Editorial

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Taken in its broadest possible meaning, 'medical technology' refers to the collectivity of drugs, methods of diagnosis, collection of health-relevant information, treatment procedures, medical devices, and the organisation of health services. In this general form, one could think of it as the 'production function' that transforms medical inputs provided to patients into outputs, or more precisely, health outcomes. For much of recent human history, improvements in this production mechanism, whether in the form of technological innovation, or by way of technology transfers, have paved the way for significant improvements in population health. The discovery of antibiotics in the middle of the last century revolutionised the way infections were treated and led to considerable improvements in life expectancy (Cutler and Meara, 2001). The development of AZT and a later generation of drug cocktails have played a major role in expanded life expectancy among HIV/AIDS patients, both in developed and

developing countries. Newer interventions against heart disease, such as angioplasty and CABG, has been a major factor in reduced mortality from heart disease in the latter half of the 20th century (Cutler and Huckman, 2003). Studies show that the diagnostic power of MRIs and CT-scans are particularly effective in the clinical investigation of strokes, and in brain surgery, more generally (Foerster et al., 2005; Holzman and Lester, 2007). There is also evidence that telemedicine may be cost-effective as a means of addressing shortages of specialised medical personnel in poor and/or remote areas (Johnston et al., 2004), and the use of systematic check-lists in surgical procedures has been shown to considerably increase the survival chances of patients (Gawande, 2007).

Low- and middle-income countries have much to gain from an efficacious application of medical technology to the care of their populations, given that they currently account for more than 85% of the global burden of disease. A large number of these countries suffer not only from a disproportionate share of infectious diseases such as HIV/AIDS, tuberculosis and malaria, but also face an emerging epidemic of non-communicable conditions and injuries. The achievement of these potential health gains by an application of medical technology requires at least three conditions. These are, firstly, that the technology used is effective in bringing about improved health outcomes at reasonable cost. Secondly, the technology is in reasonable proximity to population groups most likely to benefit from it in an affordable manner. This process may involve technology transfers from richer countries, where much of the R&D on medical technology is concentrated, to their poorer counterparts, or from urban areas and better-off groups, to rural areas and poorer populations; or, it may involve transferring patients closer the technology. Thirdly, the technology used must be affordable, relative to what potential beneficiaries can afford to pay.

From the standpoint of policymakers in many developing countries, the implementation of steps to satisfy the three conditions outlined above is not straightforward. Governments often lack the resources necessary to finance some elements of technology such as, for instance, ARV drugs and to adopt interventions to address expensive non-communicable conditions such as cancers and heart disease. The low incomes of large numbers of people, and intellectual property right protections, further limit access to these types of modern medical technology and associated benefits to all but the most well off populations in many developing nations. Moreover, to the extent that the provision of this technology is mediated by unregulated private providers, as in many countries, there is the risk that the technology used is not inappropriate, and associated benefits, if any, will be limited to those who can afford to pay. Even when elements of the technology in question are *prima facie* affordable, as in the case of polio vaccines, de-worming treatments, antibiotic drugs and interventions focused on preventive behaviour, its effective translation into health outputs is likely to be hampered by shortfalls in key inputs. These include a lack of trained personnel, limited oversight of existing providers including their prescription practices, and low levels of accountability. Moreover, the limited epidemiological information on population health in these countries increases the risks of generating misguided policy priorities.

Policy discussions and research relating to the introduction, the spread, the cost, and outcomes associated with modern medical technology tend to be limited in developing countries. By contrast, in developed countries, the subject of medical technology has attracted much attention. These inquiries span a wide range of topics, including the impact of innovations on health expenditures, factors influencing the development and diffusion of medical technology and benefit-cost assessments of expenditures associated

with drugs, medical devices, treatment procedures and so forth. Systematic thinking on these issues ought to engage health policymakers in developing countries, given especially that they are likely to experience demand side pressures to adopt medical innovations in the future, as their populations become increasingly aware of newer technologies, as global trade links grow, as population disease burden grows and as their populations age. There may be supply side pressures as well, as hospitals seek to adopt the latest innovations to attract both customers and leading medical professionals, who might otherwise choose to practice elsewhere. Suppliers of new technologies, whether drugs, or medical devices, or newer ways of organising healthcare, are also likely to become more active, as they expand their efforts to growing developing country markets.

