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A New Database of Health Professional Emigration from Africa

By Michael A. Clemens and Gunilla Pettersson

Abstract

The migration of doctors and nurses from Africa to rich countries has raised fears of an African medical brain drain. But empirical research on the issue has been hampered by lack of data. How many doctors and nurses have left Africa? Which countries did they leave? Where have they settled? As part of a larger study of the consequences of the international migration of African health professionals, we compiled a database of the cumulative bilateral net flows of African-born physicians and nurses to the nine most important destination countries. It is the first database of net bilateral migration flows specific to a skilled profession collected systematically for a large number of developing countries. In this note we make these data available to the research community.

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A NEW DATABASE OF HEALTH PROFESSIONAL EMIGRATION FROM AFRICA

Michael A. Clemens and Gunilla Pettersson[1]
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Research on health professional migration from developing countries suffers from an acute lack of systematic data on the phenomenon. As part of a larger study of the consequences of the international migration of African health professionals, we compiled a database of the cumulative bilateral net flows of African-born physicians and nurses to the nine most important destination countries. It is the first database of bilateral migration flows specific to a skilled profession collected systematically for a large number of developing countries. In this note we make these data available to the research community.

Policy and academic debate—often impassioned—on health professional migration from developing countries has frequently advanced beyond systematic knowledge of the extent of the phenomenon. In South Africa, epicenter of the HIV catastrophe, the health minister recently claimed that "if there is a single major threat to our overall health effort, it is the continued outward migration of key health professionals, particularly nurses."[2] After the UK National Health Service ended its active recruitment of staff from Sub-Saharan Africa in 2001, the British Medical Association (BMA) and the Royal College of Nursing praised this "strong moral lead," adding that "[i]t is now essential that other developed countries … make a similar commitment

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[2] Dr. Manto Tshabalala-Msimang, quoted in "We must end doctor brain drain", *The Citizen* (South Africa), August 20, 2002.

to address the issue."[3] BMA Chairman of Council James Johnson flatly declared that "the rape of the poorest countries must stop."[4] In academic circles, Harvard's Sabina Alkire and Lincoln Chen urge that rich countries' migration policy "should adopt 'medical exceptionalism' based on moral and ethical grounds."[5] Devesh Kapur and John McHale caution against "poaching" health workers from developing countries and claim that the case is "obvious" for "restraint" in the recruitment of doctors and nurses.[6] Philip Martin, Manolo Abella, and Christiane Kuptsch assert that South Africa is "suffering" from a "brain drain" of doctors and nurses and decries a fiscal impact over $1 billion.[7]

Some of the above statements were carefully researched using available information. But none of them could be based on clear measures of the extent of health professional migration because systematic data on international flows of African health workers have not heretofore existed. Incompletely-tested hypotheses and untested hypotheses abound.

What is an African doctor?

There is no single statistic that captures the extent of "African health worker emigration". One can interpret each component of the phrase in multiple ways. Is an "African" someone resident in Africa, someone born in Africa, someone whose ancestors for several generations were born in Africa, someone trained in Africa, or someone who holds African citizenship? Does "Africa" include North Africa and all of South Africa? Is a "health worker" someone who was trained as such or someone who currently works in the health sector? How long must one stay outside the country for that movement to be "emigration"?

[3] Joint British Medical Association/Royal College of Nursing letter to Rt Hon Gordon Brown, 15 June 2005. http://www.bma.org.uk/ap.nsf/Content/SkillsDrainBrown, accessed August 9, 2005.
[4] James Johnson (2005), speech to Annual Representative Meeting, June 27, http://www.bma.org.uk/ap.nsf/Content/ARM05ChCo, accessed August 11, 2006.
[5] Alkire, Sabina, Lincoln Chen (2004) "'Medical exceptionalism' in international migration: should doctors and nurses be treated differently?" Draft paper prepared for the workshop "Global Migration Regimes", Institute of Future Studies, Stockholm, 9 June 2004.
[6] Devesh Kapur and John McHale (2005), *Give Us Your Best and Brightest: The global hunt for talent and its impact on the developing world* (Washington, DC: Center for Global Development), p. 180.
[7] Philip Martin, Manolo Abella, and Christiane Kuptsch (2006), *Managing Labor Migration in the Twenty-First Century* (New Haven: Yale University Press), pp. 45, 71.

This database takes one of many possible valid stances on these questions. Here, we classify "Africans" by country of birth; we include the entire African continent; we count as doctors and nurses only those currently employed as doctors and nurses; and we call "emigrants" those who were residing in the receiving countries on a sufficiently permanent basis circa 2000 to be included in that country's most recent census.

These choices make this database more useful for some questions than for others. Take the example of a physician born in Zimbabwe and trained in South Africa who lives in Canada and works in a management position in the pharmaceutical industry. Researchers interested in the incentives faced by young educated people in Zimbabwe might be more interested in her country of birth, while those interested in the fiscal impact of emigration on South Africa might be more interested in her country of training. Those interested in the relationship between migration and Black Economic Empowerment might be more interested in her ethnicity than her country of birth. Those interested in the specifically medical dimension of professional emigration might be interested to know that she was trained as a clinician despite the fact that she does not now work as such.

