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ESSENTIALS Access to quality healthcare and education for all are essential elem- ents underpinning national development as well as prerequisites for personal well-being. This makes it important to grasp the inequalities that still prevail in human and institutional capacity, including access to and use of research resources. The goals of fostering medical re- search in resource-constrained countries are: to bring outstanding science to bear on their medical and health problems; invest in building the requisite medical and health research systems; develop an evidence base to inform policies and programmes, resource al- location, and health practice; enhance scientific processes, findings, explanation, and 'discovery' by drawing on local know-how; and gain sustained engagement with policymakers, senior managers, and community leaders. Context is all-important: every country, no matter how small or resource-constrained, should have the capacity to conduct essential national health research to identify, prioritize, and respond to its own health problems. Critical to fostering medical research1 in resource- constrained countries is the need for balanced, equitable collabor- ations that emphasize longer-term building of human and institutional capacity. This speaks to the true opportunity offered by the promise and practice of research in resource-constrained countries: to con- tribute widely to both national and global health development and, in so doing, to major and equitable progress in the human condition. Introduction Medical and health research today take place within a new era of 'global health', south-north-south collaboration, and 21st century interdisciplinary knowledge convergence. These provide promise, challenges, and opportunities, particularly for fostering research in resource-constrained countries. Globalization today is premised on speed of communication and interconnectedness which serve to 'level' peoples' aspirations and expectations across all settings; similarly, the questions, focus, and methods of science are converging more than ever before despite the variation in socioeconomic contexts. Anticipating this, a multipolar Global HIV Vaccine Enterprise was proposed in 2003. This cata- lysed an upsurge in research and institutional

development towards a still-elusive vaccine against HIV/AIDS. Most visible of 21st century innovations is the internet, which is re- shaping all forms of communication from the social to the scientific. Less visible, though in time as pervasive, is the biological revolution which has already ensured a new scientific ‘universe’ reflected in un- ravelling of the human genome along with the tools to more deeply understand and manipulate our genomic complement. The full ram- ifications and impact of the ‘biological revolution’ on science, society, and well-being are yet to be fully understood and appreciated. Despite the sometimes intolerable hardship experienced by mi- grant or refugee populations—ever-present in today’s globalized ‘in- stant media’—the moral standards the world uses to judge its actions are today more apparent and widely held. This is reflected in global debates on climate and the environment, sustainable energy use and acceptable standards of political governance that have given rise to equity-oriented research initiatives such as Future Earth and Urban Health and Wellbeing, which seek to harness science across discip- lines, sectors, and geographies. Contemporary UN Declarations as well as national constitutions—that of South Africa, our own country, for example—enshrine human dignity, the achievement of equality, and advancement of human rights and freedoms as supreme qualities. Access to quality healthcare and education (for all) are recognized as essential elements underpinning national development as well as prerequisites for personal well-being. This makes it important to grasp the inequalities that still prevail in human and institutional capacity, including access to and use of research resources. For example, national research and development (R&D) expenditure among OECD countries was estimated at 2.4% of gross domestic product (GDP) in 2012, with the R&D expenditure in the United States comprising 2.79% of GDP, and Korea 4.36%. While China’s R&D expenditure is growing (cur- rently estimated at 1.98% of GDP), R&D expenditure in South Africa, India, and the Russian Federation fall below this average (most recent estimates amounting to 0.76%, 0.81%, and 1.12% of GDP, respectively). 2.18 Fostering medical and health research in resource-constrained countries Malegapuru W. Makgoba and Stephen M. Tollman 1 The term ‘health research’ encompasses a breadth of disciplines to investigate the determinants of health and illness and the interventions, system changes, and policies needed to address these.

