

Brain drain in sub-Saharan Africa: contributing factors, potential remedies and the role of academic medical centres

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ABSTRACT

A double jeopardy exists in resource-limited settings (RLS) in sub-Saharan Africa (SSA): there are a disproportionately greater number of acutely ill patients, but a paucity of healthcare workers (HCW) to care for them. SSA has 25% of the global disease burden but only 3% of the world's HCW. Thirty-two SSA countries do not meet the WHO minimum of 23 HCW per 10000 population. Contributing factors include insufficient supply, inadequate distribution and migration. Potential remedies include international workforce policies, non-governmental organisations, national and international medical organisations' codes of conduct, inter-country collaborations, donor-directed policies and funding to train more people in-country, and health system strengthening and task-shifting. Collaborations among academic institutions from resource-rich and poor countries can help address HCW supply, distribution and migration. It is now opportune to harness bright, committed people from academic centres in resource-rich and poor settings to create long-term, collaborative relationships focused on training, clinical skills and locally relevant research endeavours, who mutually strive for HCW retention, less migration, and ultimately sufficient HCW to provide optimal care in all RLS.

INTRODUCTION

Resource-limited settings (RLS) in sub-Saharan Africa (SSA) are susceptible to multiple pressures in healthcare provision: there are greater numbers of acutely ill patients, but an insufficient number of physicians, nurses, midwives and others to care for them. The SSA healthcare worker (HCW) shortage is not a new phenomenon,^{1 2} but persistently high rates of communicable disease and a growing burden of non-communicable disease has brought the issue to the fore.³

The WHO estimates that countries need a minimum of 23 HCW (doctors, nurses and midwives) per 10 000 population to provide adequate primary care and reach Millennium Development Goals 4 and 5, which are to reduce under-five mortality by two-thirds and maternal mortality by three-quarters and achieve universal access to reproductive services by 2015.^{4 5} Fifty-seven countries worldwide do not meet this minimum standard, including 32 of the 46 countries in SSA.⁶ The OECD estimated that African countries with HCW shortages had 590 198 practicing doctors, nurses and midwives and an estimated shortfall of 817 992. This 58% shortfall ranked Africa as the region with the largest HCW shortages in the world.⁷ SSA has fewer than 1.3 physicians per 10 000 population, whereas the UK has

27.4 and the USA has 26.7 physicians per 10 000, respectively.⁸

In this article we describe the effects of HCW shortages on maternal and child health, examine the causes and provide a number of possible solutions. We present an example of one collaborative effort between Massachusetts General Hospital (MGH) and Mbarara University of Science and Technology (MUST) to address HCW shortage in Uganda by enhancing training and mentorship for Ugandan and American trainees and developing Ugandan clinician and research leaders.

HCW SHORTAGE AND MATERNAL AND CHILD HEALTH

Annually, more than 340 000 women die in pregnancy or childbirth; 99% of these deaths occur in low-income countries, where only half of all pregnant women have access to a skilled birth attendant.⁹ Annually, 7.6 million children worldwide and one of every eight children in SSA die before their fifth birthday.¹⁰ An estimated two-thirds of these lives could be saved with proven, cost-effective interventions.¹¹ Factors including lack of clean water, sanitation systems, food security, dignified housing, educational and economic opportunities play a significant role, compounded by HCW shortages.^{12 13} Table 1 lists the HCW to population ratios of countries in SSA and their corresponding health indicators, illustrating that countries with the lowest HCW to population ratios have some of the worst health indicators.

CAUSES OF HCW SHORTAGE: INSUFFICIENT SUPPLY, INADEQUATE DISTRIBUTION AND MIGRATION

Insufficient supply of HCW in SSA is well-documented: SSA has 25% of the global burden of disease and only 3% of the world's HCW.⁵ Only 7.5% of the world's medical schools are in SSA, and the estimated 10 000 annual graduates are insufficient.¹⁴⁻¹⁶

There is a mismatch between where most ill people live (rural areas) and where most HCW work (urban areas). For example, in Uganda, 88% of the population lives in underserved rural areas, while the majority of HCW work in urban areas.¹⁷

Nearly 100 000 African doctors and nurses have emigrated to work in OECD countries, 12% of the total SSA HCW shortage and at most 25% of any individual country's shortage.⁷ Stemming migration will not completely reverse HCW shortages. Nonetheless, migration represents a significant loss to sending countries of both personnel and

Table 1 Comparison of healthcare worker density and maternal and child health indicators from sub-Saharan African countries that do not meet the WHO critical threshold of 23 doctors, nurses and midwives per 10 000 population

