Round table

Problems and progress in public health education

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Abstract Further development of public health education is critical to improve population health globally. A debate on the relevance and direction of some 400 schools of public health and many other related institutions around the world is therefore timely. Some argue that most public health schools set up in low-income countries blindly follow their counterparts in high-income countries, reproducing classroom-based teaching, churning out epidemiologists with limited understanding of how to work within a health system to address local needs or how to align multiple partners towards population and equity health objectives. Others argue that schools in high-income countries focus on the science, whereas those in low-income countries plagued with resource constraints focus exclusively on the art. This round table discussion asks deans and directors of schools of public health from around the world to identify innovations in public health training, research and practice that will render schools relevant to health and development challenges.

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The poor-world, rich-world divide is well known, as is the divide between dominant and marginalized groups within countries. While across-country inequities were known previously, the past decade has seen the unearthing of within-country inequities in almost every corner of the world and across the entire social gradient.[1,2]

Although the Millennium Development Goals have raised new hopes for a world free of poverty, poor health and other deprivations, these goals do not address within-country inequities. Among others, a recent report published by the Task Force on Maternal Health and Child Health under the UN Millennium Project has called for a new vision and strategies to address the health problems that people in low- and middle- income countries face. A key component is how existing knowledge can be made available to the world's poor and marginalized.[3] This message is not new, but remains to be acted on.

Further development of public health, as a profession and as a discipline, is critical to enable people to act. Public health, as defined nearly a century ago by CEA Winslow, is "the science and art of preventing disease, prolonging life and promoting health and efficiency through organized community effort".[4] The Alma Ata Conference of 1978 reaffirmed the critical role of public health in attaining health for all, with particular emphasis placed on the centrality of equity, community participation and intersectoral collaboration.

The institutions that are dedicated to promoting both the science and art of public health include the schools, institutes or faculties of public health. These institutions have been in existence for nearly a century. However, in recent times there has been increasing debate about their relevance and direction.[5,6] Are the existing models of public health schools adequately preparing graduates? Are they able to make a significant contribution towards improving the health of the population, and particularly of the poor and other marginalized groups? If not, why are they failing? Is there a mismatch between the ideal and the reality of the situation? Is the world producing enough quality graduates to lead public health programmes and relevant research?

As WHO noted in 2006, the world is facing a major shortage of health workers, including those who are trained to address population health.[7] Is it not scandalous that 57 countries are in crisis, with 36 of these countries concentrated in the African region? Although information is known about the distribution of clinicians (e.g. physicians, nurses, midwives, dentists), little is known about workers addressing population health, including public and environmental health workers, community health workers or health managers.

WHO recently estimated that there are probably 400 schools of public health around the world. This, of course, does not include departments of community medicine or similar programmes attached to medical schools. How are these schools distributed? The United States of America (USA) alone has some 40 accredited schools plus many more programmes. Compare that with large regions of the world, such as Africa or South-East Asia. With a population five times as large as the USA, South Asia is estimated to have 12 schools.[8] Africa has about 50 schools.[7]

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Beyond the numbers, what resources (faculty, infrastructure, students, field sites, etc.) do schools draw on? Schools can use training, research and practice to convert resources into professionals who could meet and perhaps exceed the expectations of future employers.

Training

The challenge is to scale up the production of public health professionals with appropriate skills and competencies. What is at stake? Some schools emphasize getting the right balance between teaching and research; others, particularly in low- and middle-income countries, focus on aligning training to develop competencies that enable individuals to manoeuvre within a specific country's health system. Clearly, quality as well as quantity matters. The quality of training and impact on students is a function of many factors: faculty, curriculum, pedagogical methods, teaching aids, facilities and students, who bring their experiences and expectations.

Faculty

Almost all schools of public health in low-income countries are perennially deficient in quality faculty. There are many reasons for this: inadequate supply, lack of appropriate training, absence of financial and motivational incentives, and migration. Will the promise of distance learning materialize to strengthen public health capacity?

Curriculum

In many countries, the skills and competencies of public health graduates are not well matched to the task of addressing the population's health needs, particularly in the area of health policy, health management and leadership. What approaches exist to increase collaboration across policy-makers, public health managers, communities, researchers, educators and public health practitioners, to make curriculum relevant? How can curriculum reinforce public health approaches, such as intersectoral, interdisciplinary and community-oriented, as well as benefit from coordinated international collaboration?

