Responding to the HIV Pandemic: The Power of an Academic Medical Partnership

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Abstract

Partnerships between academic medical center (AMCs) in North America and the developing world are uniquely capable of fulfilling the tripartite needs of care, training, and research required to address health care crises in the developing world. Moreover, the institutional resources and credibility of AMCs can provide the foundation to build systems of care with long-term sustainability, even in resource-poor settings.

The authors describe a partnership between Indiana University School of Medicine and Moi University and Moi Teaching and Referral Hospital in Kenya that demonstrates the power of an academic medical partnership in its response to the HIV/AIDS pandemic in sub-Saharan Africa. Through the Academic Model for the Prevention and Treatment of HIV/AIDS, the partnership currently treats over 40,000 HIV-positive patients at 19 urban and rural sites in western Kenya, now enrolls nearly 2,000 new HIV positive patients every month, feeds up to 30,000 people weekly, enables economic security, fosters HIV prevention, tests more than 25,000 pregnant women annually for HIV, engages communities, and is developing a robust electronic information system.

The partnership evolved from a program of limited size and a focus on general internal medicine into one of the largest and most comprehensive HIV/AIDS-control systems in sub-Saharan Africa. The partnership's rapid increase in scale, combined with the comprehensive and long-term approach to the region's health care needs, provides a twinning model that can and should be replicated to address the shameful fact that millions are dying of preventable and treatable diseases in the developing world.

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As physicians and academicians, it is our privilege and our responsibility to provide services to our patients and their communities, to nurture and inspire our students and trainees, and to examine and understand the complexities of our world. The power of this tripartite academic mission is particularly evident in the collaborative response of some academic medical centers (AMCs) and large public hospitals to the health problems of uninsured populations in the United States. Over the last several decades, for example, the political and academic leaders of the city of Indianapolis leveraged the entrepreneurial and intellectual energy of the city's academic community to respond meaningfully to the health needs of a broad swath of its most vulnerable population. A comprehensive care system was established in affiliation with the public hospital and a number of community-based health centers.[1] Those sites, in turn, became laboratories for research and classrooms for training generations of health professionals dedicated to providing a single standard of care for all persons. Though much work needs to be done, we can look proudly at many such achievements of AMCs across the United States.

Sub-Saharan Africa, in contrast, is facing an HIV/AIDS crisis—one of the most devastating pandemics in human history—and has yet to realize the power of its AMCs. The reasons for this oversight are many: inadequate collaboration and communication between the ministry of health and ministry of education in many countries, inadequately prepared managers and leaders, systems that are ill equipped and/or inadequately structured to manage and deliver complex and comprehensive programs, and a pervasive, insidious feeling of fatalism. The failure of most African countries in the 1990s to control the HIV/AIDS pandemic is self-evident. And, even with the advent of the Global Fund and the President's Emergency Plan for AIDS Relief in the current decade, the number of success stories in Africa is far too few. It is ironic that AMCs have failed to engage fully against the pandemic that is sweeping the African continent, because they are the only resource in Africa and the United States capable of simultaneously providing service, mobilizing manpower, teaching, and conducting research.

In this article, we will describe a unique and replicable model of a partnership between an American AMC and its African counterpart that created and implemented a successful, comprehensive system to control the HIV/AIDS crisis in western Kenya. We will describe the nature of the partnership, the growth of the HIV/AIDS-control system, our responses to the obstacles faced in building and sustaining the system, and the lessons we learned. We will illustrate the synergistic capacity of two AMCs to respond effectively to thousands of people dying of treatable and preventable diseases in Kenya, and we will challenge the donor community and our colleagues around the world to awaken the dormant power of AMCs across our globe.

The Indiana–Moi Partnership

At its inception in 1990, Moi University Faculty of Health Sciences (now named Moi University School of Medicine), the second medical school in Kenya, did not

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have a sufficient number of Kenyan faculty members and was seeking expatriate clinical teachers and institutional partners. At the same time, three general internists from Indiana University School of Medicine (IUSM) with long-term volunteer experience in developing countries were seeking to develop a relationship between Indiana University and a medical school in sub-Saharan Africa. Their aim was to develop leaders in health, foster the values of the medical profession, and foster health for the human family in this developing region. Led by these three faculty members, Indiana University's Division of General Internal Medicine committed to keeping at least one of its faculty members on site in Kenya. IUSM faculty members in Kenya serve under the direction of the Kenyan head of department and share with their Kenyan counterparts responsibilities for clinical care, community based education and service, teaching, and research. Though the partnership's response to the HIV epidemic would not begin until 2000, the overarching focus on primary care and institution building during the partnership's first decade formed the framework for its HIV-control program.

