for health innovation is possible, necessary and urgently required. It should be based on the lessons provided by innovation studies, effectively addressing each of the six innovation components and the three different health failures by identifying appropriate roles for each country and public- or private-sector organization. A GHIS does not exist today so we do not know what exact form it would assume. But without changes from the status quo, it is likely that 10 or 20 years from now we will have only a few new products on the market: most will be stuck in the pipeline. To open the floodgates to new innovation, we need a widely accepted, understood and cost-effective GHIS. We propose that its architecture should be integrated to become more than the mere sum of its parts: the innovation systems of PDPs, developing countries, developed countries and international networks. One may think of it as an overarching system that discusses, shapes and provides a long-term strategic vision, a system that offers best practices and policies adapted to the particular needs and environments of all the participating organizations. ❑

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References

Anonymous 2005, Medical Research and Development Treaty (MRDT). http://www.cptech.org/workingdrafts/rndtreaty4.pdf: p. 12.

Anonymous 2006a. Innovative ways to fund human development. [cited 2006 April 12]; Available from: http://www.diplomatie.gouv.fr/en/IMG/pdf/argumen taires-eng.pdf.

Anonymous 2006b, The CPMF: Myths and realities from the Economic and Administrative Points of View. http://www.receita.fazenda.gov.br/Historico/EstTributarios/TopicosEspeciais/CPMFIngles/default.htm

Anonymous 2006c, Washington Consensus. http://www.wikipedia.org/wiki/Washington_Consensus

Ash C & Jasny B 2005, 'Trypanosomatid genomes. Introduction'. *Science*, vol. 309, p. 339.

Brewster AL, Chapman AR & Hansen SA, 2005, 'Facilitating Humanitarian Access to Pharmaceutical and Agricultural Innovation'. *Innovation Strategy Today*, vol. 1, no. 3, pp. 203–216.

Barder O, MK & Levine R 2005, 'Making Markets for Vaccines: Ideas to Action. 2005, Center for Global Development': Washington, DC, p. 113.

Bush V 1945, *Science and the Endless Frontier: A Report to the President*. United States Government Printing Office: Washington DC.

Chandler A 2005, *Shaping the Industrial Century. The Remarkable Story of the Evolution of the Modern Chemical and Pharmaceutical Industries*, Cambridge, Massachusetts, and London, England: Harvard University Press. p. 366.

Chocarro L 2006, WHO, Personal communication, January 2006, Also, Chocarro, L 2005, quoted in Braine T. 'Rotavirus vaccine introduction in Mexico sets precedent', *Bull World Health Organ*, vol. 83, pp. 167.

Cohen J 2005, 'The New World of Global Health', *Science*. pp. 162–167.

Commission on Intellectual Property Rights 2006, *IaPH, Public Health: Innovation and Intellectual Property Rights*. World Health Organization, Geneva. p. 228.

de Savigny D, et al. 2004, *Fixing Health Systems*. International Development Research Centre, Ottawa, p. 126.

DiMasi JA, Hansen RW & Grabowski HG 2003, 'The price of innovation: new estimates of drug development costs'. *Journal of Health Economics*, vol. 22, pp. 151–185.

Freeman C 1987, *Technology Policy and Economic Performance: Lessons from Japan*.Pinter Publishers, London and New York, p. 155.

Gardner C & Garner C 2005, 'Technology licensing to nontraditional partners'. *Industry and Higher Education*, pp. 241–247.

Gibbons M, et al. 1994, *The new production of knowledge: the dynamics of science and research in contemporary societies*, SAGE Publications, London, Thousand Oaks, and New Delhi, p. 179.

Glickman SW, et al. 2006, 'A Portfolio Model of Drug Development for Tuberculosis'. *Science*, vol. 311, pp. 1246–47.

Garner C 2005, *Dealmaking and Intellectual Property Management for Public Interest*. Aeras Foundation, IPPPH, Bethesda, MD.

Keusch G 2003, 'Health research: Tapping the power of small institutions'. *Nature*, vol. 422, pp. 561–562.

Klausner R, et al. 2003, 'The Need for a Global HIV Vaccine Enterprise'. *Science*, June 27, vol. 300, pp. 2036–2039.

Krimsky S 2003, *Science in the private interest: Has the lure of profits corrupted biomedical research?* Rowman & Littlefield Publishers, Inc., Lanham, Boulder, New York, Oxford, p. 247.

Lall S 1992. 'Technological capabilities and industrialization'. *World Development*, vol. 20, no. 2, pp. 165–186.

