REVIEW ARTICLE

GLOBAL HEALTH

Global Supply of Health Professionals

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THERE IS A GLOBAL CRISIS OF SEVERE SHORTAGES AND MARKED MALDISTRIBUTION of health professionals that is exacerbated by three great global transitions — demographic changes, epidemiologic shifts, and redistribution of the disability burden. Each of these transitions exerts a powerful force for change in health care systems, the roles of health professionals, and the design of health professional education.[1-5] Every country will have to respond to these global pressures for change.

There are many other reasons that it is important to think globally about the education and role of health professionals.[6] The knowledge base of the profession is global in scope, and there is increasing cross-national transfer of technology, expertise, and services. Health professionals are migrating in what is now effectively a global market for their talent, while patients are also traveling for treatment. One quarter of the doctors in the United States come from abroad, and the "medical tourism" market for travel to such countries as Thailand and Singapore is growing at a rate of 20% annually.[7,8] All people worldwide are threatened by risks such as global infectious epidemics and climate change. Health professionals globally are interlinked and interdependent, facing shared challenges.

Global diversity characterizes the way health professionals are defined, educated, and deployed.[5] The U.S. pattern of 4 years of college followed by 4 years of medical school is unusual. The United Kingdom requires 5 or 6 years of post–high-school education, and China is moving to consolidate its education of doctors to two levels of 5 or 8 years after high school. Nursing education is more varied, ranging from vocational high-school training to doctoral programs.

There are also large differences among countries and regions in numbers of health workers and their skill mix. Table 1 shows that there are 9.2 million doctors and 18.1 million nurses worldwide.[9] The United States, with 4% of the world's population, has 8% of the doctors and 17% of the nurses. Among world regions, the density of health workers can vary by a factor of 10, and there is great variability in the skill mix. The United States has a nurse-to-doctor ratio of 4, whereas the ratios in China and India are close to 1.

The World Health Organization has underscored the alarming global shortage of approximately 4.3 million doctors and nurses, which constitutes a shortfall of 15% of the total number of doctors and nurses worldwide. It is estimated that 57 poor countries are facing a severe crisis in that they have insufficient human resources to meet minimum needs.[3] The shortage is worsened by a global imbalance between the availability of health workers and the burden of disease. Figure 1 shows countries according to the density of doctors, nurses, and midwives. Figure 2 shows that sub-Saharan Africa, with the lowest density of doctors and nurses, has the highest disease burden.

These problems are made worse by migration. The 2010 WHO Global Code of Practice on the International Recruitment of Health Personnel highlighted these

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Table 1. Workforce of Doctors and Nurses According to Country or Region in 2010.*

Country or Region	Population	Doctors	Nurses	Doctors and Nurses/ 1000 Population	Nurse-to-Doctor Ratio
	in millions	*in thousands*			
Country					
China	1338	1915	1,864	2.8	0.97
India	1225	768	1,179	1.6	1.54
United States	309	756	3,064	12.3	4.05
Brazil	195	338	1,278	8.3	3.78
United Kingdom	62	166	626	12.7	3.77
South Africa	50	37	198	4.7	5.30
Region					
Americas	937	1974	4,947	7.4	2.5
Europe	899	2744	5,870	9.6	2.1
Middle East and North Africa	590	654	894	2.6	1.4
Southeast Asia	1795	997	1,810	1.6	1.8
Sub-Saharan Africa	847	150	778	1.1	5.2
Western Pacific	1821	2696	3,814	3.6	1.4
World	6888	9216	18,114	4.0	2.0

* A doctor or nurse is defined as a person with the appropriate qualifications recognized in his or her own country. In this table, the nurse workforce includes nurses and midwives. Data are from the World Health Organization.[9]

issues, aiming to bring awareness to richer countries of the importance of reducing recruitment from poorer nations that have health worker shortages.[11] However, wider measures, including increased investment, improved training, and better human-resources management, are needed to address the shortfalls in both rich and poor countries.[12]

International imbalances are mirrored by inequitable distribution within nearly all countries. Remote rural and poor populations are often not able to attract or retain health professionals. There is evidence that an increased number of professionals can be retained in rural areas through improved policies in the education sector (medical and nursing school locations, admissions policies, scholarships, and "bonding" [requiring a period of service in a rural area after training is complete]) and health sector (hardship pay, schooling for children, and professional career development).[13] Many countries either do not recognize the need for these policies or are unable to implement them. Consequently, a practical option in disadvantaged areas is to train community health workers, nurse practitioners, or other health professionals without medical degrees who perform many tasks typically performed by physicians in the United States. The obverse of this rural neglect is excessive urban concentrations of health professionals, which can generate other problems, such as unnecessary, wasteful, and costly medical procedures.[14]

Despite widespread assertions of the right to health, it is estimated that at least 1 billion people do not have access to a trained health worker. Millions of people operate as unpaid caretakers — mostly women whose contribution and human rights are often ignored.