Counterpart relationships at both individual and departmental levels are the keystone of the Indiana–Moi partnership.[2] The partnership currently involves collaboration among virtually all of the major disciplines at both medical schools, though the administrative issues of the IUSM portion of the partnership are handled primarily within its division of general internal medicine. After initial success with the Indiana–Moi partnership, IUSM sought to make a wider impact on academic medicine in sub-Saharan Africa. Since 1997, several other North American medical institutions have joined IUSM in a partnership called the America/sub-Saharan Africa Network for Training and Education in Medicine (ASANTE) Consortium. (*Asante* means *thank you* in Kiswahili, one of Kenya's two national languages.) This consortium currently includes IUSM, Brown Medical School, Duke University School of Medicine, Lehigh Valley Hospital and Health Network, Providence Portland Medical Center, the University of Utah School of Medicine, and the University of Toronto Faculty of Medicine. In total, more than 800 Kenyans and Americans have participated in exchange of faculty members, postgraduate trainees, and students through the ASANTE Consortium. The partnership has had a major impact on delivery of health services, education, and research in Kenya, including dozens of jointly authored publications.[3–36]

One of the philosophical underpinnings necessary to sustain the Indiana–Moi partnership is that all participants in the partnership expect and work for mutual benefit. We have discovered that altruism is a necessary but insufficient reason for either institution to continue in the partnership. To achieve mutual benefit, the institutional relationship strives for equity, not equality, because medical systems in the developed and developing world are inherently unequal. For example, IUSM does not expect financial commitment on the part of Moi University to support IUSM's participation. However, IUSM does expect its trainees and faculty members to be given the opportunity at Moi to benefit personally and professionally from involvement in the program.

In part, IUSM's role in the partnership follows a distinguished precedent of U.S. AMCs engaging their considerable resources in response to the needs of underserved populations. Many distinguished AMCs and large public general hospitals in urban areas of the United States have entered into relationships that produced mutual benefit for underserved populations and the collaborating AMCs.[37] But there is substantially less evidence of similar success when U.S. AMCs collaborate with counterparts in the developing world. Collaborations inspired by financial incentives to U.S. medical schools during the 1950s through the early 1960s were phased out because of problems with sustainability and a disproportionate focus on tertiary care.[38] Most current examples of successful collaboration between U.S. AMCs and their counterparts in the developing world have been limited to focused initiatives, especially shared research interests. These collaborations have largely failed to facilitate improvements in the developing country's health care system and have tended to overemphasize curative care relative to disease prevention and health promotion.[39]

The Moi–Indiana system-building efforts also stand in contrast to short-term commitments from individual health care workers traveling to developing countries from the United States. Of course, these efforts can offer value to both the health care providers and the patients served.[40] However, lacking institutional backing and without connection to a long-term effort, these approaches cannot substantially contribute to the building of developing countries' health care systems. In response to this need for sustained system building, there have been many recent calls for partnerships between institutions in developed and developing countries to confront poverty-related diseases in developing countries.[41] AMCs should be the leaders in responding to these calls, because such centers are uniquely capable of fulfilling the tripartite needs of care, training, and research required to foster health of individuals and their communities in the developing world. Disappointingly, however, funding often does not exist to encourage North American medical schools to join with counterparts in Africa to respond to health care crises and build systems of care. Our experience strongly suggests that government and philanthropic support should be directed toward long-term institutional partnerships that contribute to system building.

Academic Model for Prevention and Treatment of HIV/AIDS

The tragic scope of the HIV/AIDS pandemic is well known. In 2005, an estimated 38.6 million people worldwide were living with HIV, and an estimated 2.8 million lost their lives to AIDS. In Kenya, it is estimated that 1.3 million people are living with HIV.[42]

The once-high cost of antiretroviral drugs, along with concerns about therapy adherence and the possible negative effect of antiretroviral therapy on risk behaviors, posed barriers to widespread HIV/AIDS treatment in sub-Saharan Africa. Many of those concerns have been addressed in recent years, and delivery of antiretroviral therapy has been successful in several settings in Africa.[43,44]

However, sustaining effective antiretroviral therapy and controlling HIV/AIDS in a place like Kenya is a uniquely difficult challenge. Conditions in sub-Saharan