Country	Healthcare workers/10 000 population*	Maternal mortality ratio (no. deaths/100 000 live births)†	Under 5 mortality ratio (no. deaths/1000 live births)‡	Infant mortality ratio (no. deaths/1000 live births)‡	% HIV positive pregnant women who received ARVs for PMTCT¶	% Children <5 years of age who are stunted**	Child deaths/100 000 attributable to sanitation and hygiene**
Burundi	2.2	970	142	88	12	63	1088
Somalia	2.3	1200	180	108	0	42.1	885
Ethiopia	2.5	470	106	68	13	50.7	705
Niger	2.5	820	143	73	25–74	54.8	1229
Chad	3.2	1200	173	99	6	44.8	618
Liberia	3.3	990	103	74	16	39.4	885
Mozambique	3.6	550	135	92	70	47	388
Senegal	3.8	410	75	50	16–45	20.1	530
Sierra Leone	3.9	970	174	114	19	37.4	1473
Tanzania	3.9	790	76	50	70	44.4	322
Togo	4.7	350	103	66	26	26.9	419
Rwanda	4.8	540	91	59	65	51.7	970
Central African Republic	5.1	850	159	106	34	44.6	511
Djibouti	5.9	300	91	73	10	32.6	454
Burkina Faso	6	560	176	93	32	35.1	786
Mali	6.1	830	178	99	26–82	38.5	880
Malawi	6.1	510	92	58	58	53.2	617
Madagascar	6.1	440	62	43	1–5	49.2	540
Eritrea	6.3	280	61	42	34	43.7	379
Congo, Democratic Republic	6.4	670	170	112	4–11	45.8	786
Guinea	6.7	680	130	81	17	40	480
Lesotho	6.7	530	85	65	64	45.2	44
Cote d'Ivoire	7.2	470	123	86	54	39	561
Mauritania	7.5	550	111	75	12–37	23	390
Guinea-Bissau	8.1	1000	150	92	24	28.1	873
Uganda	8.1	430	99	63	53	38.7	427
Equatorial Guinea	8.3	280	121	81	26	35	506
Zimbabwe	8.8	790	80	51	56	35.8	256
Comoros	8.9	340	86	63	10–33	46.9	177
Benin	9.2	410	115	73	46	44.7	518
Ghana	10.7	350	74	50	27	28.6	226
Congo	11.6	580	93	61	12	31.2	220
Angola	12.7	610	161	98	19	29.2	1266
Kenya	12.8	530	85	55	73	35.2	362
Gambia	14.3	400	98	57	43 to >95	27.6	286
Cameroon	17.9	600	136	84	27	36.4	497
Nigeria	19.8	840	143	88	22	41	560
Zambia	22.3	470	111	69	69	45.8	503

*The World Health Report 2006. *Working Together for Health*. http://www.who.int/whr/2006/whr06_en.pdf (accessed 5 Jun 2012).

†WHO, UNICEF, UNFPA, World Bank. *Trends in Maternal Mortality 1990–2008*. http://whqlibdoc.who.int/publications/2010/9789241500265_eng.pdf (accessed 25 Nov 2011).

‡UN Inter-Agency Group for Child Mortality Estimation. *Levels and Trends in Child Mortality*. 2011. http://www.who.int/maternal_child_adolescent/documents/20110915_unicef_childmortality/en/index.html (accessed 25 Nov 2011).

¶UNAIDS. *Report on the Global AIDS Epidemic 2010*. http://www.unaids.org/globalreport/documents/20101123_GlobalReport_full_en.pdf (accessed 27 Nov 2011).

**WHO Global Health Observatory Data Repository. <http://apps.who.int/ghodata/?vid=93000> (accessed 6 Dec 2011).

ARVs, antiretrovirals; PMTCT, prevention of mother to child transmission.

investment.^{12–18} Approximately 25% of African physicians and 10% of African nurses work in a developed country.¹⁹ Half of SSA countries lose more than 30% of the physicians they train to migration (see table 2). The economic cost of migration is high: nine SSA countries lost more than 2 billion US dollars in returns on investments made to train doctors who subsequently emigrated.²⁰

FACTORS DRIVING THE THREE CAUSES OF HCW SHORTAGE

Economics

Global, national and local economies, policies, demographics, workplace conditions, and educational and professional development opportunities combine to discourage aspiring HCW, compromise the education and training process, and push and