Lall S 1998, '"Market-Stimulating" Technology Policies in Developing Countries: A Framework with Examples from East Asia'. *World Development*, vol. 26, no. 8, pp. 1369–1385.

Lall S 2003, Indicators of the Relative Importance of IPRs in Developing Countries. UNCTAD/ICTSD Project on IPRs and Sustainable Development, (Paper No. 3).

Lee K & Lim C 2001, 'Technological regimes, catching-up and leapfrogging: findings from the Korean industries'. *Research Policy*, vol. 30, pp. 459–483.

Lob-Levyt J & Affolder R 2006, 'Innovative financing for human development'. *The Lancet*, vol. 367, pp. 885–887.

Mahoney R, Lee K & Yun MK 2005, 'The evolution of biotechnology in Korea: a Framework for Analysis; a case study of the vaccine industry'. *Innovation Strategy Today*.

Mahoney R, Pablos-Mendez A & Ramachandran S 2004, 'The introduction of new vaccines into developing countries. III. The role of intellectual property'. *Vaccine*, vol. 22, no. 5-6, pp. 786–92.

Marchand M-H 2005, 'Louis Pasteur et la creation de L'institut Pasteur', in Louis Pasteur & Oswaldo Cruz, N. Lima and M.-H. Marchand, Editors., FIOCRUZ/Banco GNP Paribas: Rio de Janeiro. pp. 179–209.

Moran M, AR, Guzman J, Diaz J & Garrison C 2005, *The new landscape of neglected diseases*. Wellcome Trust, London.

Morel C, et al. 2002, 'The mosquito genome – a breakthrough for public health'. *Science*, vol. 298, p. 79.

Morel CM, et al. 2005a, 'Health innovation networks to help developing countries address neglected diseases'. *Science*, vol. 309, no. 5733, pp. 401–404.

Morel CM et al. 2005b, 'Health innovation in developing countries to address diseases of the poor'. *Innovation Strategy Today*, vol. 1, no. 1, pp. 1–15.

Mowery D, et al 2004, *Ivory Tower and Industrial Innovation. Innnovation and Technology in the World Economy*, ed. Kenney M & Kogut B. Stanford Business Books, Stanford, p. 241.

Mytelka L 2000, 'Local Systems of Inovation in a Globalized World Economy'. *Industry and Innovation*, vol. 7, no. 1, pp. 15–32.

Nwaka S & Ridley RG 2003, 'Virtual drug discovery and development for neglected diseases through public-private partnerships'. *Nat Rev Drug Discov*, vol. 2, no. 11, pp. 919–28.

Olive J, Risi Jr J & C de Quadros 1997, 'National immunization days: experience in Latin America'. *J Infect Dis*, vol. 175, Suppl 1, pp. S189–S193.

Passman P, Brady B & Guidera B 2005, 'Technology Innovation and Development Using the Bayh-Dole Act to Advance Development Goals'. *AUTM Journal*, vol. XVII, no. 1, pp. 1–14.

Rangel R 2003, 'Developing Countries and Systems Biology'. *Nature Biomedicine*, vol. 21, pp. 491–492.

Ryan MR 2006. *Brazil's Quiet Bio-Medical Innovation Revolution: Drugs, Patents, and the "10/90" Health Research Gap.* Creative and Innovative Economy Center, The George Washington University Law School, Washington, DC, p. 30.

Saha R, KS, Gardner CA 2004, 'Building a "Cottage Industry" for Heatlh (and Wealth): The New Framework for IP Management in India'. *IP Strategy Today*, vol. 10, pp. 26–60.

Schumpeter J 1943, *Capitalism, Socialism and Democracy*, Allen & Uwin, London.

Stokes DE 1997, *Pasteur's Quadrant: Basic Science and Technological Innovation*, The Brookings Institution, Washington, DC, p. 180.

Towse A 2004, 'Estimates of the Medium Term Financial Resource Needs for Development of Pharmaceuticals to Combat Neglected Diseases'.

Veneu F 2004, Brazil adopts innovation law. *SciDevNet*.

Viotti EB 2002, 'National Learning Systems: A new approach on technical change in late industrializing economies and evidences from the cases of Brazil and South Korea'. *Technological Forecasting and Social Change*, vol. 69, no. 7, pp. 653–680.

Wagner C, et al. 2001, Science and Technology Collaboration: Building Capacity in Developing Countries?, in RAND Science and Technology. RAND. p. 90.

Zhou P and Leydesdorff L 2006, 'The emergence of China as a leading nation in science', *Research Policy*, vol. 35, pp. 83–104.