The data are useful despite these limitations. For researchers requiring information about country of training, the World Health Organization (WHO) has published limited data for about a third of the countries in Africa on how many doctors and nurses *trained* in each sending country reside and work abroad.[8] Both the WHO database and ours share the limitation that they are based on census data and thus record each individual's occupation as the job that the person performs currently. An African trained as a nurse who now works abroad outside the health sector is therefore not counted. But to the extent that the tendency for emigrant health professionals to leave the health sector does not differ markedly by country of origin, even numbers that do not account for this phenomenon still give a good indicator of *relative* emigration across sending countries. In other words, a certain number of emigrated Senegalese nurses are not counted because they no longer work as nurses, but there is no reason to believe this tendency is stronger (nor thus that undercounting is greater) for Senegalese nurses than for Malawian nurses. An additional reason the data are informative despite the absence of those who leave the health

[8] World Health Organization (2006), *World Health Report 2006* (Geneva: WHO), Tables 5.2 and 5.3, p. 100.

profession in the destination countries is that some research questions will focus primarily on those who remain in the health field. A key question for policy research is whether or not rich countries are luring specifically health workers from poor countries to fill rich-country positions, and the incentive systems they create to do so only function to the extent that the immigrants remain in health care.

The case of Mozambique aptly illustrates the sensitivity of data like these to different assumptions. The Mozambique Medical Association estimates that only around 5% of Mozambican physicians work abroad. Destination-country census data show that about 75% of people born in Mozambique who now work as physicians do not live in Mozambique. The main cause of this disparity is the fact that many of those physicians are of European ancestry and departed in the mass exodus of Portuguese colonists around independence in 1975. But it is not at all obvious that counting whites results in a poor measure of human capital loss. In South Africa white health professionals today play an important role in educating a new generation of black health professionals. It is true that Mozambican-born physicians in the white colonist class were providing most of their health care to urban elites in the colonial era rather than to rural blacks, but the same could be said of many black physicians in today's independent African states. We take country of birth as a useful measure of "African-ness" though we recognize it is not germane to all research questions.

Nine destination countries proxy for the world

We also assume that we have a good estimate of how many African health professionals live outside each sending country simply by counting how many live in the nine most important destination countries. Those countries are the United Kingdom, United States, France, Australia, Canada, Portugal, Belgium, Spain, and South Africa. In choosing this list we sought a balance between coverage and the time and expense of additional data collection.

The primary reason that we take these countries as sufficient for most purposes to capture health professional emigration from Africa is that the first eight receiving countries alone account for

94.2% of all African-born, university-educated people residing in *any* OECD country in 2000.[9] Our experience comparing the migration patterns of African health professionals to those of other types of well-educated migrants suggests that the proportion of total African health professional emigrants is similar to this value. We add a ninth country, South Africa, because we take it to be the most important non-OECD receiving country for African health professionals. Previous datasets that have focused on a single receiving country[10] do not give a full picture of emigration rates by sending country since bilateral flows vary enormously across sending countries.

It is of course possible that another non-OECD country, such as Saudi Arabia, is important for some countries, or that health professionals differ greatly in their migration patterns from other skilled professionals. But survey data from African health professionals considering emigration suggest that neither of these is the case. Between 2001 and 2002, the World Health Organization interviewed 2,382 doctors, nurses, and other health professionals in six African countries.[11] Each person declaring an intention to emigrate was asked his or her favored destination. The fraction of these in each country who gave one of our nine destination countries was 89.3% in Cameroon, 91.8% in Senegal, and 94.6% in South Africa. A small percentage of respondents in Zimbabwe mentioned Botswana and New Zealand as destinations but the vast majority mentioned one of our nine receiving countries. Respondents from Ghana and Uganda did not mention any countries outside Africa besides the US and UK, and these two destinations plus South Africa accounted for the vast majority of favored destinations in both cases.

Oosthuizen[12] surveyed in 2002 the favored destination countries of a sample of Registered Nurses in South Africa who had just finished their training if they were to work outside South Africa. Of these, 24% mentioned countries outside Africa not included in the nine considered

[9] Calculated using the census data from Jean-Christophe Dumont and Georges Lemaître (2005), "Counting immigrants and expatriates in OECD countries: A new perspective," Directorate for Employment Labour and Social Affairs (Paris: OECD).
[10] Such as Amy Hagopian et al. (2004), "The migration of physicians from sub-Saharan Africa to the United States of America: Measures of the African brain drain", *Human Resources for Health* 2: 17.
[11] M. Awases, A. Gbary, J. Nyoni, and R. Chatora (2004), *Migration of Health Professionals in Six Countries: A Synthesis Report* (Brazzaville, Rep. of Congo: World Health Organization Regional Office for Africa), Section 4.9, p. 38.
[12] Martha Johanna Oosthuizen (2005), *An analysis of the factors contributing to the emigration of South Africa nurses*, PhD dissertation, Department of Health Studies (Pretoria: University of South Africa), p. 177.