Table 2 Expatriation rates of nurses and doctors trained in sub-Saharan African countries that do not meet the WHO critical threshold of 23 doctors, nurses and midwives per 10 000 population

Country	Nurses		Doctors	
	No. working in OECD countries	Expatriation rate	No. working in OECD countries	Expatriation rate
Mozambique	779	16.5	935	64.5
Angola	1703	11.5	1512	63.2
Sierra Leone	2057	56.3	236	58.4
Tanzania	970	6.8	1018	55.3
Liberia	1240	66.9	122	54.2
Guinea-Bissau	227	18	182	49.2
Senegal	256	8.9	449	43
Congo	452	12.3	539	41.6
Benin	166	3.2	215	40.9
Togo	78	4	153	40.5
Malawi	200	2.7	162	37.9
Kenya	2523	6.4	2385	34.6
Equatorial Guinea	98	31	78	33.8
Somalia	250	14.4	155	33.3
Uganda	1210	7.4	1084	32.9
Eritrea	548	18.8	104	32.6
Ghana	5230	24.9	1469	31.2
Zambia	820	4.6	567	31
Zimbabwe	3619	27.9	828	28.4
Burundi	57	4.1	71	26.2
Ethiopia	1421	9.1	633	24.6
Gambia	62	3.7	46	22.8
Central African Republic	92	8.4	83	20
Chad	117	5.2	69	16.7
Cameroon	1338	4.9	572	15.5
Comoros	64	11.7	20	14.8
Madagascar	1157	24.4	889	14.6
Mali	227	3.7	160	13.2
Nigeria	13,398	9.5	4611	11.7
Cote d'Ivoire	337	4.2	261	11.1
Mauritania	96	5.5	38	10.8
Rwanda	54	1.5	45	10.1
Guinea	94	2.1	99	9.1
Burkina Faso	16	0.3	65	7.6
Niger	19	0.8	26	6.5
Congo, Democratic Republic	404	1.4	350	5.7
Lesotho	Not reported			
Djibouti	Not reported			

Immigrant Health Workers in OECD Countries in the Broader Context of Highly Skilled Migration. *Intl Migration Outlook*. SOPEMI 2007 Edition. <http://www.oecd.org/dataoecd/22/32/41515701.pdf>.

pull HCW to migrate to national urban centres or high-income countries.^{21–25}

During the 1980s, heavily indebted low-income countries were at risk of defaulting on their loans; many feared that this would collapse the global financial system. Wealthy countries sought to promote economic stability via new World Bank and International Monetary Fund loans that required indebted governments to implement Structural Adjustment Programmes (SAP), comprised of micro and macro-economic policies to privatise previously state-run enterprises, reduce government

barriers to trade and investment, and deregulate goods and services.^{26–29}

SAPs required borrowing governments to institute cost-saving measures: they cut public programmes, privatising health, education, water, sanitation and infrastructure enterprises.^{30–31} They cut health budgets and workforce size: many were required to stop recruiting public sector workers to qualify for a loan.³²

Decreased government spending on health services meant salary reductions for health personnel and reduced investment in infrastructure. Medical and nursing school enrolment fell and some public health facilities closed, which further reduced personnel and increased the burden on existing HCW.³³ HCW retention fell as working conditions deteriorated, with unreliable electricity, drugs, equipment and water supply in clinical settings.³⁴ SAP macroeconomic policies exacerbated HCW shortages in Uganda, Sudan, Mozambique, Cameroon and other countries.^{35–39}

Targeted donor initiatives

Donor funding in response to the HIV/AIDS pandemic pulled local HCW to HIV-related work. International non-governmental organisation (INGO) salaries are 5–10 times higher than those in the public sector.^{40–41} Among alumni from Uganda's MUST medical school over the past 15 years, 51% work for an HIV-focused NGO.⁴² This type of internal HCW migration draws trained HCW out of the country's public health system.⁴³

Medical school infrastructure and staffing

Ten SSA countries have no medical school. At the 169 medical schools in SSA, nearly 30% of faculty positions are unfilled. One-third of faculty supplement their income by working in private clinics, which limits their availability to patients and trainees in the public health system. Low salaries, limited career options, heavy teaching workloads, high student-to-teacher ratios and poor conditions contribute to low faculty retention and make it difficult to provide quality medical education and attract a younger cadre into academia.¹⁶ Rather than discouraging medical migration, some medical schools pride themselves on producing HCW who train in the UK or USA, a marker of success for student and teacher.⁴⁴ Furthermore, most medical students are from urban areas and are unlikely to choose work in rural locations.⁴⁵