Pedagogy

Most public health schools set up in low-income countries follow their counterparts in high-income countries; that is, they are essentially classroom-based. Yet there is a movement to integrate community experiences, such as the Rockefeller Foundation-sponsored Schools of Public Health Without Walls taking place in Ghana, Kenya, Uganda, Viet Nam and Zimbabwe. These efforts and others either remain relatively small-scale or their success is not well documented. Will information and communications technologies allow greater numbers of professionals to train within their own country and perhaps on the job?

Students

Who becomes a public health student? Is diversity in terms of personal and professional backgrounds being adequately achieved in order to fulfil the art and the science of public health?

Research

Knowledge generation and evidence building needs to be driven by values that make explicit the goals of public health and its application to serve disproportionately the disadvantaged and marginalized. Was Wright[4] on the mark with his assessment that schools in the USA have systematically ignored the art (application) in favour of the science based on discovery and the medical model of diagnosis and treatment? In low- and middle-income countries, is the opposite true? Has this imbalance resulted in the mismatch of the progress of public health's art and science? Or is the narrative more complex?

Practice

All debates underscore the need to integrate training and research with practice, if schools of public health are to attract diverse students and faculty, teach relevant and timely content, and enable graduates to work in specific contexts whether within an institution, sector, country or region. However, successes seem few and far between.[6]

This round table discussion asks deans and directors of schools of public health (or other educational institutions providing public health education and training) from around the world to address these issues:

- How to make public health education and training more relevant to the 21st century health and development landscape?
- What are the innovations in public health education and training that have impact on health outcomes and improve health equity?
- What are the best approaches to integrate in core public health curriculum student-led research to address "real-world" problems?
- How to scale up public health education and training in low- and middle-income countries to benefit broader populations in need?
- How schools of public health have influenced other educational institutions, such as schools of law, international affairs or business administration, to add public health issues to their curricula? ■

Competing interests: None declared.

Résumé

Problèmes et progrès dans l'éducation à la santé publique

Il est essentiel de poursuivre le développement de l'éducation à la santé publique pour améliorer la santé de la population à l'échelle mondiale. Il est donc opportun de débattre de l'utilité et de l'orientation des quelque 400 écoles de santé publique et des nombreux autres établissements d'enseignement dans des domaines connexes du monde. Certains avancent que la plupart des écoles de santé publique créées dans les pays à faible revenu suivent aveuglément leurs homologues des pays à haut revenu, en reproduisant leur enseignement magistral et en formant des épidémiologistes sachant peu travailler dans un système de santé de manière à répondre aux besoins locaux ou aligner l'activité de plusieurs partenaires avec des objectifs en faveur de la santé de la population et de l'équité en matière de santé. D'autres considèrent que les écoles des pays à haut revenu se focalisent sur la science, tandis que celles des pays à faible revenu, accablées par les contraintes budgétaires,

s'intéressent exclusivement à des questions de forme et de pratique. La présente table ronde demande aux doyens et aux directeurs des écoles de santé publique du monde entier de trouver des innovations en matière de formation, de recherche et de pratiques en santé publique, qui permettent aux écoles de s'adapter aux défis rencontrés dans les domaines de la santé et du développement.

Resumen

Problemas y progresos de la formación en salud pública

Un mayor desarrollo de la formación en salud pública es fundamental para mejorar la salud de la población a nivel mundial. Es oportuno por tanto lanzar un debate sobre la utilidad y orientación de unas 400 escuelas de salud pública y de muchas otras instituciones relacionadas en todo el mundo. Algunos opinan que la mayoría de las escuelas de salud pública que funcionan en los países de bajos ingresos reproducen ciegamente lo que hacen sus homólogas de los países de ingresos altos, fomentando la docencia basada en clases teóricas y produciendo epidemiólogos con unos conocimientos limitados sobre la manera de desenvolverse dentro de un sistema de salud para atender las necesidades locales o la manera de coordinar a varios asociados en torno a objetivos relacionados con la salud de la población y la equidad sanitaria. Otros consideran que las escuelas de los países de altos ingresos centran su atención en el quehacer científico, mientras que las de los países de ingresos bajos, afectadas por graves limitaciones de recursos, se centran exclusivamente en el quehacer práctico. En esta mesa redonda se pide a los decanos y directores de escuelas de salud pública de todo el mundo que señalen el tipo de innovaciones que habría que introducir en la formación, las investigaciones y las prácticas de salud pública para adecuar mejor las escuelas a las exigencias de la salud y el desarrollo.