Africa require a system of care that must effectively address issues of poverty, hunger, gender discrimination, and stigma that present barriers to successful treatment and contribute to the spread of the disease. Establishing and maintaining that system of care is especially difficult in sub-Saharan Africa, which suffers from 60% of the world's HIV/AIDS burden but can call on only 1.3% of the world's health care workforce to confront the challenge.[45]

Throughout its first decade, the Indiana–Moi partnership failed to respond systematically to the HIV/AIDS crisis. In fact, by 2000, we had failed to treat even one person with antiretroviral therapy. However, our successful treatment of a young Kenyan medical student dying of AIDS in 2001 inspired us to formulate a systemic response to the pandemic. Leveraging the power of our academic medical partnership, we established the Academic Model for the Prevention and Treatment of HIV/AIDS (AMPATH).[46]

AMPATH has quickly become one of the largest and most comprehensive HIV/AIDS-control systems in sub-Saharan Africa, providing a complete system of care that has been described as a model of sustainable development.[47] Delivery of services occurs in the public sector through hospitals and health centers run by Kenya's Ministry of Health. Through community engagement, education, promotion of safe-sex practices, experience-sharing by persons living with HIV/AIDS, counseling and testing, and other prevention activities, AMPATH touches the lives of millions in a wide geographic area. AMPATH has treated over 40,000 HIV-positive patients at 19 urban and rural clinical sites across western Kenya, currently enrolling nearly 2,000 new patients each month. (Figure 1) AMPATH feeds up to 30,000 people weekly and provides antenatal services that aim to prevent mother-to-child transmission of HIV in nearly 25,000 pregnant women annually. All eligible pregnant mothers in AMPATH's system are immediately referred for antiretroviral therapy. After delivery, all mothers are advised of the risks and benefits of exclusive breastfeeding or exclusive formula feeding with respect to transmitting HIV to their children. Eligible mothers who choose exclusive replacement feeding for their babies are provided formula at no cost. Furthermore, innovative efforts have been implemented to ensure access to safe water.

Starting an HIV-care system from scratch and expanding it in five years to serve comprehensively more than 40,000 patients and their communities was a daunting task. As we tackled the pandemic in our region of Kenya, we faced a series of obstacles. However, because of our academic medical partnership, we were able to craft effective responses to each challenge.

Stigma

At rural health clinics in particular, we discovered that the stigma associated with HIV/AIDS impeded access to care. However, our already existing strong ties with village elders, opinion leaders, and health providers (established through community-based work not related to HIV throughout the previous decade),