182 section 2 Background to medicine A further indicator of this disparity is the level of researchers per thousand employed people in these different regions. The OECD average is 7.7 people per thousand employed in 2011, with Finland reporting the highest ratio of 16.06. South Africa and China report relatively low estimates of 1.43 and 1.83 people per thousand em- ployed in research. In the health sector, OECD countries average 3.16 physicians to 1000 inhabitants with the United Kingdom re- porting a ratio of 2.8 and the United States a ratio of 2.5 in 2011. In contrast, India and South Africa most recently estimate 0.7 and 0.8 physicians to 1000 people, respectively. It follows that across low- and middle-income countries (LMICs) there are different constraints with little uniformity in the infrastructure available for research, reflecting variable investment and the uneven status of research in national development. Pockets of excellence exist in middle-income settings that range from Brazil to China to India and South Africa—but widely inadequate research and infrastructure devel- opment characterize most lower-income countries thereby denying the fruits of research and scientific advance to many of the world’s poorest and marginalized communities and, indeed, to future generations. Critical, unresolved research questions confront the scientific, policy and citizen leadership of LMICs—on the rapidly evolving burden of disease and risk and their social and biological deter- minants in contrasting environments, coupled with understanding and improving the health and social systems that can address these effectively. Such issues pose a profound challenge to scientists and practitioners within and across disciplines.

They shine a light on the sociopolitical context in which such issues are being addressed. Whereas scientific and social progress hold the promise of major advances in personal and population health, persisting disparities can exacerbate inequalities and render ‘catch-up’ all but out of reach. Fostering medical research in resource-constrained countries is not only essential but also requires institutional and individual sci- entific development—with attention to career paths, research leadership, sound ethics, the sustaining of versatile research platforms (molecular, clinical, service and population-based), and institu- tional support. Broadly put, the goal is to: • Bring outstanding science to bear on the medical and health prob- lems of resource-constrained countries and communities. • Invest in building the requisite medical and health research sys- tems based on sound governance and long-term institutional cap- acity strengthening. • Build an evidence base to inform policies and programmes, re- source allocation, and health practice from primary care to advanced clinical settings; these should focus on national priorities and tackle inequities. • Enhance scientific processes, findings, explanation, and ‘dis- covery’ by drawing on local know-how and indigenous know- ledge and expertise. • Gain sustained engagement with policymakers and senior man- agers as well as community leadership, to foster the uses of evi- dence and encourage enhanced investment in health research and healthcare. The work of the Commission on Health Research for Development was a landmark which, in 1990, published ‘Health Research: Essential Link to Equity in Development’. This far-reaching report envisaged that every country, no matter how small or resource-constrained, should have the capacity to conduct essential national health re- search in order to identify, prioritize, and respond to its own health problems. In addition, that all countries, no matter how limited their resource base, should contribute to the global health research enter- prise. These aspirations—widely shared and as timely today—clearly align with aspirations for the new ‘global health’. They highlight the national and scientific competencies needed to ensure deep and sus- tained progress towards the Millennium Development Goals and their recent successor, the Sustainable Development Goals. Changing profiles of health, disease, and

well-being: Setting priorities for health research Health problems facing resource-constrained countries—where poverty is widespread amid income and social inequalities—can occur with unexpected intensity, evidenced by the recent Ebola epidemic in the West African countries of Guinea, Liberia, and Sierra Leone. While the infec- tion itself carried an overwhelming mortality rate, the knock-on effects were similarly devastating: primary care services were hit hard, affecting immunizations and maternal and child care, while household liveli- hoods were severely undermined contributing to vulnerability of the do- mestic economies. The emergency reaction of Médecins Sans Frontières was critical, but a generally sluggish global response prompted soul-searching on the future role of high-income countries like the United Kingdom, agencies such as the World Health Organization (WHO), and international strategies for vaccine and drugs development. A resurgent epidemic in the Democratic Republic of Congo (DRC), aggravated by community mistrust of measures introduced to limit the outbreak, high- lights the complexity of epidemic containment. Reflected in recent assessments of the global burden of disease, complex health transitions are underway in LMICs. Rapid changes in national health profiles are being fuelled by the socioeconomic forces driving (for example) labour migration within and across national boundaries, and new forms of transport and communication that link people and places at unprecedented speed and scale. Together, these act to juxtapose infectious conditions (malaria, TB, HIV/AIDS, neglected tropical diseases) with unfolding non-communicable dis- eases—notably cardiovascular disease, stroke, and diabetes, respira- tory conditions, cancers, and mental illness. The natural history of these diseases and their attendant risks pose challenges to personal