ملخص

المشكلات والتقدُّم الـمُحْرَز في تعليم الصحة العمومية

يتطلب تحسين صحة السكان في العالم مزيداً من التطوير لأسلوب تدريس الصحة العمومية. ولذا أصبح الوقت مناسباً لمناقشة توجُّه ومدى ملاءمة نحو 400 كلية من كليات الصحة العمومية والعديد من المؤسسات ذات العلاقة بالصحة العمومية في جميع أنحاء العالم. ويرى البعض أن معظم كليات الصحة العمومية الموجودة في البلدان المنخفضة الدخل تسير مغمضة العينين على خطى نظرائها في البلدان المرتفعة الدخل، فتحاكي نظام التدريس المرتكز على قاعات الدراسة، وتخرِّج اختصاصيِّين في الوبائيات ذوي فهم محدود لكيفية العمل في إطار نظام صحي يستهدف تلبية الاحتياجات المحلية، أو لكيفية حشد شركاء متعدِّدين من أجل تحقيق الأهداف الصحية للسكان وأهداف المساواة في الحصول على الخدمات الصحية. ويرى فريق آخر أن الكليات في البلدان المرتفعة الدخل تركِّز على العلوم، في حين أن الكليات الموجودة في البلدان المنخفضة الدخل، المبتلاة بضيق الموارد، ينصب تركيزها على الفنون والآداب. تطلب هذه المناقشة التي تدور حول مائدة مستديرة من عمداء ومديري كليات ومعاهد الصحة العمومية في بلدان العالم أن يحدِّدوا الأفكار المبتكرة في مجال التدريب على الصحة العمومية وبحوثها وممارستها، والتي من شأنها أن تؤهل هذه الكليات للتصدي لتحدِّيات الصحة والتنمية.

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Round Table Discussion

A Bangladeshi approach
Mushtaque Chowdhury[a]

The base paper by Petrakova and Sadana is a thought-provoking call for innovation and action in public health education. The approach used by the BRAC University James P Grant School of Public Health (BSPH) in Bangladesh addresses many of these issues.

To be relevant to the needs of society, we envision our graduates to:

- be committed to the health needs of the global South;
- be equipped to deal with problems faced by disadvantaged sections of the society;
- be aware of the interplay and importance of factors such as poverty, education, women's status, environment and power relations within and beyond family, as they affect health and health care;
- appreciate that health is "not merely the absence of disease, but a state of complete physical, mental and social well being";
- be life-long, problem-based learners and critical interdisciplinary thinkers;
- be promoters and practitioners of both the science and art of public health; and
- be future leaders in public health practice, research and teaching.

Set up in 2005, two batches of 51 participants from more than 12 countries have now graduated from BRAC through its master of public health (MPH) programme, all of whom are now back in their own countries and have taken up responsibilities in government, donor agencies, media and nongovernmental organizations (NGOs). Some have started doctoral-level studies.

Research

We are building research capacity in the BRAC school. We have initiated collaborative research with other existing research groups in the country, such as BRAC's Research and Evaluation Division and the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR). From the research carried out at the school the students learn issues and challenges in global health. The students choose a topic from among the many health interventions being implemented in Bangladesh for their final end-of-the course thesis.

Training

Starting with a small nucleus recruited from within the BRAC organization, the faculty is now growing through recruiting from among the school's own graduates. With the school becoming known, there is also some interest among non-resident Bangladeshis to return. To overcome staff shortage and to bring diversity, we have adjunct faculty from partner institutions who also train our faculty in good teaching practices.

Curriculum development is an ongoing process and we constantly review it for further improvement and relevance.