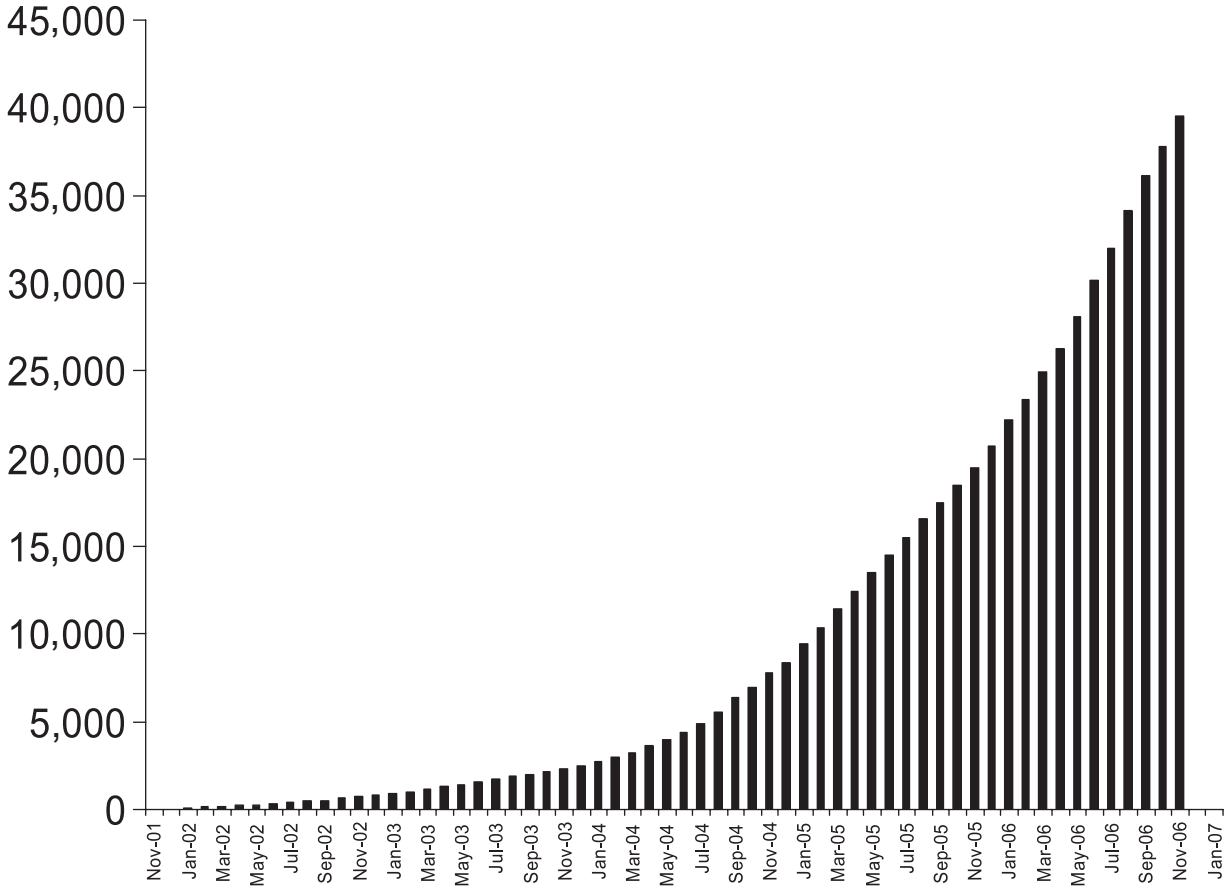

Figure 1 Cumulative number of persons infected with HIV enrolled in the Academic Model for the Prevention and Treatment of HIV/AIDS from November 2001 through January 2007.

along with some timely and visible success stories with early patients, allowed us largely to overcome that barrier. Other measures to confront stigma and enable prevention included community mobilization and health education, more aggressive community-based testing for the virus, and changes to HIV/AIDS-related policy in hospitals. Moi Teaching and Referral Hospital set the pace in Kenya for adopting policy that enabled opt-out HIV testing on all wards, predating by several years similar policy in the United States and in other sub-Saharan countries. Where we once offered HIV/AIDS screening and felt lucky if four or five people showed up, we now hold community-based rallies and test nearly a thousand people in a day. AMPATH has transformed whispers of shame and stigma into a community-wide embrace of people living with HIV/AIDS.[48]

Food security

We found that, depending on location, between 20% and 50% of AMPATH's patients were hungry and lacked food. It was apparent that the physical limitations of living with HIV/AIDS had made it difficult for patients to work their small farms or take on outside jobs, and this left them and their families impoverished and malnourished. In response, we initially created a demonstration farm on 10 acres of land donated by a local high school. This farm, which we called the HAART and Harvest Initiative (*HAART* stands for *highly active antiretroviral therapy*), had a dual purpose: it enabled farmers to learn how to increase their yields of crops, milk, and eggs, and the produce from the demonstration farm was distributed to our most needy patients. The farm serves as a focal point for the community and a gathering place where persons living positively with HIV/AIDS can engage with the greater community. The farm also gives the community more ownership in the response to the HIV epidemic. For these reasons, the farm had an unintended benefit of slashing HIV stigma in the community.

Over time, as AMPATH expanded to other sites, the HAART and Harvest Initiative evolved into four high-tech, high-production farms plus three demonstration farms. These farms currently produce more than five tons of fresh produce weekly, all of which is distributed to our hungriest patients and their families. The United Nations World Food Program complements the fresh produce from our farms with donations of corn, beans, corn/soy blend, and oil. AMPATH now provides food assistance to up to 30,000 people per week. Food distribution, however, is a formidable challenge. The daily measure of supply and demand must be translated into individual patient allocations, which are to be picked up at specific distribution sites spread over western Kenya. Industrial engineers from Purdue University have joined with AMPATH to create the proper computerized nutrition information system capable of getting the right food to the right place at the right time. In addition, this component of the AMPATH food program is complex, requiring trucks, storage warehouses, distribution centers, distribution workers, and data clerks.

