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SPECIAL REPORT

The Human Resources for Health Program in Rwanda — A New Partnership

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A global shortage of 4.3 million health professionals poses a major bottleneck to poor people worldwide with regard to benefiting from the fruits of modern medicine.¹ Among existing health professionals, there are also staggering inequities in skill levels and geographic distribution.²⁻⁴ Unsurprisingly, the deepest national gaps in human resources for health run parallel to poor population-level health outcomes.¹

Sub-Saharan Africa bears 24% of the global burden of disease⁵ but is served by only 4% of the global health workforce.¹ The health graduate schools in the region face overwhelming financial, infrastructural, and personnel constraints, limiting their ability to address the shortage.^{2,5,6}

THE RWANDAN CONTEXT

From 1989 through 1997, Rwanda had the lowest life expectancy of any country in the world⁷; rates of preventable deaths due to infectious disease and unsafe birth skyrocketed as a result of the 1994 genocide.⁸ Workforce setbacks further plagued the country; many clinicians fled or were killed. With the turn of the century, however, years of intensive reconstruction began as Rwanda emerged from a period of lingering instability.

During the past decade, Rwanda has rebuilt its health system and registered some of the steepest declines in premature mortality in recent history.⁹ With a population of nearly 11 million people today,¹⁰ Rwanda had a total health expenditure of \$56 per capita in 2010, of which 47% was provided by donors.⁸ Deaths due to infectious disease and maternal disorders have declined dramatically since 2000, and Rwanda is now on

track to achieve each of the health targets set by the United Nations for child and maternal mortality, human immunodeficiency virus (HIV) infection, tuberculosis, and malaria in the Millennium Development Goals.⁹ Nearly all Rwandans have health insurance, and the poorest 25% of the population pay no fees.⁹ Between 2000 and 2011, life expectancy in Rwanda rose from 48 to 63 years of age (up from just 27 years of age in the early 1990s).⁷

Unprecedented global funding for HIV and AIDS since 2002 has assisted Rwanda and other countries in expanding the availability of highly active antiretroviral therapy (HAART) for the treatment of HIV infection, transforming the disease from a death sentence to a manageable chronic illness and forever altering the context of global health in the process.¹¹ Having achieved universal access to HAART and steeply reduced its AIDS-related mortality,⁹ Rwanda now faces the challenge of sustaining these gains while tackling a mounting burden of long-term complications of HIV infection and noncommunicable diseases including cardiovascular disease, cancer, diabetes, chronic pulmonary disease, and major mental illness.

The health sector in Rwanda has pioneered task-shifting by transferring agency for many clinical decisions and activities to nurses and community health workers,^{12,13} but a persistent shortage of adequately trained health professionals poses a major barrier to scaling up the availability and quality of specialized care. In 2011, Rwanda had 625 physicians, 8273 nurses, and 240 midwives providing care at 4 referral hospitals, 41 district hospitals, and 442 health centers (Table 1).¹⁴ With a combined health-service-

provider density of 0.84 physicians, nurses, and midwives per 1000 population,⁹ Rwanda falls far below the minimum level recommended by the World Health Organization (WHO) of 2.3 providers per 1000 population.¹ Approximately 45,000 community health workers across the 14,837 villages in Rwanda offer basic empirical diagnosis and treatment services, in addition to general health promotion, and they have been instrumental in the control of infectious diseases and the reduction of costs.

Until 2012, most of the physicians in Rwanda were trained as generalists, and more than 90% of the nurses have the lowest level of nursing training available (equivalent to secondary-school qualifications, or A2 level). Access to specialists is generally limited to the two university hospitals and other facilities in Kigali, the capital. Despite the increasingly high retention of health professionals trained in Rwanda, owing to public-service contracts signed by physicians after the completion of medical school and residency as well as the performance-based financing system, it has proved difficult to narrow the gap between supply and need (especially in rural areas) when the only medical school in the country produced an average of 100 physicians each year from 2004 through 2010.¹⁵

HUMAN RESOURCES FOR HEALTH PROGRAM

Similar to its perspective on the urgency of scaling up access to HAART in the early 2000s, the