The BRAC school promotes a field- and problem-based experiential learning approach. Village exposure is the foundation of the programme. The students spend half of their 12 months in a village campus allowing continuous interactions with villagers as well as the local health systems. International students are paired with their local counterparts to overcome the language barrier.

Practice

Discovering and providing knowledge is meaningless unless it is put into practice to protect and save people from unnecessary disease burden. For this to happen, a close interaction with policy-makers and implementers of interventions is necessary. The school links with NGOs, government and international organizations, as they recruit many of the graduates who find a ready constituency to practice what they have learned. ■

Solving problems
Barry R Bloom[b]

Public health schools are critical to the development of knowledge and information about the health of populations and countries. As the economist Dean Jamison stated: "Knowledge about disease prevention, good surveillance for infectious diseases, the lessons from intervention research, sharing of health data, and the development of new products such as vaccines – all are public goods." In terms of providing new knowledge in public health and compelling evidence to affect policy in meaningful ways, schools of public health should, in my view, seek to contribute in each of four areas:

- research: defined as the generation of new knowledge and providing scientific evidence for decision-making at the individual or societal levels;
- training: not only of doctoral and master's degree students, practitioners and researchers, but of political leaders and public officials at national and local levels;
- communication: providing skills to inform leaders, the media and the public about health risks and prevention and health promotion best practices;
- practice: as an integral component of training; taking knowledge from the laboratory and population research into communities that inform about cultural contexts, disparities, needs and barriers, to have a real impact on the public's health.

A dilemma faced by all schools of public health is the balance between our responsibility to create new knowledge and transmit that knowledge to a future generation, and the need to apply existing knowledge to improve the health of populations now. In the United States of America (USA), we struggle

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to define what it is that students should know, from broad disciplines like epidemiology, biostatistics and health management, to new categories of competencies, such as informatics, communications, cultural competency, global health, policy and law, and ethics.[1]

My view is simpler: it is that in contrast to most graduate or postgraduate programmes organized around disciplines, professions, skills or sectors, our overarching aim in public health is to train our students to solve problems affecting the public's health. Our vision at Harvard is to encompass a continuum of scientific disciplines and programmes, from fundamental science to application locally and globally, in order to address most effectively the big problems in public health. To do so, we place great emphasis on multidisciplinary and interdepartmental approaches to problems and education. Education should not stop with satisfying the disciplinary or credentialing requirements. BRAC has brilliantly immersed the students directly in the health problems in villages. We are revising our curriculum to include, in addition to a practicum experience in the community, more case-based learning and analytical thinking. In both schools, the aim is to provide our students with the best skills in solving problems in public health.

What is the knowledge that is important? I believe there are three kinds: "public knowledge" accessible to everyone, as in published scientific literature; "contextual knowledge", namely how to apply public knowledge in a particular place or health context; and "tacit knowledge", the knowledge that cannot be taught but is learned by example, that breaks down barriers of culture or training, and is transformational in the lives of people.[2] These are the great challenges, as I see them, in public health education. ■

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Producing a capable workforce
Kuku Voyi [a]

Public health education must be viewed in the context of globalization and practical plans applied to the current situation. Disease knows no border; the developed and developing worlds are united by one scourge – the shortage of a public health workforce. Therefore the issue is not about whether the emphasis should be about the art or science of the discipline, but about public health schools producing a workforce that is capable of protecting the public's health.

The capacity of public health schools differs vastly, both inter- and intracountry. The argument could be: who deter-

mines quality? Clearly, a core curriculum which includes strong leadership training is a useful base from which the different strands of public health can be launched. However, the burden of disease and health of the population within each region and country will influence the emphasis in each focus area. Private, public, academic and other institutions that could contribute to the improvement of public health should collaborate. This innovative approach is being encouraged in public health schools as best practice for community engagement. There is evidence that such practice is beneficial to the community, trainees and the public sector.[1]

Public health as a discipline requires broadening and should include non-medical disciplines that could contribute to, and thus enrich, the workforce. The health sector can no longer manage and deliver public health without contributions from these other sectors. The type and quantity of the public health workforce is rarely mapped, therefore graduates could be mismatched and may not meet the population's health requirements. The Essential National Health Research model established by the Commission on Health Research for Development,[2] currently used in 60 countries, can be expanded to map health needs against human resources for health supply.