here: Ireland (2%), New Zealand (4%), and Saudi Arabia (18%). An additional 11% mentioned unspecified “other countries in Europe and Africa”, a subset of which may be included in the nine countries considered here. These results are somewhat difficult to interpret since, of the 105 people who answered the survey, only 85 stated that they would ever consider working outside the country while 91 gave a favored destination if they were to work outside the country. The 105 respondents were self-selected from a pool of 500 inititally contacted, so nonresponse bias in these numbers is a real possibility. Note also that direct recruitment of nurses by Saudi Arabia in South Africa is a very recent phenomenon, meaning that the proportion of emigrating South African Registered Nurses who went to Saudi Arabia before the year 2000 is certainly much lower than 18%.

Both in the surveys of Awases et al. and of Oosthuizen a small fraction of emigrating African health professionals reveal the intent to work in another African country, a flow which is not captured by the data presented here and which represents a small discrepancy between these numbers and true emigration to all other countries. It is smaller still when one considers reciprocal flows: A small number of emigrating Nigerian physicians go to work in Ghana, but a small number of emigrating Ghanaian physicians go to work in Nigeria. Counting each as an additional loss would ignore the fact that for intra-Africa movements, one country's loss is another's gain. And this discrepancy, to the extent that it is small and largely independent of country characteristics, contributes primarily white noise to the data here rather than any bias that would affect the analysis. In sum, the true number of health professionals working abroad may exceed the number working in the nine destination countries focused on here by an amount on the order of 5-10%. There is little reason to think that this discrepancy is systematic across countries, so the indicator remains a good estimate of the relative degree of health professional emigration across countries.

The data

In late 2005 we contacted the census bureaus of the nine most important destination countries for African health professional emigrants to obtain estimates of the number of African-born doctors and nurses living in each destination country at the time of the most recent census.

Table 1 presents these numbers for physicians, and Table 2 presents the numbers for professional nurses. Combined with statistics for the number of physicians and professional nurses who live and work in each African country, this allows us to estimate—in the final column of each table—the fraction of total doctors and nurses born in each African country who live abroad. Figure 1 presents this fraction graphically for physicians from all African countries, and Figure 2 does the same for nurses.

Figure 1 suggests a relationship between the loss of professionals and economic and political stability. Angola, Congo-Brazzaville, Guinea-Bissau, Liberia, Mozambique, Rwanda, and Sierra Leone all experienced civil war in the 1990s and all had lost more than 40% of their physicians by 2000. Kenya, Tanzania, and Zimbabwe all experienced decades of economic stagnation in the late 20th century and by its end, each had lost more than half of its physicians.[13] Countries with greater stability and prosperity—Botswana, South Africa, and pre-collapse Côte d'Ivoire—managed to keep their doctors. It further appears that physicians may not leave countries too destitute to educate large numbers of doctors with the human and financial capital necessary to emigrate—such as Congo-Kinshasa, Niger, and pre-pipeline Chad. All three of these are among the poorest countries on earth, are not the site of any of Africa's strongest medical schools, and have very low physician emigration rates. Large countries (Nigeria, South Africa) appear better at generating domestic opportunities for health professionals. Doctors from Francophone African countries may face language barriers or other impediments in the destination countries with the most opportunities for foreign doctors. These are simple correlations; establishing causal relationships awaits more systematic analysis of these numbers.

Discussion

Researchers performing quantitative analysis of the effects of international trade on development can purchase detailed bilateral trade statistics from the International Monetary Fund, disaggregated by product and service with great detail. Those studying international investment

[13] Real income per capita growth between 1975 and 2000 averaged just 0.3% per year in Kenya, –0.5% in Tanzania, and –0.3% in Zimbabwe. Source: Angus Maddison (2003), *The World Economy: Historical Statistics* (Paris: OECD).

flows have ready access to bilateral data from the World Bank and the United Nations disaggregated by financial instrument. But there exists no comprehensive and systematic bilateral database of the international flows of human beings for all countries, much less one that provides details about the migrants such as their occupation. All rich countries collect occupation-specific data on people who arrive in the country but most do not do so for people who depart the country, making high-frequency occupation-specific data on bilateral gross migration flows impossible to compile.

Until such a database exists, quantitative study of this crucial aspect of globalization will be impeded. Researchers will face the labor-intensive task of compiling data anew for each investigation. We are currently using the numbers reported here to perform the first systematic quantitative analysis of the effects of health professional emigration on Africa,[14] the first systematic calculation of return-migration rates for African professionals, and the first systematic calculation of the net fiscal impact of African health professional emigration. These are the first papers in a large-scale research initiative on the effects of rich-country immigration policy on poor countries.