Rwandan Ministry of Health viewed a systematic effort to address long-term care for patients with HIV infection and those with noncommunicable diseases as a triple imperative: moral, epidemiologic, and economic. In line with the Health Sector Strategic Plan II¹⁶ as well as the WHO building blocks for health systems strengthening¹⁷ and the Treat, Train, Retain initiative,¹⁸ the Ministry of Health identified the strengthening of a specialized health workforce in Rwanda as a priority step toward fulfilling the triple imperative while sustaining infectious-disease control. In 2011, its technical working group on Human Resources for Health developed a long-term strategy and implementation plan to increase the quantity of health professionals in the country, as well as the quality and diversity of their training.^{15,19}

The Ministry of Health asked the Clinton Health Access Initiative — an organization that first came to Rwanda in 2002 to assist the government in the planning of its response to HIV and AIDS — to extend invitations to leading universities and academic medical centers from across the United States for the establishment of an academic consortium. With a planning grant from the ELMA Foundation, the Clinton Health Access Initiative convened a U.S. academic consortium that included 16 academic medical centers, six schools of nursing, one school of public health, and two dental schools (Table 2) to forge a 7-year partnership with the government of Rwanda. The Human Resources for Health Program focuses on knowledge transfer, sustained collaboration, and the establishment

Table 1. Training Targets for the Human Resources for Health Program in Rwanda, 2011–2018.*

Objective	Baseline, 2011	Target, 2018
	<i>number</i>	
Increase the total number of physicians	625	1,182
Increase the number of specialists in priority clinical areas	150	551
Increase the total number of nurses and midwives	8513	11,384
Increase the number of nurses and midwives with A0 credentials	104	1,011
Increase the number of nurses with qualifications upgraded from A2 to A1 level credentials	797	5,095
Introduce the role of health manager at the district hospital level and increase the number of health managers	7	157
Increase the number of oral health professionals, including dental assistants, therapists, and surgeons	122	424

* Nurses with A2 level credentials have completed a nurse-training program at a secondary school, those with A1 level credentials have completed a 3-year postsecondary program and are registered nurses, and those with A0 level credentials have completed a 4-year bachelor's degree program.

Table 2. Institutions Affiliated with the Human Resources for Health Program.		
Focus of Collaboration	Rwandan Affiliates	U.S. Affiliates
Medical degree	National University of Rwanda National University of Rwanda Faculty of Medicine	Albert Einstein College of Medicine at Yeshiva University Beth Israel Deaconess Medical Center Boston Children's Hospital Brigham and Women's Hospital Columbia University Medical Center Duke University School of Medicine Geisel School of Medicine at Dartmouth Harvard Medical School Massachusetts General Hospital Rhode Island Hospital at Brown University University Emergency Medicine Foundation at Brown University University Medicine Foundation at Brown University University of Maryland School of Medicine University of Texas Medical Branch University of Virginia School of Medicine Yale School of Medicine
Nursing degree	Byumba Nursing and Midwifery School Kabgayi Nursing and Midwifery School Kibungo Nursing and Midwifery School Kigali Health Institute National University Faculty of Nursing Sciences Nyagatare Nursing and Midwifery School Ruli School of Nursing Rwamagana Nursing and Midwifery School	Duke University School of Nursing Howard University School of Nursing New York University College of Nursing University of Illinois at Chicago College of Nursing University of Texas Health Science Center at Houston University of Maryland School of Nursing
Health management degree	National University of Rwanda School of Public Health	Harvard Medical School Department of Global Health and Social Medicine Yale University Global Health Leadership Institute
Oral health degree	Kigali Health Institute National Dentistry Association	Harvard School of Dental Medicine University of Maryland School of Dentistry
General support	National Council of Nurses and Midwives Rwanda Medical Association Rwanda Nursing Association	Duke Global Health Institute

of new medical residency, nursing specialty, health management, and oral health programs within the Rwandan education system.