In Africa, the AfriHealth project has endeavoured to map the capacity of institutions offering public health education and training. Regrettably, South–South collaboration, which could help to establish a robust sandwich programme using inter- and intracountry expertise, is uncommon.

The use of technology needs to be exploited to address ways of meeting the needs of a modern world in a resource-poor setting. The Knowledge Management for Public Health (KM4PH) project of the WHO should be considered and analysed as to whether it can benefit public health alumni in rural settings in developing countries.

Supportive links with alumni and purposeful mentorship graduate programmes should be established. These are known to be powerful tools for networking, and for retaining and informing the workforce post-training. ■

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The challenges of scaling-up
Andy Haines [b] & Sharon Huttly [b]

Petrakova and Sadana make an important distinction between the science and the art of public health, where the art is concerned with application. However, while it is correct to say there is still much to be learned about how to deliver public health interventions, there is a growing body of research on health systems and policies that helps to guide the delivery of preventive and curative services at different

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levels of socioeconomic development.[1] Schools of public health should therefore aim to address health systems and policies through research and teaching as well as through the traditional public health approaches to understanding the causation of disease, the determinants of health and the evaluation of specific interventions.

Interdisciplinarity

Modern public health is an interdisciplinary endeavour that needs to integrate within broader development policies, requiring closer linkages with a range of sectors and disciplines such as agriculture, education, veterinary sciences and development economics. While schools of public health clearly need to maintain their focus on improving population health and reducing inequalities, they also need to reach out more broadly into the academic community. At London School of Hygiene and Tropical Medicine (LSHTM), for example, we have been engaged in setting up the London International Development Centre (LIDC), which will bring together staff in a range of disciplines from six colleges of the University of London (http://www.bloomsbury.ac.uk) to promote interdisciplinary research, teaching and capacity-building to address international development from an intersectoral perspective.

Scaling-up research and teaching

Meeting the growing needs for more public health professionals, including the expansion of the research workforce, will require international cooperation, increased resources and long-term commitment. LSHTM's experience of free licensing materials for course development in low-income settings has assisted in establishing local teaching programmes. It has often been difficult to get research funders to support long-term capacity-building initiatives but the situation is changing, and several major research funding bodies are now actively discussing how best to provide support. It will be essential to develop strategies for expanding masters' and doctoral training programmes, and also to ensure that able researchers can be sustained in their country of origin through the use of postdoctoral fellowships and international collaborations that allow them to develop as independent researchers.[2]

Governments and multi- and bilateral donors must also prioritize the development of human resources to underpin the attainment of international goals such as the Millennium Development Goals (MDGs). In addition to the formation of large numbers of new public health professionals, a further challenge is the need to improve the retention and performance of the existing public health workforce. Schools of public health need to respond to the needs of 21st-century students and to think ambitiously about scaling-up access to appropriate education and training. This should include how they can provide on-going support for lifelong learning, conducted as far as feasible in the workplace, which in turn will require provision of learning opportunities that are flexible in terms of location, time, approach, pace and content. Information technology used appropriately can support the necessary changes, which should capitalize on both distance and classroom-based learning to create new opportunities for scaling up access to education and training throughout the careers of public health professionals. ■

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Strategic training for health in Brazil

Antônio Ivo de Carvalho[a]

Brazil's Unified Health System (*Sistema Unificado de Saude – SUS*) is probably the largest public health system in the world today.

In 1988, the Sergio Arouca National School of Public Health of the Oswaldo Cruz Foundation (*Fundação Oswaldo Cruz* – FIOCRUZ) set up the School of Health Governance (*Escola de Governo em Saúde*), and embarked on a substantial "reorientation of its teaching and research programmes with a view to helping expand health governance capability and quality in Brazil". This new school has had a history of health achievements and social results including health improvements for citizens in large and previously often marginalized portions of the population. It is now imperative to managerial capability and quality, and to make health care effective, humane and comprehensive. In future, the challenge will be to consolidate the school as a centre for intersectoral policies and foster a new leading role for society and citizenry in the social production of health and well-being.