FORCES DRIVING GLOBAL CHANGE

There is growing demand and competition for health workers globally. The saying, "no health without a workforce"[15] is increasingly recognized as a universal truth. Although there is no consensus on the subject, some researchers in the United States are projecting shortages of 85,000 doctors by 2020 and 260,000 nurses by 2025.[16,17] Countries with fast-growing economies, such as India, China, Brazil, and South Africa, want more trained health workers, and critical shortages remain in the world's poorest countries.

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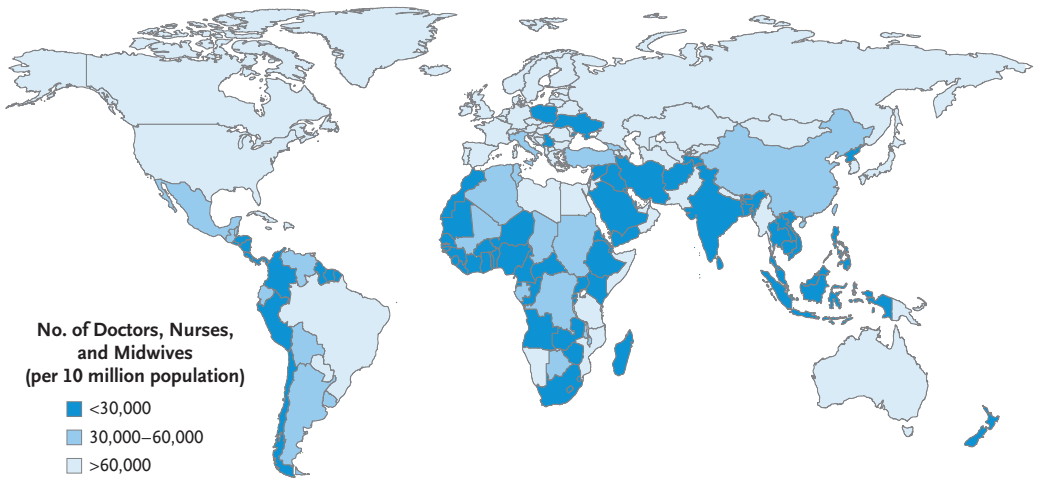

Figure 1. Doctors, Nurses, and Midwives per 10 Million Population, 2011.
Year 2011 data were not available for some countries; in those cases, the most recent available data are shown. Data are from the World Health Organization (WHO) Global Health Workforce Statistics.[9]

An interactive graphic is available at NEJM.org

At least five forces are shaping global supply and demand. The first are the major transitions — demographic and epidemiologic changes and shifts in disability burden — that are sweeping across many countries. Demographically, populations are aging and becoming more urbanized and more mobile. Epidemiologically, noncommunicable diseases are displacing the earlier infectious, nutrition-related, and maternity-related causes of death.[4] The disability burden attributable to mental health disorders, musculoskeletal impairment, and chronic diseases is growing rapidly. There is an urgent need to redesign most health systems to meet these challenges.

Second, people today are better educated and more assertive and enjoy greater access to information.[18] Professionals are no longer the sole source of medical or health knowledge; consequently, their relationship with their patients is changing. The shift is toward shared medical decision making and health responsibility. Some have labeled this the "coproduction of health."[19] Evidence shows that patient engagement can lead to better use of resources and improved quality of health care.[20] Remarkable stories of patient-led care are emerging, such as the report of patients with renal disease in Jonköping, Sweden, who deliver their own dialysis treatment, coming and going from the unit as they choose, with the result that quality of care is improved and costs are reduced at the same time.[21]

Third, the revolution in biosciences and information-communications technologies will continue to generate many new diagnostics, vaccines, and drugs. Expansion of the toolkit is likely to usher in greater professional specialization. At the same time, new technologies can also open opportunities for deprofessionalization and decentralization. Many diagnostic and therapeutic regimens may not require professionals to be involved in real time, and mobile technologies could enable lay workers and even patients to function more effectively at a distance from the medical professional.