Income security

We discovered that many patients had lost their jobs due to the physical limitations of their illness or because of the stigma associated with being HIV positive. The majority of our initial patients had been widowed by the disease and did not have the skills or capital necessary to support their families. Enabling these patients to earn a sustainable source of income to achieve well-being and sustain or restore human dignity was nearly as important as providing food assistance. In response to this need, the Indiana–Moi partnership created the Family Preservation Initiative. Up and running at four of AMPATH's 19 sites and currently expanding to three more sites, the Family Preservation Initiative aims to address patients' economic security needs through skills training, microcredit, agribusiness support, a fair-trade-certified crafts workshop and agricultural cooperatives.

Information system

The complicated and lifelong nature of HIV/AIDS care, monitoring patient adherence to antiretroviral therapy, and the need for reliable research demands accurate and detailed record keeping, a significant barrier to sustainable care in the developing world.[49] Before the founding of AMPATH, Indiana and Moi had already created the first-ever electronic medical records system in sub-Saharan Africa.[4] Now, in collaboration with Partners in Health, an organization that provides comprehensive health care to underserved communities throughout the world, this system has evolved into a shareware electronic medical record system called OpenMRS, a common framework on which medical informatics efforts in developing countries can be built. OpenMRS is already being used by AMPATH, in HIV/AIDS clinics in Rwanda, and in a hospital in South Africa.[50]

Clinics, classrooms, labs

In many of our sites, as the number of patients treated increased beyond hundreds to thousands, we found that the necessary amount of care could not be provided in existing facilities alone. So, the partnership built a number of additional facilities, including the AMPATH Centre of Excellence for HIV Care, Kenya's first facility solely dedicated to caring for HIV-positive patients. At this 80,000-square-foot facility in Eldoret, patient care is provided and medical school faculty, clinical officers, and nursing staff are trained in providing comprehensive multidisciplinary care to HIV-infected patients. The center also serves as a home for multiple research projects, a tuberculosis diagnostic laboratory, and an HIV reference laboratory.

Transparency and accountability

One of the most critical challenges we faced with AMPATH was to develop the administrative capacity to support an increase in staff numbers and to assure fiscal accountability in a time of rapidly increasing budgets. We did this by creating a research and sponsored programs office administered jointly by Moi Teaching and Referral Hospital and Moi University, housed in the AMPATH Centre. Administrators from IUSM's research and sponsored program's office played a key role in this process. Philanthropic support coupled with in-kind support from Indiana University enabled bilateral exchange and the eventual success of this endeavor.

Although many challenges remain in front of us, the partnership's efforts to confront the HIV/AIDS pandemic have been successful. AMPATH is Kenya's largest public sector HIV/AIDS program and has been designated by the ministry of health as the training site for providers

in western Kenya. Treatment of AMPATH's patients has been shown to result in significant and persistent clinical and immunological benefit, with patients showing both weight and CD4 cell count increases well into the third year of follow-up.[44]

After IUSM, Moi Teaching and Referral Hospital, and Moi University articulated a shared vision and commitment to address the HIV/AIDS crisis in Kenya, funding followed. AMPATH has been supported by grants from the United States Agency for International Development, the President's Emergency Plan for HIV/AIDS Relief, the U.S. Centers for Disease Control and Prevention, the Maternal to Child Transmission Plus Initiative, the Bill and Melinda Gates Foundation, private family foundations in Canada and the United States, and other private philanthropy. Importantly, since the inception of the Indiana–Moi partnership, in-kind support from Indiana University, private philanthropic support (including from the interfaith community), and a willingness to take calculated risks have been keys to the success of the partnership. We cannot overstate the vital role that private philanthropy has played in enabling the partnership to respond nimbly and effectively to problems at hand.

Institution Building and Risk-Taking in Kenya

Beyond the parameters of the HIV/AIDS response, the long-term commitment of the Indiana–Moi partnership has inspired a focus on sustaining the emerging health system in Kenya. Through Moi's, IUSM's and Moi Teaching and Referral Hospital's access to a broad array of funding sources, the partnership enhances financial security and provides sustained support for Kenyan faculty members. IUSM has coordinated a program for United States-sponsored tuition scholarships and work–study opportunities for Moi University students. This support, along with support for programmatic and faculty development in multiple disciplines, works to increase the capacity of Kenya to address its own health needs while also combating the disturbing phenomenon of "brain drain" in Kenya and other developing countries.[51]