development along the life course—from conception, birth and child- hood to puberty, and adolescence to adulthood—in a world where populations are ageing while national incomes remain uncertain. This ‘dual burden’ of disease—graphically described as a colli- sion of epidemics—amounts to a ‘quadruple burden’ when the un- finished agenda of maternal, neonatal and child health is included along with persistently high levels of injury (violent and uninten- tional) and rising accident rates (from motor vehicles especially). Such a rapidly changing disease burden must profoundly impact on the framing of national and global research priorities—and the resources and capabilities required to enable effective research. Context is all-important Our long-standing African experience brings home the overriding importance of social and political context in fostering, conducting,

2.18 Fostering medical and health research in resource-constrained countries 183 interpreting, and then ensuring the applications of research. Indeed, given many countries’ history and experience with the deliberate marginalizing of poorer communities (now in the voting majority post-independence), research in LMICs cannot be separated from broader public concerns with national and social development. This manifests in several ways. Contestation between science and politics This translates to a pervasive culture of resorting to political au- thority to resolve issues that elsewhere would be addressed by public sector executives. Research findings, whatever the evidence, and particularly if results conflict with prevailing social norms or pol- itical ideologies, may be actively contested with appeals to popular leadership for guidance and direction. Leading politicians in LMICs face high, at times unrealistic, pressure from their constituencies to resolve deeply entrenched social and development concerns—hence politicians’ and policymakers’ preoccupation with answers in con- trast to researchers’ emphasis on understanding. Examples from our recent history illustrate vividly the interplay between politics and bio-sciences: Adolf Hitler was a dominant pol- itical figure who, on rising to power in Germany, used science to justify the political ideology on which the Nazi state was based, and which justified barbarous treatment of ‘non-Aryans’. Trofim Lysenko was an influential Soviet agricultural scientist, with a powerful ally in Joseph Stalin, who for over 40 years undermined, then destroyed, biological science (notably genetics) teaching and research in the Soviet Union. Thabo Mbeki and Manto Tshabalala-Msimang, for- merly president and minister of health in South Africa, confused a nation and led it into denial about HIV/AIDS causation for a decade, with devastating consequences for human lives (see next). Deep respect for human and community rights (reflected in the UN charter as well as national constitutions) Disparities in wealth and education—as much within as between countries—raise concerns about the rights and protections of vulner- able persons (such as children, the disabled, or unemployed) and com- munities in all spheres, and notably in research. Concern for the dignity of research participants, confidentiality regarding personal informa- tion, and equitable access to findings and resultant benefits (e.g. new diagnostic tests, therapeutics, equipment) weigh heavily on public rep- resentatives who increasingly are held to account by an activist citizenry. Sensitivity to purpose and relevance Keen interest in the focus of research—what research is conducted, how, and for what purpose—lies behind the strenuous debates on research priorities in LMICs and presents great opportunity to work at the frontiers of socially responsive science. Such research environments support interdisciplinary efforts that engage with community perspectives; and tend to a more holistic approach to both the conduct and translation of research including health systems development and all aspects of professional practice. It follows that while concern for the impacts of research is plainly evident in industrialized countries, in LMICs it is becoming an im-perative. While working relationships with public leadership bear on the applications of research to