HCW shortages in wealthy countries

Physicians migrate from RLS to high-income countries to meet a growing demand: industrialised countries confront negative population growth, an increasing elderly population, specialisation of domestic physicians and rural-urban HCW shortages.^{46–47} International medical graduates (IMG) are more likely to practice in community health centres and primary care shortage areas.^{48–49} IMGs represent 23–28% of physicians in the USA, UK, Canada and Australia; 40–75% of IMGs migrate from RLS.^{23–50–53} Some countries regulate HCW immigration, but most do not.^{54–55}

STRATEGIES TO ADDRESS HCW SHORTAGE

The complex problem of HCW shortage, its causes and driving forces, are interrelated and require a multifaceted approach.^{56–57}

Multilateral guidelines for recruitment and task-shifting

In 2006, the WHO, bilateral and multilateral development partners, governments, and private sector and professional

organisations formed the Global Health Workforce Alliance and produced recommendations for addressing HCW shortages by defining task-shifting, appropriate workforce skill mix, accreditation of community and mid-level HCW, and incentives and work environments to increase worker retention.^{58–62} Additional guidelines written by national and international medical organisations,^{63–64} NGOs,^{65–39} individual countries⁶⁶ and others⁶⁷ define codes of conduct on ethical, equitable recruitment and distribution of HCW; human resource planning; salaries, incentives and local capacity building to increase retention; and strengthening of healthcare infrastructure.

Expanding existing medical schools and establishing new ones

Many African countries are investing resources in medical education and most have expanded enrolment.¹⁶ Public–private partnerships founded new private medical schools, such as Kampala International University in Uganda. Ethiopia's Health Worker Extension Program opened five new medical schools and has tripled enrolment at existing medical schools since 2009.^{68–69} Similar strategies could be employed in wealthy countries to reduce the need for HCW from RLS.⁷⁰

Inter-country collaborations and academic medical centres

Inter-country collaborations are an effective way to increase the number of trainees in medicine. Cuba implements a comprehensive strategy to mitigate HCW shortages in RLS. Since the 1960s, through bilateral agreements with many SSA countries, Cuba has established medical schools and Cuban physicians have staffed them until replaced by local faculty.^{71–73} Since 1999, its Latin American Medical School (Escuela Latinoamericana de Medicina, ELAM) has trained more than 10 000 students from Africa, Asia, Latin America and the Caribbean who return to their countries of origin to work in underserved areas, thus increasing supply and improving the distribution of HCW.

Physicians in the USA are advocating for a similar inter-country collaboration, an 'International Health Service Corps' modelled after the Peace Corps, through which US HCW would teach and work collaboratively with HCW in RLS to increase HCW supply, improve infrastructure and decrease migration.^{74–75}

Another US-based collaboration, the 2010 Medical Education Partnership Initiative (MEPI) is a 5-year plan to fund medical and public health schools in 12 African countries who partner with US medical and public health schools, 30 regional partners, the US Department of Health and Human Services, the National Institutes of Health, and the US President's Emergency Plan for AIDS Relief (PEPFAR). MEPI's goal is to train 140 000 HCW, improve primary care capacity and incorporate interventions for HCW retention.^{76–78}

The AIDS International Training and Research Program, funded by the US Fogarty International Center and National Institutes of Health, supports US universities who train researchers from developing countries in HIV and tuberculosis (TB). A study of five of its 15-year-old programmes identified key components of success: strong mentorship, access to journals and professional networking to support researchers conducting locally relevant studies, temporary US study visas and repayment programmes. With this combination of scientific, political and economic strategies, 80% of trainees remained in their native RLS to form a foundation of health research expertise and train the next generation of local researchers.⁷⁹

The European Union's Tempus Programme to modernise higher education in Eastern Europe, Central Asia and the

Mediterranean is a similar inter-country collaboration that may be applicable to SSA medical schools. Through the Tempus Programme, all medical schools in Bosnia and Herzegovina gave enhanced training to academic staff, and successfully improved medical school staff recruitment and retention.^{80–83}

Inter-country collaborations between professional organisations provide opportunities for professional development and specialisation without migrating. Ethiopia collaborates with the University of Toronto to provide subspecialty psychiatry training. Ghana collaborates with the Royal College of Obstetricians and Gynaecologists and the American College of Obstetricians and Gynecologists for obstetric and gynaecological subspecialty training. Both result in national certification and create and/or strengthen a core team in-country to train and increase the number of local HCW with subspecialty expertise.^{84–85}

Task-shifting

Task-shifting is a process by which certain appropriate healthcare responsibilities are delegated to trained, less specialised HCW to make more efficient use of available human resources. In many SSA countries, mid-level practitioners provide care to people with HIV and TB and perform caesarean sections.^{86–90} Task-shifting to lay HCW and non-physicians increases the overall supply, improves distribution of HCW and expands the capacity of healthcare systems.^{91–92}

Cross-university collaboration in Mbarara, Uganda

Like many SSA countries, Uganda has significant HCW shortages (1.5 HCW per 10 000 population) for multiple reasons.^{33–39–42–93–96} To address HCW shortages, MUST has been focusing on medical education, training and faculty development.