It is important to note the essential role that multiinstitutional cooperation within Kenya played in creating and sustaining the partnership. Ministries of health and education in developing countries are routinely called on to respond to health crises, but too often, the ministries are not encouraged or empowered to combine forces and take advantage of their complementary resources. In our case, Moi University School of Medicine, under the banner of the Kenyan Ministry of Education, and Moi Teaching and Referral Hospital, part of the Kenyan Ministry of Health, accepted the risks of a partnership with each other and with IUSM. These risks included the possibility of a failed program, loss of prestige that comes with shared leadership, and diverting funds from other pressing needs. Of course, IUSM also accepted its own risks of lost resources and prestige. At its inception, the institutional partnership among IUSM, Moi University School of Medicine, and Moi Teaching and Referral Hospital resulted from personal, departmental, and institutional commitments and agreements. We did not begin at the level of the ministries and work down; rather, we effected relationships at personal, departmental and institutional levels and then involved the greater universities, ministries, and central governments.

Many institutions in North America and sub-Saharan Africa have not been willing to accept the risk of partnership in pursuing ambitious public health goals. But, in our case, key faculty members of both schools of medicine altered their time commitments to accept the partnership challenge, and the institutions made priority adjustments as well. All involved agree it is unlikely that the extensive cross-ministry cooperation within Kenya would have occurred without the catalytic role of IUSM, which was able to approach the health crisis from a broad and "neutral" perspective removed from, but not insensitive to, internal Kenyan political interests.

The Power of an Academic Medical Partnership

Although limited research has been conducted on best practice approaches to building health care systems in the developing world,[52] the Indiana–Moi experience provides a model for institutional partnerships meeting the challenge of providing health care in a resource-poor environment. AMPATH's success lies in its ability to achieve a rapid increase in required services and resources to meet the treatment needs of tens of thousands of HIV patients at multiple clinical sites, to combine care at rural and urban settings, and to provide a comprehensive system of care in an environment that hosts training and research. These capacities are directly attributable to the substantial resources created by the academic medical partnership between Moi and IUSM.

The current crisis facing sub-Saharan Africa demands a response from every available resource within Africa, joined with meaningful contributions from the full spectrum of resources available to developed countries. For African AMCs, this means discovering the dormant power that resides in the tripartite mission of patient and community service, teaching, and research. For U.S. AMCs, it means risking far more than collaboration in fully funded research and training ventures, and instead engaging in a committed and equitable relationship with their developing world counterparts.

It was an accident of epidemiology that caused our Indiana–Moi partnership to be confronted by the greatest pandemic of our time, but it is no accident that an academic medical partnership has been able to respond to the crisis quickly, comprehensively, and effectively. We call on other AMCs in North America and Africa, and the funders that support them, to discover their own potential for a similarly meaningful response.

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References

1 Hale HA. Caring for the Community: The History of Wishard Hospital. Indianapolis, Ind: Wishard Memorial Foundation; 1999.

2 Einterz RM, Kelley CR, Mamlin JJ, van Reken DE. Partnerships in international health. The Indiana University–Moi University experience. Infect Dis Clin North Am. 1995;9:453–455.

3 Rotich JK, Hannan TJ, Smith FE, et al. Installing and implementing a computer-based patient record system in sub-Saharan Africa: the Mosoriot medical record system. J Am Med Inform Assoc. 2003;10:293–303.

4 Hannan TJ, Rotich J, Odero WWO, et al. The Mosoriot medical record system: design and initial implementation of an outpatient electronic record system in rural Kenya. Int J Med Inform. 2000;60:21–28.

5 Hannan TJ, Tierney WM, Rotich JK, et al. The Mosoriot medical record system (MMRS) phase I to phase II implementation: an outpatient computer-based medical record system in rural Kenya. Medinfo. 2001;10: 619–622.

6 Tierney WM, Rotich JK, Smith FE, Bii J, Einterz RM, Hannan TJ. Crossing the "digital divide:" implementing an electronic medical record system in a rural Kenyan health center to support clinical care and research. Proc AMIA Symp. 2002:792–795.

7 Hannan TJ, Tierney WM, Rotich JK, et al. Technological and human factors affecting the utilization of a CBPR system in western Kenya. Medinfo. 2004:1627.

8 Odero WW, Einterz RM, Mungai S, Tierney WM. Using an electronic medical record system to describe injury epidemiology and health care utilization at an inner-city hospital in Indiana. Inj Control Saf Promot. 2005;11:269–279.