Finally, two contrasting policy forces will affect all aspects of the work of health professionals. Market forces are intrinsically part of the health care system, with health expenditures now amounting to 10.1% of the world's gross domestic product and the health care industry turning over more than $6.6 trillion annually.[9] Individuals and consumers are linked to health markets, and there is a premium on the capability and willingness of health professionals with business and management skills to work in markets, devise incentives, control processes, and deliver outcomes to consumers in managed systems.

There are also countervailing forces of social justice pushing for health equity as a basic human right. There is growing social demand for fairness in health, including universal health coverage.[22] The ethos that no one, however poor,

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should suffer unnecessarily from preventable pain or should die prematurely is gaining consensus worldwide. Such social forces will engage citizens and communities to influence the wider social and environmental determinants of health.

EFFECT ON HEALTH PROFESSIONALS

All these forces ensure that future demand for health professionals will not simply be more of the same. Each force will make demands for different types of workers with relevant competencies.

The demographic and epidemiologic transitions and the shifts in disability burden mean that health systems and health professionals will have to reach into homes and communities. Teamwork involving nonprofessionals and lay people will become even more important. Better communication with an increasingly educated and informed public will be essential, so that measures for promoting health and preventing disease can influence individual behavior and lifestyle, as well as shape macro policies such as the restriction of salt or trans-fat content in foods.

Therapeutic systems will have to manage new biotechnologies delivered in the context of changing doctor–patient relationships. Technology will enable monitoring and intervention at a distance. Although health professionals will have the enhanced support of information technology, new skills will be needed to validate, synthesize, and practically apply decisions that are derived from an overload of available information.

Finally, all professional work will be embedded in complex market and social environments, with all their ambiguities and tensions. The social justice rationale, for example, emphasizes the importance of understanding social issues, leading to new demand for public health workers who are able to manage collaboration across sectors.[23] Commercial goals, on the other hand, require business and managerial qualities and the ability and willingness to work in market-based systems.

FRONTIERS OF EDUCATIONAL REFORM

All these changes have come together in the ferment of new ideas and actions around the education of health workers. The Commission on the Education of Health Professionals for the 21st Century, of which both of us were members, has brought many of these ideas of shared competencies, systems thinking, and social purpose together in a framework of instructional and institutional changes.[5] The commission proposes that we move into a third generation of "system-based" education. The Flexner Report, written by Abraham Flexner in 1910, introduced a scientific basis into medical education in North America that had previously been absent and resulted in the closure of many medical schools. Building on Flexner's first generation of science-based curricular reform in universities and moving through the second generation of problem-based learning with the growth of academic centers, the commission proposes a third generation of reforms that are competency-based in academic health systems (i.e., health systems that provide professional education in a variety of service settings). The emphasis on competencies moves beyond pedagogy to reexamining the skills required for a changing health care system. Synchronizing academic educational and health systems can improve horizontal integration of training from the undergraduate to the clinical-practical level and vertical integration from tertiary care to primary care teaching sites.

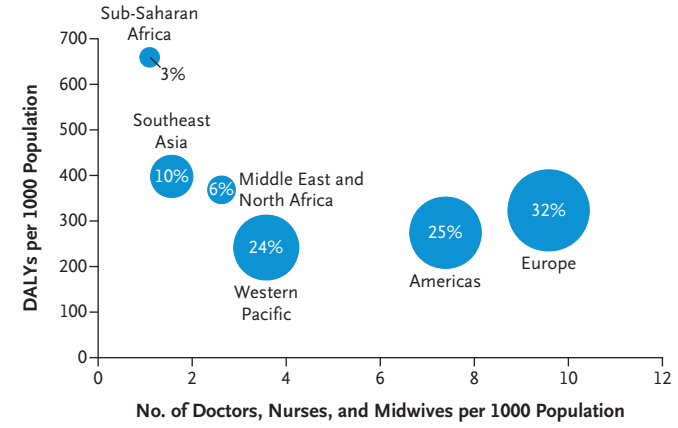

Figure 2. Global Health Workforce and Burden of Disease According to WHO Region.