The four papers in this special issue seek to address four different dimensions of the topic of medical technology likely to interest developing country policymakers and researchers. The first paper, by Lichtenberg (2009), uses cross-country panel data on cancer drugs and cancer incidence in a sample of nearly developed and developing countries to inquire whether these drugs have improved cancer survival rates. The paper also focuses on another subject of concern to policymakers – namely, what are the factors that likely drive the introduction of newer cancer drugs in any given country? Using data for 17 different types of cancers, Lichtenberg finds that the number of cancer drugs available has a positive impact on one- and five-year survival rates of cancer patients. Another key conclusion of the paper is that the size of the 'market' – as measured by cancer incidence – has a strong influence on new cancer drug launches in a given country.

Of course, the mere availability of efficacious drugs and medical procedures does not ensure that they will reach people who most need it. One way to address distributional issues associated with the application of medical technology and financial risk associated with ill health is to expand health insurance coverage, often with the help subsidies on insurance premiums to those who cannot otherwise afford to buy insurance. However, expanded insurance coverage, by increasing utilisation of health services may substantially increase overall costs of healthcare (Newhouse, 1992). The second paper, by Yip et al. (2009) examines the efficacy of technologically advanced treatments for Acute Myocardial Infarction (AMI), and the impacts of these treatments on costs, for Taiwan, over the period from 1997 to 2001. Using data on more than 30,000 AMI patients, the study estimated the effects of changes in usage of advanced procedures, such as bypass surgery and angioplasty, on mortality rates and medical spending. It also compared the values of estimated life-gains to their associated cost increases. Because Taiwan had recently instituted National Health Insurance (NHI), the study also provided an opportunity to assess the extent to which NHI had helped bring about improved population health and its implications for cost of healthcare services. Taiwan's experience suggests that by providing comprehensive coverage and controlling provider prices, NHI was able to improve population health, by making available technologically advanced procedural treatments, while curtailing inflationary pressures on health spending.

A major factor why health systems in many poor countries fail to adequately serve the needs of the poor and populations living in remote areas is the absence of good record keeping systems. Shortages of paper, storage space and the like make it almost impossible for local health workers (most of whom are not physicians) to keep track of the health status of individuals visiting them, or of the health of members of local populations during periodical rounds for preventive, or health promotion purposes.

Good record keeping, for instance of patient histories, is also necessary in circumstances of referral to higher level facilities, or when treatment follow-up is required. The HIV/AIDS epidemic has put these issues in sharp focus, given the complex nature of HIV treatment regimens. Some developing countries, particularly those in sub-Saharan Africa, have been further handicapped by large international outflows of physicians and nurses, and the size of HIV epidemics they face. The paper by Mitchell et al. (2009) focuses on the use of electronic systems for health information collection, storage and transmittal, as well as the implementation of clinical algorithms in settings with limited numbers of trained physicians. This paper describes an approach, using hand-held computers, to scale up HIV treatment that relies on providers with specially developed clinical algorithms on a hand held computer to screen patients and maintain patient records in settings where doctors are limited; and highlights the key policy, personnel, treatment efficacy and ethical issues that must be addressed by such innovations in order to be scaled up.

Much of the research and production of medical devices, particularly those at the high-end of the business, takes place in developed countries, so that international trade (imports) is the means by which medical devices make their way to developing nations. The magnitude of this trade and an understanding the factors driving it can yield important insights into pace and the causes of international medical technology diffusion. The final paper (Mahal and Kothari, 2009) in this special issue focuses on imports of medical devices to India over the period from 1987 to 2003. Based on detailed commodity-level data from Indian customs records, the paper establishes rapid growth, dating back to the mid-1990s, in both therapeutic and diagnostic devices. Rising incomes and the associated increase in demand for foreign-produced devices and lowered import duties were an obvious factor in this growth. However, other supply-side factors, namely large numbers of medical graduates trained in modern medicine produced by India's medical education system, growing numbers of private providers and rapid technological change abroad appear also to be important drivers of imports.

Much remains to be done in understanding the drivers, assessing the efficacy, and the cost-effectiveness of the tools that comprise modern medical technology, and medical innovation. We hope that this collection of papers stimulates further discussion and research on this subject in developing countries.

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