9 Siika AM, Rotich JK, Simiyu CJ, et al. An electronic medical record system for ambulatory care of HIV-infected patients in Kenya. Int J Med Inform. 2005;74: 345–355.

10 Mamlin BW, Biondich PG. AMPATH medical record system (AMRS): collaborating toward an EMR for developing countries. AMIA Annu Symp Proc. 2005;490–494.

11 Diero L, Rotich JK, Bii J, et al. A computer-based medical record system and personal digital assistants to assess and follow patients with respiratory tract infections visiting a rural Kenyan health centre. BMC Med Inform Decis Mak. 2006;6:21.

12 Nyarang'o PM. Kenya's innovation in medical education. SGIM News. 1990;13:4–5.

13 Ayuku DO, Einterz RM, Esamai F, et al. Interviewing: A Manual on Interviewing for Health Professionals. Eldoret, Kenya: Moi University Faculty of Health Sciences; 1991.

14 Odero WWO. Community-oriented medical education: a strategy for implementing primary health care in Kenya. SGIM News. 1991;4:5.

15 Mamlin J. Academic general internal medicine in the developing world: a personal perspective. SGIM News. 1993;14:1,3–4.

16 Bettinger P, Takesue B. A resident's perspective of a hospital rotation in Kenya. SGIM News. 1993;16:2,7.

17 Dean RA, Ochieng W, Black J, Queener SF, Bartlett MS, Dumaual NG. Simultaneous determination of primaquine and carboxyprimaquine in plasma using high-performance liquid chromatography with electrochemical detection. J Chromatogr B Biomed Appl. 1994;655:89–96.

18 King NW, Ndiema M, Neff AW. Anterior structural defects by misexpression of Xgbx-Z in early Xenopus embryos are associated with altered expression of cell adhesion molecules. Dev Dyn. 1998;212:563–579.

19 Maritim AC, Moore BH, Sanders RA, Watkins JB III. Effects of melatonin on oxidative stress in streptozotocin-induced diabetic rats. Int J Toxicol. 1999;18:161–166.

20 Strother RM, Thomas TG, Otsyula M, Sanders RA, Watkins JB. Characterization of oxidative stress in various tissues of diabetic and galactose-fed rats. Int J Exp Diabetes Res. 2001;2:211–216.

21 Maritim AC, Dene BA, Sanders RA, Watkins JB. Effects of β-carotene on oxidative stress in normal and diabetic rats. J Biochem Mol Toxicol. 2002;16:203–208.

22 Maritim AC, Sanders RA, Watkins JB. Effects of alpha-d-lipoic acid on biomarkers of oxidative stress in streptozotocin-induced diabetic rats. J Nutr Biochem. 2003;14:288–294.

23 Maritim AC, Sanders RA, Watkins JB. Effects of pycnogenol treatment on oxidative stress in streptozotocin-induced diabetic rats. J Biochem Mol Toxicol. 2003;17:193–199.

24 Maritim AC, Sanders RA, Watkins JB. Oxidative stress, antioxidants and diabetes: a review. J Biochem Mol Toxicol. 2003;17: 24–38.

25 Otsyula M, King MS, Ketcham TG, Sanders RA, Watkins JB III. Oxidative stress in rats after 60 days of hypergalactosemia or hyperglycemia. Int J Toxicol. 2003;22: 423–427.

26 Einterz RM, Goss JR, Kelley S, Lore W. Illness and efficiency of health services delivery in a district hospital. East Afr Med J. 1992;69: 248–253.

27 Menge I, Esamai F, Van Reken D, Anabwani G. Paediatric morbidity and mortality at the Eldoret District Hospital, Kenya. East Afr Med J. 1995;72:165–169.

28 Wools K, Menya D, Mulli F, Jones R, Heilman D. Perception of risk, sexual behaviors, and STD/HIV prevalence in women attending an urban and a rural health centre in western Kenya. East Afr Med J. 1998;75:679–683.

29 Ayaya SO, Esamai FO, Rotich J, Sidle J. Perinatal morbidity at the Moi Teaching and Referral Hospital, Eldoret East Afr Med J. 2001;78:544–549.

30 Maritim AC, Kamar KK, Ngindu A, Akoru CN, Diero L, Sidle J. Safranin staining of *Cyclospora cayetanensis* oocysts not requiring microwave heating. Br J Biomed Sci. 2002;59: 114.

31 Ngindu A, Kamar K, Choge A, et al. Survey of faecal parasites in patients from western Kenya. J Egypt Soc Parasitol. 2002;32:1–7.