MUST redesigned the medical school curriculum with an emphasis on rural health, rural clinical sites and the social determinants of health. MUST built collaborations with the University of Bristol, UK and McMaster University, Canada with faculty exchanges. Ugandan physicians acquired specialty skills in the UK and Canada; all returned to MUST to assume faculty positions.

MUST also created a collaboration with faculty from multiple departments at MGH to promote locally relevant research and strengthen healthcare delivery; build local capacity through distance learning, training and mentorship, and faculty and resident exchanges; train MGH residents in global health and health systems improvement; and develop global health leaders (practitioners and researchers) in Uganda and the USA. To address infrastructure needs, MGH is constructing a public health building and technology innovation laboratory.^{97–100}

CONCLUSION

HCW shortages in SSA contribute to poor child health outcomes and have complex, multifactorial causes. The conceptual framework presented above connects three underlying causes of HCW shortages (insufficient supply, inadequate distribution and migration) to driving forces underpinning those causes, thereby elucidating points of intervention and possible strategies. Redressing HCW shortages in poor countries will require multiple strategies, including international regulation of HCW recruitment, international collaborations, task-shifting and bilateral collaborations between academic medical centres (see figure 1).^{101–104} Much has been written about 'brain drain'. Initiatives like those of MUST and others provide examples of strategies that promote 'brain circulation',^{105–106} learning between committed partners from academic centres in

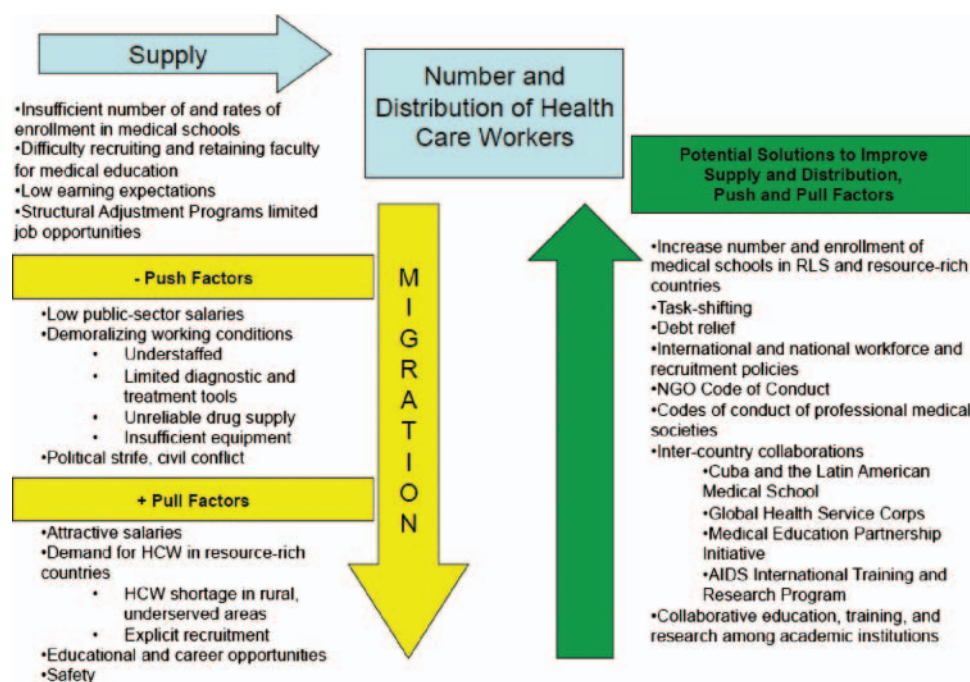


Figure 1 Conceptual framework and driving factors behind healthcare worker shortages in resource-limited settings in sub-Saharan Africa.

resource-poor and rich settings that through solidarity, clinical and research training and mentorship may increase HCW supply, reduce the push/pull forces of migration, and help redress HCW shortages in SSA.

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