[14] E.g. Michael A. Clemens (2006), "Do visas kill? The effects of African health professional emigration", forthcoming Working Paper (Washington, DC: Center for Global Development).

Figure 1: Fraction of African-born physicians residing and working abroad in 2000

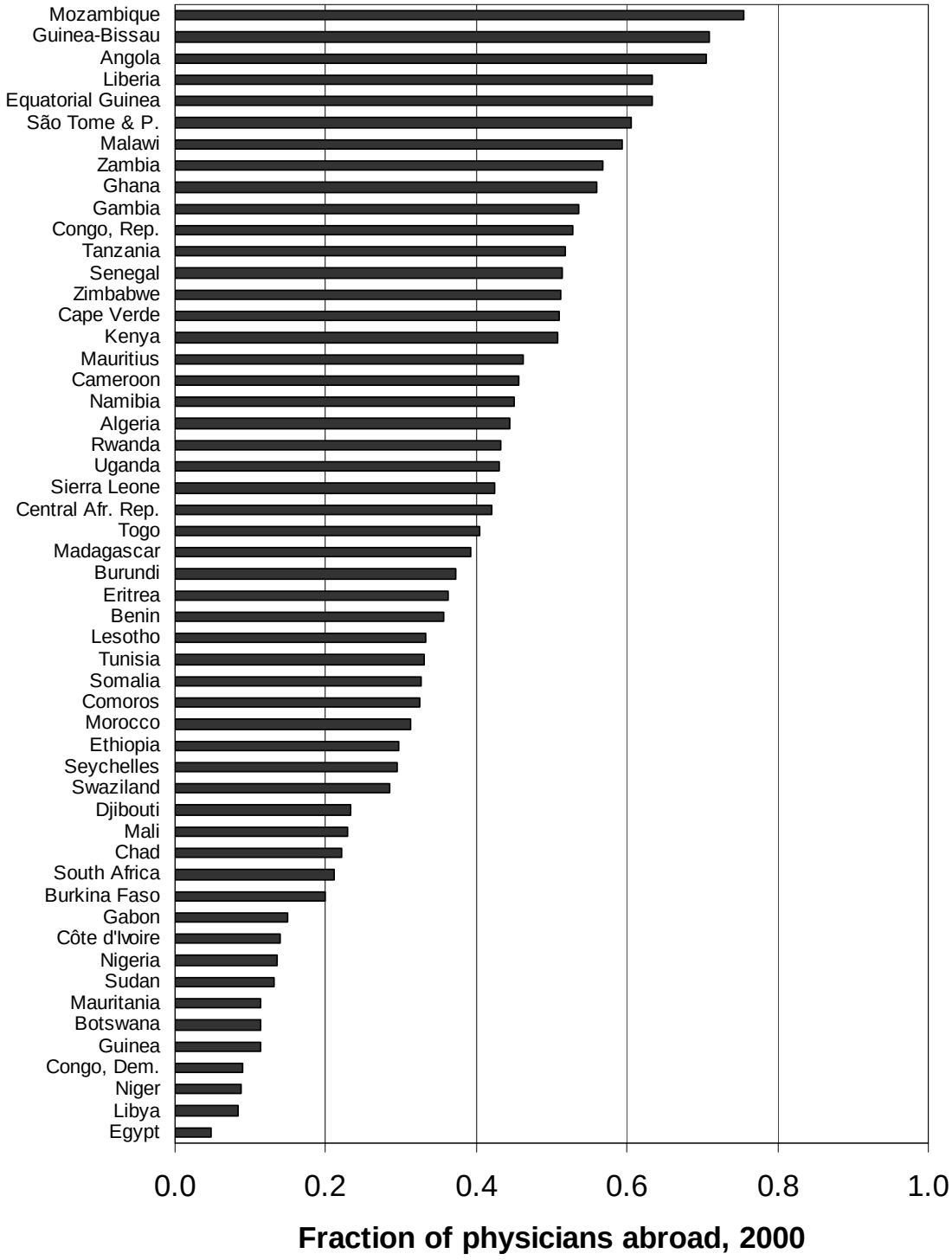

Figure 2: Fraction of African-born professional nurses residing and working abroad in 2000