The sizes of circles reflect the percentage share of the total global health workforce of doctors and nurses. Health workforce data are from WHO Global Health Workforce Statistics,[9] and data on the burden of disease, expressed as disability-adjusted life-years (DALYs) for all causes and both sexes, are from the Institute for Health Metrics and Evaluation.[10]

COMPETENCY-BASED SKILLS

Given all these impending changes, continuous reassessment of competencies relevant to local contexts should drive a learning process that pre-

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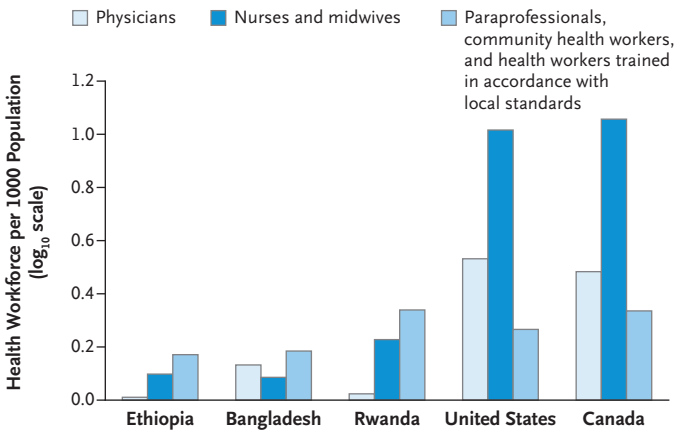

Figure 3. Health Workforce in Five Countries, According to Type of Health Worker, 2011.

Year 2011 data were not available for some countries; in those cases, the most recent available data are shown. Data are from WHO Global Health Workforce Statistics,[9] with the following exceptions: the number of community health workers in Ethiopia, which includes numbers of Health Extension Program workers and their supervisors, is from Belatchew[28]; the number of community health workers in Bangladesh is from Standing et al.[29] and Reichenberg et al.[30]; the number of paraprofessionals in the United States, which includes nurse practitioners and physician assistants, is from the Henry J. Kaiser Family Foundation[31,32]; and the number of paraprofessionals in Canada, which includes midwives, nurse practitioners, and social workers, is from the Canadian Institute for Health Information.[33] Because the absolute number of workers per 1000 population in some cases was less than 1, which resulted in negative values when converted to a logarithmic scale, 1 was added to each value before conversion.

serves valuable old skills, discards outdated procedures, and adds new capabilities. Although there have been efforts at establishing a single universal competency, there cannot be only one standard for all health professionals in a world of 200 countries among which the burden of disease and the capacity of health systems vary enormously.[5] The average national income in the richest and the poorest countries differs by a factor of more than 300 (from $271 in Burundi to $98,081 in Norway), and expenditures in health care vary by a factor of more than 600 (from $14 in Eritrea to $8,608 in the United States).[9] Recognition of these differences does not imply that we should discard requirements for core competencies; there are those that can and should be required of health professionals, regardless of country. Although the emphasis on disease, technology, service systems, and financing will necessarily vary across countries and regions, all local competencies must draw on the common pool of global knowledge, and all professional learning must progress along the continuum from basic science education to the application of knowledge in academic health systems, which combine the educational and health systems.

CHANGING ROLES

New roles are already evolving among different cadres of health workers. The demarcation of the responsibility and authority of different professions is not fixed. New technologies and practices will enable some health workers — imaging technologists, nurse endoscopists, physician assistants, and the like — to take on work previously performed by those with higher qualifications. Much innovation in such roles is taking place in low-income and middle-income countries in which the scarcity of resources has prompted some remarkable innovations to flourish.[24] In Mozambique, *técnicos do cirurgia* — mainly nurses with extra training — perform nearly all cesarean sections, with outcomes that are as good as those observed when the procedure is performed by physicians, and at a much lower cost,[25] and Pakistan's "Lady Health Workers" have shown the ability to influence health promotion and treatment in villages.[26] Community health workers, such as those in Bangladesh, are contributing to better child survival in many countries.[27] Figure 3 shows the numbers of such paraprofessionals, community health workers, and health workers trained in accordance with local standards in comparison with the numbers of doctors and nurses in various countries. In some low-income countries, the former can be more numerous than the latter. Some of the lessons about community health workers that have been learned from poorer countries are now being applied in richer countries (see, for example, the efforts to incorporate community health workers in the New York City health care system[34]).