32 Jablonski-Cohen MS, Kosgei RJ, Reimoi AJ, Mamlin JJ. The emerging problem of coronary heart disease in Kenya. East Afr Med J. 2003;80:293–297.

33 Diero L, Stiffler T, Einterz RM, Tierney WM. Predictors of *Pneumocystis carinii* pneumonia in HIV infected patients. Int J Med Inform. 2004;73:743–750.

34 Dabis F, Balestre E, Braitstein P, et al. Cohort Profile: Antiretroviral Therapy in Lower Income Countries (ART-LINC): international collaboration of treatment cohorts. Int J Epidemiol. 2005;34:979–986.

35 Shaffer D, Yebei V, Kimaiyo S, et al. Equitable treatment for HIV/AIDS clinical trial participants: a focus group study of patients, clinician–researchers, and administrators in western Kenya. J Med Ethics. 2005;32:55–60.

36 The Antiretroviral Therapy in Lower Income Countries (ART-LINC) Collaboration; ART Cohort Collaboration (ART-CC) groups. Mortality of HIV-1-infected patients in the first year of antiretroviral therapy: comparison between low-income and high-income countries. Lancet. 2006;367:817–824.

37 Moy E, Valente E Jr, Levin RJ, Griner PF. Academic medical centres and the care of underserved populations. Acad Med. 1996;71: 1370–1377.

38 World Health Organization. The Role of Hospitals in Primary Health Care: Karachi Conference Report. Geneva, Switzerland: World Health Organization; 1981.

39 Ulmer DD. Some international efforts of medical schools to improve health systems. Infect Dis Clin North Am. 1995:9:425–431.

40 Institute of Medicine. Healers Abroad: Americans Responding to the Human Resource Crisis in HIV/AIDS. Washington, DC: The National Academies Press; 2005.

41 Bosch X. Europe and Africa forge new alliance against poverty-related disease. Lancet. 2002;359:1588.

42 UNAIDS. 2006 Report on the Global HIV/AIDS Epidemic. Geneva, Switzerland: World Health Organization; 2006.

43 Stringer JSA, Zulu I, Sinkala M, et al. Rapid scale-up of antiretroviral therapy at primary care sites in Zambia: feasibility and early outcomes. JAMA. 2006;296:782–793.

44 Wools-Kaloustian K, Kimaiyo S, Diero L, et al. Viability and effectiveness of large-scale HIV treatment initiatives in sub-Saharan Africa: experience from western Kenya. AIDS. 2006;20:41–48.

45 High Level Forum on the Health Millennium Development Goals. Addressing Africa's Health Workforce Crisis: An Avenue for Action. Abuja, Nigeria: World Bank and World Health Organization; 2004.

46 Mamlin JJ, Kimaiyo S, Nyandiko W, Tierney WM, Einterz RM, eds. Academic institutions linking access to treatment and prevention: case study. In: Perspectives and Practice in Antiretroviral Treatment. Geneva, Switzerland: World Health Organization; 2004.

47 Tobias R. Testimony to U.S. Senate Foreign Relations Committee; March 7, 2006. Available at: (http://www.usaid.gov/press/speeches/2006/ty060307.html). Accessed April 26, 2007.

48 Voelker R. Conquering HIV and stigma in Kenya. JAMA. 2004;292:157–159.

49 Godlee F, Pakenham-Walsh N, Ncayiyana D, Cohen B, Packer A. Can we achieve health information for all by 2015? Lancet. 2004;364:295–300.

50 Biondich PG, Mamlin BW, Hannan T, Tierney WM. A call for collaboration: building an EMR for developing countries. AMIA Annu Symp Proc. 2005:894. OpenMRS available at: (http://openmrs.org). Accessed April 26, 2007.

51 Physicians for Human Rights. An Action to Prevent Brain Drain: Building Equitable Health Systems in Africa. Boston, Mass: Physicians for Human Rights; 2004.

52 Mexico, 2004: global health needs a new research agenda. Lancet. 2004;364:1555–1556.

Did You Know?

With federal funding from the National Institutes of Health, researchers at Tulane University School of Medicine, in 2004, identified a cell that prevents the immune system from destroying cancer cells in the body.

For other important milestones in medical knowledge and practice credited to academic medical centers, visit the "Discoveries and Innovations in Patient Care and Research Database" at (www.aamc.org/innovations).