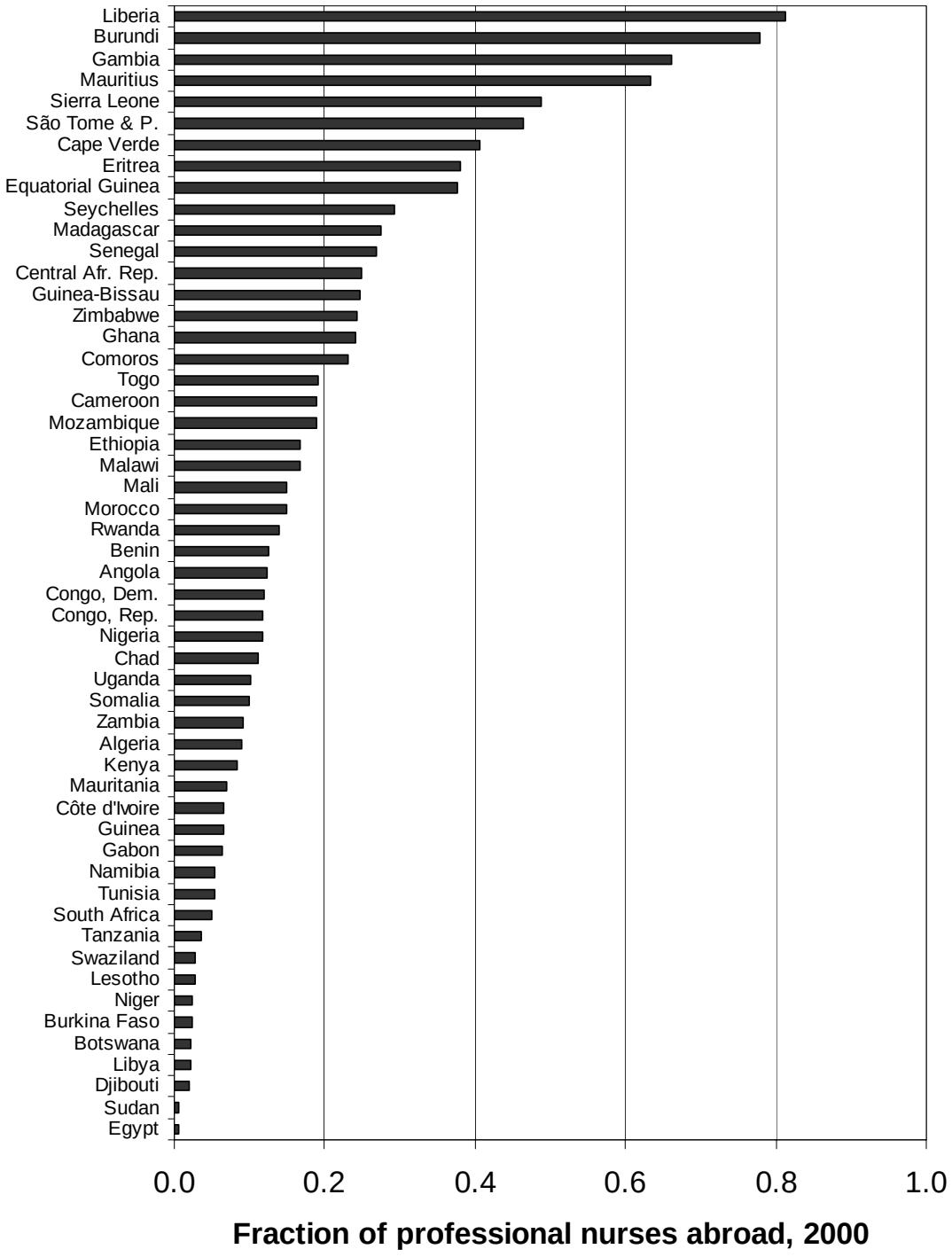

Table 1. Physicians born in Africa appearing in census of nine receiving countries circa 2000