Launched in August 2012, the program deploys nearly 100 U.S. faculty members to Rwanda each year. Each school in the consortium sends full-time faculty members for 1-year periods to partner with Rwandan faculty-member counterparts in direct academic and clinical teaching. Several subspecialist physicians from the United States rotate throughout the year as well. The “twinning” model of the program facilitates curriculum development, clinical pedagogy, service delivery, and research capacity to develop the careers and skills of Rwandan specialist clinicians and educators who will assume all teaching and care delivery after 7 years. The model also enables scholarly collaborations between Rwandan and American training partners for clinical innovation and service delivery that

will be valuable to both sides, ideally outlasting the program itself. American faculty returning to their home institutions after participating in the Human Resources for Health Program will play an integral role in strengthening global health curricula.²⁰

Rwandan students who benefit are those in medicine, nursing, health management, and oral health programs. More than 500 physicians will be trained in specialty and subspecialty areas by 2018 (Table 3). Approximately 5000 nurses will have their qualifications upgraded from secondary-school level to 3 years of postsecondary school (registered nurses, or A1 level) by means of an online training platform. Improved clinical education including an online health-learning platform will connect district hospitals with university classrooms in Rwanda and in the United States.²¹ Nursing and midwifery faculty who teach advanced courses (e.g., critical care, pedi-

atics, and midwifery) will be enrolled in advanced courses in those specialties. Beginning in 2014, general nurses will have the opportunity to become certified in a variety of nursing specialties. Simultaneously, some nurses with 3-year diplomas (A1 level) will have their qualifications upgraded to a bachelor's degree level (A0 level). The specific time-limited targets are expected to be met by 2018 (Table 1).

As is the case in other countries in the region, Rwanda does not currently have the health care management capacity that is required to support the administrative needs of each hospital. Through the Human Resources for Health Program, the School of Public Health in Rwanda will introduce two new degree programs: a master's degree in hospital and health care administration and a master's degree in global health delivery, which will focus on administration, financial management, and policy leadership. Both programs will combine coursework with supervised fieldwork. Over the course of the Human Resources for Health Program, the School of Public Health aims to graduate 75 new managers from the master's degree in hospital and health care administration program, surpassing the minimum requirement needed to ensure that at least one trained health manager is working at each of the district, provincial, and referral hospitals by 2018. To address needs in oral health care, the Human Resources for Health Program will train more than 40 dental students, 20 dental therapists, and 15 dental assistants during the first 3 years of a newly established curriculum.

The program seeks to address both the proximal and distal drivers of the human resource shortage in Rwanda by increasing the capacity and quality of medical and nursing education while also strengthening incentives to work in the public sector and in rural districts. One important consideration for the retention of health professionals that is often overlooked in discussions of "brain drain" is the persistent lack of basic equipment and supplies at facilities; physicians who benefit from improved training will not be retained if they cannot apply these skills to their clinical practice and to teaching future clinicians. Thus, the Human Resources for Health Program also focuses on adequately equipping health facilities to ensure proper teaching environments.

Table 3. Primary Education and Training Areas in the Human Resources for Health Program.

Medicine
Anesthesiology
Internal medicine (including cardiology, nephrology, oncology, and infectious disease)
Obstetrics and gynecology
Otorhinolaryngology
Pathology
Pediatrics
Psychiatry
Radiology
Surgery (including orthopedics and neurosurgery)
Nursing and midwifery
Adult critical care
General nursing
Midwifery
Neonatal nursing
Nursing education
Nursing management
Oncology nursing
Pediatric nursing
Perioperative nursing
Trauma and emergency nursing
Health management
Global health delivery
Hospital and health care management
Oral health
General dentistry
Oral surgery

PARADIGM SHIFT IN GLOBAL HEALTH PARTNERSHIP

Foreign assistance programs have traditionally contracted third-party nongovernmental organizations (NGOs) through agreements that allow little space for recipient countries to negotiate efficient cost structures by means of the issuance of competitive bids. In recent years, resource-tracking data in Rwanda has shown that a substantial proportion of foreign assistance dollars are spent on overhead instead of on direct delivery of services.⁹ Rwanda has already established a strong record of success in leading donor-funded health projects similar to the Human Resources for Health Program in scope and

complexity; its response to AIDS has often been highlighted as an example of effective national ownership.^{9,22-24}

The Ministry of Health estimated that a budget of approximately \$152 million would be necessary to finance the entire 7-year program.¹⁹ To fund the initial planning phase and the first year of the program without requiring additional resources, the Rwandan and U.S. governments reallocated a large portion of bilateral assistance for health from existing activities implemented by NGOs contracted through the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) and the U.S. Agency for International Development. A large number of NGOs that had achieved their mandate by means of successful capacity transfer transitioned activities to the Ministry of Health, eliminated certain health interventions that no longer had major effects, or implemented such interventions with greater efficiency. Each of the American institutions in the academic consortium agreed to operate with minimal administrative costs of 7% and no overhead costs.