policy development, as important are scientists' links with public representatives for drawing attention to the social importance of the research enterprise. This will help counter the tendency for findings to play but little part in public sector investment decisions—whereas findings and understanding should figure prominently in development priorities and resource allocation. An unlikely alliance: Science and politics At first glance, the apparently neutral terrain of research, scien- tists, and the public good seems a world away from the contested, at times cut-throat world of national politics. Yet history is replete with examples—from Stalinist Russia (and the Lysenko era of eu- genics, discussed earlier) to Hitler's Germany (that posited Aryan races as the apex of human development and condoned human experimentation on those judged 'lesser' persons)—where science served the goals of a political master plan. In response, ethical codes and principles governing the conduct of research—most re- cently, the ninth revision of the Helsinki Declaration—are upheld across the globe. Nevertheless, in all settings there are examples where political goals have undermined ethical practice. In South Africa at the close of the 20th century, the emergence of HIV/AIDS confronted politi- cians with an intolerable dilemma: face up to a profound health and social challenge evolving in concert with national liberation, and sup- port a talented scientific community determined to address this; or buy the argument of the AIDS 'denialists' who rejected the existence of a human immunodeficiency virus and attributed AIDS solely to widespread deprivation and related nutritional and immunological compromise. President Thabo Mbeki's 'flirtation' with HIV/AIDS denialists, notably Peter Duesberg, ushered in a decade of national confu- sion and denialism reflected in a crisis in the governance and independence of medical research; a health policy denial of anti- retroviral therapy to HIV-positive pregnant mothers and patients, with consequences estimated at 330 000 deaths; and society's pro- foundly compromised ability to impact on interpersonal and peer or community behaviour and halt the spread of infection. Thus, though difficult to accept, the consequence of the delayed rollout of antiretroviral medication was the loss of hundreds of thousands of lives. Today, some 20 years later, South Africa and its Department of Health can take credit for the widespread and sustained take-up of the largest antiretroviral therapy programme worldwide. This is saving countless lives, rapidly improving life expectancy, and preserving the livelihoods of many of the country's poorest citi- zens. Indeed, this recent but hardly isolated example illustrates how powerful political figures influencing health research can determine the future direction and success (or not) of nations. Fig. 2.18.1 provides a generic framework for the dynamic inter- actions involving science and research in national contexts. The political environment, prevailing culture and social norms, and the pursuit of human rights all act on the conduct of research and use of the findings/evidence that result. Acting together, these influences can ensure that the applications of research serve as a tremendous power for social good and human development—but equally, they hold the potential for political ma- nipulation of scientists who may be used (even coerced) to legitimate state actions in support of ends that fly in the face of obligations to advance population health and well-being.

 Conclusion While much in our past experience emphasizes 'divides'—between rich and poor, north and south or east and west, stark disciplinary divisions, and a divide between the social and biological determin- ants of health—we have entered a world of 'convergences' that is fostered and reinforced by a global health movement that empha- sizes our common future. Work that is 'convergent' lies at the heart of global improvements in child health and the great reductions in mortality from HIV/AIDS and malaria. Critical to fostering medical research in resource-constrained coun- tries is the need for balanced, equitable collaborations that emphasize longer-term building of human and institutional capacity. This vision needs to be tempered by the reality that the gap in resources—including statistical capability, computational

and technical expertise—remains profound and is paralleled by a limited clinical-physiological-molecular evidence base. Addressing this as a common, collaborative enterprise would bring returns to research and practice in all settings and fields. Beyond this, positive recognition is justified for the sophisticated, lo- gistically complex field-based research that increasingly extends from molecular to population levels, and similarly for generating the 'public good' data being made widely accessible. In summary, we are at the cusp of a new paradigm of research collaboration that fulfils the value-based aspirations of 'global health', bringing the best science to bear on the complex challenges facing vulnerable communities in resource-constrained countries, while recognizing the pressures to 'deliver' that are faced daily by scientists, policymakers, and politicians. This speaks to the true opportunity offered by the promise and practice of research in resource-constrained countries: to contribute widely to both na- tional and global health development and, in so doing, to major and equitable progress in the human condition.

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Culture and social norms Research Knowledge/Evidence on health and well-being Fig. 2.18.1 Framework highlighting social drivers and interactions that influence the conduct of research and use of evidence to advance human health and well-being.

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