Sending country	*Domestic*	*Receiving country* GBR	USA	FRA	CAN	AUS	PRT	ESP	BEL	ZAF	*Total abroad*	*Frac.**
Algeria	*13,639*	45	50	10,594	10	0	2	60	99	0	*10,860*	*44%*
Angola	*881*	16	0	5	25	0	2,006	14	5	31	*2,102*	*70%*
Benin	*405*	0	4	206	0	0	0	1	13	0	*224*	*36%*
Botswana	*530*	28	10	0	0	3	0	0	1	26	*68*	*11%*
Burkina Faso	*314*	0	0	77	0	0	0	0	1	0	*78*	*20%*
Burundi	*230*	5	0	53	10	3	0	1	55	9	*136*	*37%*
Cameroon	*1,007*	49	170	332	20	0	0	4	267	3	*845*	*46%*
Cape Verde	*202*	0	15	10	0	0	186	0	0	0	*211*	*51%*
Cent. Afr. Rep.	*120*	0	0	79	0	0	2	1	5	0	*87*	*42%*
Chad	*248*	0	0	69	0	0	0	0	1	0	*70*	*22%*
Comoros	*50*	0	0	20	0	0	0	0	1	3	*24*	*32%*
Congo, DR	*5,647*	37	90	139	35	0	42	4	107	98	*552*	*9%*
Congo, Rep.	*670*	11	15	468	0	0	49	4	65	135	*747*	*53%*
Cote d'Ivoire	*1,763*	0	10	262	0	0	0	1	8	3	*284*	*14%*
Djibouti	*86*	0	0	25	0	0	0	0	1	0	*26*	*23%*
Egypt	*143,555*	1,465	3,830	471	750	535	1	17	31	19	*7,119*	*5%*
Eq. Guinea	*47*	0	0	4	0	0	1	76	0	0	*81*	*63%*
Eritrea	*173*	18	55	0	20	5	0	0	0	0	*98*	*36%*
Ethiopia	*1,310*	65	420	16	30	9	1	1	2	9	*553*	*30%*
Gabon	*368*	0	0	61	0	0	0	0	4	0	*65*	*15%*
Gambia	*40*	16	30	0	0	0	0	0	0	0	*46*	*53%*
Ghana	*1,294*	590	850	16	95	0	0	4	2	82	*1,639*	*56%*
Guinea	*898*	3	15	69	10	0	0	11	7	0	*115*	*11%*
Guinea-Bissau	*103*	0	15	75	0	0	160	0	1	0	*251*	*71%*
Kenya	*3,855*	2,733	865	0	180	110	1	4	1	81	*3,975*	*51%*
Lesotho	*114*	8	0	0	0	0	0	0	0	49	*57*	*33%*
Liberia	*73*	10	105	5	0	0	0	5	1	0	*126*	*63%*
Libya	*6,371*	349	120	20	75	5	0	9	7	0	*585*	*8%*
Madagascar	*1,428*	6	30	878	0	0	0	0	6	0	*920*	*39%*
Malawi	*200*	191	40	0	0	10	2	1	1	48	*293*	*59%*
Mali	*529*	0	15	138	0	0	0	0	4	0	*157*	*23%*
Mauritania	*333*	0	10	28	0	0	0	4	1	0	*43*	*11%*
Mauritius	*960*	294	35	307	110	36	1	0	20	19	*822*	*46%*
Morocco	*14,293*	33	225	5,113	70	4	9	833	213	6	*6,506*	*31%*
Mozambique	*435*	16	20	0	10	3	1,218	4	2	61	*1,334*	*75%*
Namibia	*466*	37	15	0	30	9	0	0	0	291	*382*	*45%*
Niger	*386*	0	10	23	0	0	0	1	3	0	*37*	*9%*
Nigeria	*30,885*	1,997	2,510	29	120	0	1	13	6	180	*4,856*	*14%*
Rwanda	*155*	4	25	8	0	0	1	0	70	10	*118*	*43%*
Sao Tome & P.	*63*	0	0	0	0	0	96	1	0	0	*97*	*61%*
Senegal	*640*	0	40	603	10	0	1	9	12	3	*678*	*51%*
Seychelles	*120*	29	0	4	10	3	0	0	0	4	*50*	*29%*
Sierra Leone	*338*	118	115	9	0	0	0	0	3	4	*249*	*42%*
Somalia	*310*	53	70	0	25	3	0	0	0	0	*151*	*33%*
South Africa	*27,551*	3,509	1,950	16	1,545	1,111	61	5	0	–834†	*7,363*	*21%*
Sudan	*4,973*	606	65	17	15	40	0	1	4	10	*758*	*13%*
Swaziland	*133*	4	4	0	0	0	1	0	0	44	*53*	*28%*
Tanzania	*1,264*	743	270	4	240	54	1	1	3	40	*1,356*	*52%*
Togo	*265*	0	10	168	0	0	0	0	2	0	*180*	*40%*
Tunisia	*6,459*	16	30	3,072	10	0	0	4	60	0	*3,192*	*33%*
Uganda	*2,429*	1,136	290	1	165	61	1	1	3	179	*1,837*	*43%*
Zambia	*670*	465	130	0	40	39	3	0	3	203	*883*	*57%*
Zimbabwe	*1,530*	553	235	0	55	97	12	1	6	643	*1,602*	*51%*
Africa	*280,808*	15,258	12,813	23,494	3,715	2,140	3,859	1,096	1,107	1,459	*64,941*	*19%*
Sub-Saharan	*96,405*	13,350	8,558	4,199	2,800	1,596	3,847	173	696	1,434	*36,653*	*28%*

Sources: See Appendix. African sending countries show country of birth as recorded in the receiving-country census. Receiving countries show country of residence at the time of the last census (France [FRA] 1999; United States [USA] 2000; Australia [AUS], Belgium [BEL], Canada [CAN], Portugal [PRT], South Africa [ZAF], Spain [ESP], and United Kingdom [GBR] 2001). The copyright to some of the data in this table is retained by the source agency; see appendix for details before reproducing these data elsewhere. All data used here with written permission. *Gives the number of professionals abroad as a fraction of total professionals (domestic + abroad). † There are 834 physicians born in one of the other eight receiving countries who appear in the 2001 census of South Africa. This negative number thus represents a "netting out" term.