After negotiations and due-process review to ensure that no essential services would be cut because of reallocation, the U.S. government channeled \$27.2 million to the program through a cooperative agreement from the Centers for Disease Control and Prevention. The Global Fund to Fight AIDS, Tuberculosis, and Malaria provided \$6.4 million to round out the \$33.6 million budget for the initial phase of the program (August 2012–July 2013).

As PEPFAR and country partners learned about the difficulties of scaling up access to HAART within debilitated health systems in countries wracked by severe shortages of health workers, essential medicines, and monitoring systems, an international consensus emerged^{25,26} around the importance of an approach in which “explicit intervention priorities — such as HIV/AIDS — [are] used to drive desired improvements into the health system.”²⁷ Rwanda has pioneered the deployment of this disease-specific funding to build its primary health care system, and it has maximized synergies between PEPFAR and other bilateral, multilateral, and country health initiatives.^{28,29} The Human Resources for Health Program will help to fulfill the U.S. congressional mandate that PEPFAR contribute to the training of 140,000 new health workers in resource-constrained settings, as set forth in the

2008 Lantos–Hyde Act,³⁰ as well as the action steps laid out in the PEPFAR Blueprint for Creating an AIDS-free Generation.³¹

CONCLUSIONS

Although the ultimate goal of aid is to facilitate development so that nations can achieve self-sufficiency and no longer require aid, few models exist that comprehensively achieve this in the health sectors of developing nations. The Human Resources for Health Program aims to change this paradigm by addressing both the proximal and distal drivers of the health workforce shortage in Rwanda. After 7 years, Rwanda plans to operate the residency and training programs within its own budget and with its own teachers and clinicians.

Long-term professional connections between U.S. and Rwandan faculty are designed to be sustained past the 7-year duration of the Human Resources for Health Program. The duration and scope of this commitment is a departure from the traditional model of many shorter-term medical mission trips. With this new model for global health partnership, the program will help Rwanda meet its goal of creating a world-class health system.

Global solidarity has made it possible to decrease the burden of infectious disease, and the world now looks to the next frontiers of improving service delivery. Other countries that are positioned to take on the Human Resources for Health Program model can look to Rwanda for lessons on increasing the effectiveness of foreign aid and improving health systems. New partnerships that bridge gaps in human resources will help nations achieve universal health coverage and self-sufficiency.