The school provides ongoing training and is directed to the production and large-scale dissemination of new professional and institutional competences to meet the challenges of the SUS. It gives special priority to the 100 000 managers at different spheres and levels of the SUS.

The school has expanded, and now involves some 40 000 practitioner-students in new teaching programmes as well as around 50 institutional partnerships in Brazil. The new model sees training as a component of the work process, directly oriented to the health system environment.

The school works within an agenda agreed with the SUS management, and developed from a shared perception of the deficits in managerial competence and resultant training needs.

The school proposes an educational path that fosters competence in mobilizing scientific knowledge for management practice. In view of the regional inequalities in existing training capacity in Brazil, the School of Governance model is being set up progressively as a single training system for the SUS. It is organized as a network of government schools, and the extensive use of new information, communication and distance-education technology allows these institutions to combine efforts and share resources in an appropriate time frame and at a tolerable cost. For FIOCRUZ, it has been stimulating to develop and coordinate, using this School of Governance model, Brazil's network of Schools of Public Health (about 30), SUS Technical Schools (about 50) and the Public Health

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Virtual Campus (in cooperation with the Pan American Health Organization).

More recently, in a joint venture with the Ministry of Health and universities, the Federal Nucleus of the School of Government was set-up. Under the coordination of the National School of Public Health (ENSP), it will develop advanced courses directed to the upper echelons of government, with a view to enabling various sectors to take a stronger role in the social construction of health. ■

Setting-up in a transitional country
Maksut Kulzhanov [a]

Kazakhstan is a new independent country formed after the dissolution of the Soviet Union. The health-care system of the Kazakh Republic has been reformed dramatically. The results of this reform process show that the national health-care system needs new types of public health specialists. In 1997, the Kazakhstan School of Public Health (KSPH) was established with the support of WHO, the United States Agency for International Development (USAID) and other international agencies. During the 10 years of its history, the KSPH has had a partnership programme with the Virginia Commonwealth University in Richmond, Virginia, United States of America, and collaborates with many other institutions that provide public health education in Europe and in the Americas. We have now created and adopted in our legislation a two-year master's programme in public health (MPH), as well as a one-year certificate programme and more than 30 short-term programmes for existing managerial staff of health facilities.

In the past five years, more than 100 MPH students have graduated from the KSPH and most of them returned back to their "oblast" (province) health-care system. Some of our MPH graduates have taken up high-level administrative positions and influenced the regional health-care reform process.

Research

We are building research capacity in the KSPH with projects from the Ministry of Health and collaboration with other universities. From the research done at the school, the students learn issues and challenges in global health. The students choose a topic from among the many health reform plan activities in Kazakhstan for their final end-of-course thesis.

To support public health research in central Asia, the KSPH created the *Central Asian Health Services Research* journal (http://journal.ksph.kz/indexe.htm), which is published quarterly in two languages – English and Russian. The annual scientific conference organized by the KSPH every September is now the platform for health professionals from central Asia to present and share their experiences.

Training

A short training course started in 1999 and the first master's degree course began in 2001. The faculty has grown by re-cruiting from the school's own graduates. The KSPH now has five departments with 40 full-time professors. To overcome staff shortage and to bring diversity, we have adjunct faculty from partner institutions who also train our faculty in good teaching practices.

Curriculum development is an ongoing process and we constantly review it for further improvement and relevance. A priority is to introduce distance-learning. The KSPH promotes a field- and problem-based learning approach.

The summer school network for central Asia is an important KSPH activity and supports close collaboration with neighbouring countries, including Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. ■

Lessons, challenges and future plans from Kerala, India
K R Thankappan [b]

The Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), an institute in Kerala established by an act of the Indian parliament in 1980, introduced India's first master's programme in public health (MPH) in January 1997, and so far, nine batches of students have graduated. Today, it remains the only MPH programme recognized by the Medical Council of India, the accrediting body for medical degrees in India.[1] It was implemented when the MPH was not a required qualification for any job position in India. Despite this, the course has gained demand and recognition, and all the graduates have been able to find gainful and meaningful employment. Several institutions in India are now planning to start an MPH programme and the demand for guidance from the SCTIMST for such initiatives is increasing. Demand for the MPH programme is also increasing from the student community, as is evident from the increase in the number of applications for the entrance test at SCTIMST since 2006.