TEAMWORK

Teamwork will be essential for the successful management of health care systems. A reasonable hypothesis is that insular training for individual professions does not sufficiently promote understanding, respect, and knowledge of allied professions in a health team. The current model of professional training — in which members of each health profession are trained in isolation from the others until they join the workplace, where they are expected to perform as teams — needs to be reexamined with the aim of inculcat-

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ing cooperative and collaborative skills, through interprofessional and transprofessional education, as professionals are trained to be members of health teams.

INNOVATIONS IN LEARNING

We are at the leading edge of a wave of innovations in the education of health professionals. Recently, massive open online courses (MOOCs), provided by companies such as Coursera, MIT–Harvard edX, Udacity, and iTunes U, have captured much attention.[35] Information technology–based mass online courses can expand time for new approaches to teaching, such as the "flipped classroom," in which the sequence of lecture and homework is reversed. Online materials can be taken as homework before peer and mentored interactions, with an aim toward enhancing the learning process in classrooms. Some of the innovations are coming from outside the health field; for example, the Khan Academy, an online educational organization that began by teaching online middle-school and high-school math, has now partnered with the Stanford School of Medicine "to provide free health and medicine content to anyone, anywhere" (www.khanacademy.org/partner-content/stanford-medicine). Other innovations come from the health field, such as Peoples-uni and the Institute for Healthcare Improvement Open School, a student-led initiative that in 3 years has grown to include 628 chapters in 65 countries.[36,37] Hospital groups, such as North Shore–Long Island Jewish Health System in New York State, have set up new medical schools. A study of African medical schools has shown how much innovation is emerging.[38] The large number of new private medical schools in Brazil and India is an additional development — one that is driven by commercial purposes but that nevertheless meets the aspirations of many young people.[5]

Not all these educational reforms will proceed smoothly. There are great concerns about the quality of skills and service delivery systems around the world. These concerns are magnified by commercial incentives that prioritize profit rather than health goals. The explosive growth of private medical education (more than three quarters of new medical schools that were opened in the year 2000 were private rather than public) harkens back to the pre-Flexner era, during which many low-quality schools were eventually forced to close. Another concern is that changes in professional roles — referred to as "task shifting," "task sharing," or "skill-mix changes" — have frequently not succeeded in the past, sometimes compromising health care quality and safety. Moreover, there may be instances in which new knowledge dictates that tasks need to be shifted to specialists rather than to less-trained workers. There is, however, already evidence regarding the factors that make for success — such as whether roles are well defined and whether workers are well trained, have access to retraining, and can refer patients to more skilled colleagues.[39] Teamwork is a desirable process and outcome, but we have little evidence about the kinds of medical school curricula, role modeling, or extracurricular activities that can nurture qualities that promote teamwork. The wave of new learning methods and new medical schools is too recent to allow us to draw conclusions about their effect.

Most important, the education of health professionals must reflect the different yet complementary roles that professionals play in the health care system. Beyond simply producing functionaries to serve a given health care system, education also produces researchers and scientists, leaders and change agents, and health policymakers and managers. That is why the commission argued for a third educational stage of "transformative learning." The first, informative stage provides information and may be expected to create an expert. The second, formative stage inculcates values and behavior for producing members of a profession. Transformative learning, the third stage, promotes the development of leaders and change agents who are able to engage in the transformation of health care systems. It may be hypothesized that the blended learning process introduced by MOOCs, involving flipped classrooms, peer interaction, individual mentoring, and interactive problem identification and problem solving, promises to help accelerate the transition of learning from informative and formative to transformative. While many professionals perform routinized work, others must also rise above functionality to serve as leaders in navigating the changes of the existing health system.

To do so, the professions will have to navigate the underlying tension between social and market forces. For example, there is a movement to instill the "social accountability" of medical education in schools. In the same vein, commer-

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cial schools must achieve acceptable levels of competency. The social mission is important to societies and governments seeking to improve the health of all people. However, health is also a financial business. The pressing health issues — access, quality, and costs — must all be tackled by health professionals with these wider perspectives in their hearts and minds.

Resistance to change may be expected. After all, millions earn their living from the status quo. That may be why policymakers in the past have found it easier to redesign services than to redesign roles. There are powerful forces demarcating responsibility, privilege, and authority.

Change, however, is already under way, and there is great energy and impetus for more. Educators of health professionals must grasp the opportunity to produce transformative leaders who have the motivation and capability to shape the future — or themselves be shaped by it.

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