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- World health report 2006: working together for health. Geneva: World Health Organization, 2006 (<http://www.who.int/whr/2006/en>).
- Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet* 2010;376:1923-58.
- Chen L, Evans T, Anand S, et al. Human resources for health: overcoming the crisis. *Lancet* 2004;364:1984-90.
- Hongoro C, McPake B. How to bridge the gap in human resources for health. *Lancet* 2004;364:1451-6.
- Celletti F, Reynolds TA, Wright A, Stoertz A, Dayrit M. Educating a new generation of doctors to improve the health of populations in low- and middle-income countries. *PLoS Med* 2011;8(10):e1001108.
- Mullan F, Frehywot S, Omaswa F, et al. Medical schools in sub-Saharan Africa. *Lancet* 2011;377:1113-21.
- DataBank: world development indicators and global development finance. Washington, DC: World Bank, 2012 (<http://databank.worldbank.org>).
- World health statistics 2012. Geneva: World Health Organization, 2012 (http://www.who.int/gho/publications/world_health_statistics/2012/en).
- Farmer PE, Nutt CT, Wagner CM, et al. Reduced premature mortality in Rwanda: lessons from success. *BMJ* 2013;346:f65. [Erratum, *BMJ* 2013;346:f534.]
- National Institute of Statistics of Rwanda. 2012 Population and housing census (provisional results) (<http://www.statistics.gov.rw/publications/2012-population-and-housing-census-provisional-results>).
- Dybul M. Lessons learned from PEPFAR. *J Acquir Immune Defic Syndr* 2009;52:S12-S13.
- Shumbusho F, van Griensven J, Lowrance D, et al. Task shifting for scale-up of HIV care: evaluation of nurse-centered antiretroviral treatment at rural health centers in Rwanda. *PLoS Med* 2009;6(10):e1000163.
- Rich ML, Miller AC, Niyigena P, et al. Excellent clinical outcomes and high retention in care among adults in a community-based HIV treatment program in rural Rwanda. *J Acquir Immune Defic Syndr* 2012;59(3):e35-e42.
- Rwanda health statistics booklet 2011. Kigali: Ministry of Health of the Republic of Rwanda, 2012 (http://moh.gov.rw/english/wp-content/uploads/2012/05/MOH_Annual_booklet-2011.pdf).
- Human Resources for Health Program. Strategic plan 2011-2016. Kigali: Ministry of Health of the Republic of Rwanda, 2011 (<http://www.brown.edu/academics/medical/bright/sites/brown.edu/academics.medical.bright/files/uploads/MOH%20Rwanda%20HRH%20Strategic%20Plan%202011%20-%202016.pdf>).
- Health sector strategic plan. Kigali: Ministry of Health of the Republic of Rwanda, June 2009 (http://transition.usaid.gov/rw/our_work/for_partners/images/rwandahealthsectorstrategicplanii.pdf).
- Everybody's business: strengthening health systems to improve health outcomes. Geneva: World Health Organization, 2007 (<http://www.who.int/healthsystems/strategy/en>).
- Treat, Train, Retain initiative: the AIDS and health workforce plan. Geneva: World Health Organization, 2006 (<http://www.who.int/hiv/pub/meetingreports/ttr/en/index.html>).
- Rwanda Human Resources for Health Program 2011-2019: funding proposal. Kigali: Ministry of Health of the Republic of Rwanda, 2011 (http://medicine.yale.edu/intmed/global/sites/413_129987_Rwanda%20HRH%20Proposal%20FINAL.pdf).
- Syed SB, Dadwal V, Rutter P, et al. Developed-developing country partnerships: benefits to developed countries? *Global Health* 2012;8:17.
- Kim JY, Farmer P, Porter ME. Redefining global health-care delivery. *Lancet* 2013;382:1060-9.
- The AIDS response and the Millennium Development Goals: Rwanda case study. Geneva: Joint United Nations Program on HIV/AIDS, 2010 (http://www.unaids.org/en/media/unaids/contentassets/dataimport/pub/report/2010/20100917_rwanda_aids_plus_mdgs_en.pdf).
- Goosby E, von Zinkernagel D, Holmes C, Haroz D, Walsh T. Raising the bar: PEPFAR and new paradigms for global health. *J Acquir Immune Defic Syndr* 2012;60:Suppl 3:S158-S162.
- Kim JY. Ending AIDS and poverty. Presented at the 19th International AIDS Conference, Washington, DC, July 22, 2012 (<http://www.worldbank.org/en/news/2012/07/22/world-bank-group-president-jim-yong-kim-remarks-at-the-opening-plenary-international-aids-conference-2012>).
- World Health Organization Maximizing Positive Synergies Collaborative Group. An assessment of interactions between global health initiatives and country health systems. *Lancet* 2009;373:2137-69.
- Frenk J. The global health system: strengthening national health systems as the next step for global progress. *PLoS Med* 2010;7(1):e1000089.
- Committee for the Evaluation of the President's Emergency Plan for AIDS Relief. PEPFAR implementation: progress and promise. Washington, DC: National Academies Press, 2007.
- Price JE, Leslie JA, Welsh M, Binagwaho A. Integrating HIV clinical services into primary health care in Rwanda: a measure of quantitative effects. *AIDS Care* 2009;21:608-14.
- Shepard DS, Zeng W, Amico P, Rwiwerekwa AK, Avila-Figueroa C. A controlled study of funding for human immunodeficiency virus/acquired immunodeficiency syndrome as resource capacity building in the health system in Rwanda. *Am J Trop Med Hyg* 2012; 86:902-7.
- Tom Lantos and Henry J. Hyde United States Global Leadership Against HIV/AIDS, Tuberculosis, and Malaria Reauthorization Act of 2008 (Pub. L. No. 110-293). Washington, DC: United States Congress, 2008 (<http://www.govtrack.us/congress/bills/110/hr5501>).
- PEPFAR blueprint: creating an AIDS-free generation. Washington, DC: Department of State, 2012 (<http://www.pepfar.gov/documents/organization/201386.pdf>).

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