Over 40% of our graduates work with the various Indian state government health departments, 21% with nongovernmental organizations, 16% with academic institutions, 10% with WHO/United Nations Children's Fund (UNICEF), 8% work outside India, while the remainder are enrolled for advanced (PhD) studies. Obtaining employment for our graduates is easy, as the demand for qualified public health professionals in India is huge. It has been estimated that more than 10 000 public health professionals at different levels are required by the Indian government health system alone every year and the current availability is less than 400.[2] In addition, there are several opportunities for short-term appointments with the WHO-supported polio eradication programme, revised national tuberculosis control programme and several other vertical programmes.

The major challenge for the programme is recruiting and retaining good faculty; this is consistent with the expected challenge for a developing country, even in an innovative educational setting. Ours is a multidisciplinary programme

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that requires faculty in health economics, health policy, gender issues in health, anthropology, health management, epidemiology and biostatistics. There are reports claiming that health economics are neglected in the south Asia region.[3] There are also severe shortages of good faculty in other public health disciplines. Human resources for health in general, and for public health in particular, are facing major challenges in developing countries and there is an urgent need for national governments to invest in human resources.[4] It has also been argued that investment in human resources must be considered as part of a strategy to achieve the Millennium Development Goals.[5] Another challenge is to create career paths for public health professionals, in order to enhance the quality of the public health system.

Future plans for the programme are: (i) to increase both student and faculty strength; (ii) to network with other public health institutions, such as the public health foundation of India and the Indian Council of Medial Research schools of public health; and (iii) to develop a plan to pool faculty and other resources for teaching and research in public health. ■

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The role of information and communications technology

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Although each of the questions posed by the authors of the base paper deserves extensive discussion and decisive action, we will limit our comments to the issue of "scaling up public health education and training in low- and middle-income countries". In particular, we would like to comment briefly on our experiences in using information and communications technology (ICT) to address this issue.

Many public health institutions in developed countries take state-of-the-art ICT for granted and assume that institutions in other countries have, or should have, a high level of ICT "literacy". They also often assume the same level of access to the vast amount of information on the Internet. Both of these assumptions are incorrect about institutions in the majority of developing countries. Indeed, 80–85% of the world's population has no access to the Internet, and, consequently, has no access to, or use of, educational materials as configured in developed-country institutions, assuming those materials are even appropriate for their needs.

Institutions in developing countries need ICT that is low-cost, requires a minimal level of training and experience, and has been proven to be both dependable and effective under conditions in developing countries. After much trial and error, we are currently devoting our efforts to a combination of two proven technologies that are now in use in more than 50 developing countries. These technologies are used to augment and support, but not supplant, ongoing health education programmes for multiple levels of health workers, policy-makers and the public. Although the specific configuration at each location is determined by local training needs and existing resources, each site has two core components. The first is an on-site digital library that provides (multiple) users with instantaneous, off-line access to millions of documents, web sites and educational/curricular materials. Materials in these digital libraries are instantly available 24 hours a day, every day, at virtually no cost to the users. These libraries not only serve as a source of current, comprehensive health information, even in remote "unconnected" locations, but an update mechanism allows dissemination ("publishing") of locally produced materials to other institutions in the global network.

The second technology is the use of online, real-time connections to outside resources by means of web-conferencing designed specifically to work even over slow, low-quality internet connections, where available. This technology provides live connections to courses, teachers, and consultants from partnering and twinning institutions in developing and developed countries. Using this system, institutions can interact on the basis of specific topics (e.g. malaria, HIV/AIDS, emergency preparedness), specific health disciplines (e.g. nursing, community health work) and/or countries/regions (e.g. east Africa, Indonesia) to meet identified local needs for health information and education. Because of its readily adaptable technology, the network of institutions can be easily expanded to include as-yet-unidentified professional organizations, governmental bodies, policy-makers, nongovernmental organizations (NGOs) and others.

Together these technologies provide the information infrastructure for sharing knowledge and resources on a regional, national and global basis. In the end, the focus is not about technology, but about what technology can help accomplish. ■

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