The full contents of this table are available in an Excel workbook here: http://www.cgdev.org/doc/Data/Africa_health_emigration.xls

Table 2. Professional nurses born in Africa appearing in census of nine receiving countries circa 2000

Sending country	*Domestic*	*Receiving country* GBR	USA	FRA	CAN	AUS	PRT	ESP	BEL	ZAF	*Total abroad*	*Frac.**
Algeria	83,022	37	138	7,953	40	6	1	26	44	0	8,245	9%
Angola	13,135	22	135	12	10	4	1,639	8	11	0	1,841	12%
Benin	1,315	4	28	155	0	0	0	0	0	0	187	12%
Botswana	3,556	47	28	0	0	0	0	0	0	5	80	2%
Burkina Faso	3,097	0	14	50	0	0	0	1	11	0	76	2%
Burundi	38	10	14	1	25	0	0	0	83	0	134	78%
Cameroon	4,998	118	664	343	0	0	0	5	33	0	1,163	19%
Cape Verde	355	0	91	25	0	0	128	0	0	0	244	41%
Cent. Afr. Rep.	300	3	6	85	0	0	0	0	6	0	99	25%
Chad	1,054	0	21	110	0	0	0	0	0	0	131	11%
Comoros	231	0	6	64	0	0	0	0	0	0	70	23%
Congo, DR	16,969	44	207	206	50	0	9	4	1,761	7	2,288	12%
Congo, Rep.	4,933	28	114	369	0	0	14	4	122	9	660	12%
Cote d'Ivoire	7,233	0	185	302	0	0	0	0	22	0	509	7%
Djibouti	424	0	0	9	0	0	0	0	0	0	9	2%
Egypt	187,017	108	661	89	45	87	0	2	0	0	992	1%
Eq. Guinea	162	0	0	0	0	0	0	98	0	0	98	38%
Eritrea	811	27	384	0	75	11	0	0	0	0	497	38%
Ethiopia	5,342	61	888	16	75	37	0	0	0	0	1,077	17%
Gabon	1,554	0	14	93	0	0	0	0	0	0	107	6%
Gambia	144	57	221	4	0	0	0	0	0	0	282	66%
Ghana	14,972	2,381	2,101	1	275	0	0	2	0	6	4,766	24%
Guinea	3,847	0	171	53	10	0	0	27	6	0	267	6%
Guinea-Bissau	799	5	0	45	0	0	212	0	0	0	262	25%
Kenya	26,267	1,336	765	4	135	110	0	0	0	22	2,372	8%
Lesotho	1,266	5	6	0	0	0	0	0	0	25	36	3%
Liberia	185	28	773	5	0	0	0	1	0	0	807	81%
Libya	17,779	72	299	1	10	7	0	2	0	0	391	2%
Madagascar	3,088	4	43	1,096	10	0	1	1	17	0	1,171	28%
Malawi	1,871	171	171	0	10	14	0	0	0	11	377	17%
Mali	1,501	0	57	208	0	0	0	0	0	0	265	15%
Mauritania	1,580	0	21	94	0	0	0	2	0	0	117	7%
Mauritius	2,629	4,042	107	86	75	195	1	0	22	3	4,531	63%
Morocco	29,462	47	276	3,707	60	4	5	560	517	0	5,176	15%
Mozambique	3,664	12	64	0	10	0	748	2	6	11	853	19%
Namibia	2,654	18	6	0	0	4	1	0	6	118	152	5%
Niger	2,668	0	28	38	0	0	0	0	0	0	66	2%
Nigeria	94,747	3,415	8,954	24	160	0	0	8	6	12	12,579	12%
Rwanda	1,805	13	85	24	20	3	1	1	144	0	292	14%
Sao Tome & P.	172	0	0	8	0	0	141	0	0	0	149	46%
Senegal	1,887	3	102	584	0	0	0	0	6	0	695	27%
Seychelles	422	80	28	8	30	29	0	0	0	0	175	29%
Sierra Leone	1,524	747	696	4	10	0	0	0	0	0	1,457	49%
Somalia	1,486	76	47	8	30	3	0	0	0	0	164	10%
South Africa	90,986	2,884	877	20	275	955	58	3	33	–261†	4,844	5%
Sudan	26,730	42	85	12	20	7	0	0	0	0	166	1%
Swaziland	3,345	21	36	0	10	4	0	0	0	25	96	3%
Tanzania	26,023	446	228	0	240	32	2	1	0	4	953	4%
Togo	782	10	36	140	0	0	0	0	0	0	186	19%
Tunisia	26,389	11	64	1,365	20	0	0	1	17	0	1,478	5%
Uganda	9,851	714	291	0	75	29	0	1	0	12	1,122	10%
Zambia	10,987	664	299	0	25	68	2	0	0	52	1,110	9%
Zimbabwe	11,640	2,834	440	0	35	219	14	3	0	178	3,723	24%
Africa	758,698	20,647	20,983	17,421	1,865	1,828	2,977	763	2,872	239	69,589	8%
Sub-Saharan	414,605	20,372	19,545	4,297	1,690	1,724	2,971	172	2,294	239	53,298	11%

Sources: See Appendix. African sending countries show country of birth as recorded in the receiving-country census. Receiving countries show country of residence at the time of the last census (France [FRA] 1999; United States [USA] 2000; Australia [AUS], Belgium [BEL], Canada [CAN], Portugal [PRT], South Africa [ZAF], Spain [ESP], and United Kingdom [GBR] 2001). The copyright to some of the data in this table is retained by the source agency; see appendix for details before reproducing these data elsewhere. All data used here with written permission. *Gives the number of professionals abroad as a fraction of total professionals (domestic + abroad). † There are 261 professional nurses born in one of the other eight receiving countries who appear in the 2001 census of South Africa. This negative number thus represents a "netting out" term.

The full contents of this table are available in an Excel workbook here: http://www.cgdev.org/doc/Data/Africa_health_emigration.xls

Appendix: Data sources and copyright information

Most publicly released custom tabulations from census data either contain small random perturbations or are scaled up from a random sample of the full census database using sampling weights, both of which seek to protect the privacy of individual census respondents. While the size of these alterations makes them immaterial to the analysis in this paper, it should be borne in mind that 1) the numbers in Tables 1 and 2 are not an exact representation of the full census results and 2) a separately-prepared custom extract of precisely the same variables from the same census may yield slightly different numbers.

Australia: Physician and professional nurse stocks are from Australian Bureau of Statistics "data available upon request", 2001 Census of Population and Housing (received October 31, 2005). Copyright in ABS data vests with the Commonwealth of Australia. Used with permission. "Physicians" are ASCO (Australian Standard Classification of Occupations) code 231 and "professional nurses" are ASCO 232.

Belgium: Physician stocks from the Cadastre des Professionels de Santé, Service Publique Fédéral de Santé Publique, Sécurité de la Chaîne Alimentaire et Environnement: Administration de l'Expertise Médicale MEDEX (received December 14, 2005). Professional nurse stocks from Enquête Socio-Économique 2001, Service Publique Fédéral d'Économie, PME, Classes Moyennes et Énergie: Direction Générale de la Statistique et de l'Information Économique (received May 5, 2006).

Canada: Statistics Canada table "Labour Force 15 Years and Over by Occupation (2001 National Occupational Classification for Statistics) (3) and Place of Birth of Respondent (57)", adapted from Statistics Canada, 2001 Census, Custom Table CO-0878 (received November 16, 2005), copyright permission 2005309. Copyright retained by Statistics Canada. "Physicians" are NOCS (National Occupational Classification for Statistics) codes D011 and D012, and "professional nurses" are NOCS code D1.

France: Physician and professional nurse stocks are from a custom tabulation prepared from the 1999 Recensement de la Population Française by the Institut National de la Statistique et des Études Économiques (received November 3, 2005). "Physicians" are PCS 2003 (Professions et Catégories Socioprofessionelles) codes 3111, 3112, 3431, 3432, and 3434. "Professional nurses" are PCS 2003 codes 4311, 4312, 4313, 4314, 4315, and 4316.

Portugal: Physician and professional nurse stocks are from Instituto Nacional de Estatística–Portugal, Recenseamento Geral da População 2001, custom tabulation 15384 (received November 7, 2005).

South Africa: Physician and professional nurse stocks are from Statistics South Africa, custom extract from the full 2001 census database (received November 11, 2005). "Physicians" are South African Standard Classification of Occupations (SASCO) code 222 and "professional nurses" are SASCO code 223. The *Report of the Census Sub-Committee to the South African Statistics Council on Census 2001* suggests several deficiencies of the 2001 census data but none of these are likely to substantially affect the estimates of physicians and professional nurses in the population.

Spain: Custom tabulation from Instituto Nacional de Estadística de España, Censo de Población y Viviendas 2001, Resultados Detallados Definitivos (updated February 17, 2004), http://www.ine.es/inebase. "Physicians" are Clasificación Nacional de Ocupaciones 1994 (CNO94) code 212 and "professional nurses" are CNO94 code 272.

United States: Physician stocks are from US Census Bureau, Census 2000 Special Tabulation, STP 266 (received November 10, 2005). "Physicians" are those classified by the census as "medical doctors", i.e. Census Occupation Code (*qocc*) 304, 306-310, 312, and 325. Professional nurse stocks for the 19 sending countries with the largest stocks were "registered nurses" (PUMS occupation code 313, SOC code 29-1111) taken from U.S. Dept. of Commerce, Bureau of the Census, Census of Population and Housing, 2000 (United States): *Public-Use Microdata Sample: 5-percent sample* (computer file), ICPSR release, Washington, DC: U.S. Dept. of Commerce, Bureau of the Census [producer], 2003, Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2003. For sending countries with stocks too small to be captured in the 5% PUMS file, professional nurses listed in the PUMS file as being born in "other Africa" were allotted to each sending country proportionately to that country's representation among "other health professionals" (*qocc* 300, 303, 311, 313-324, 326-and 354) in Special Tabulation 266.

United Kingdom: Physician and professional nurse stocks are from 2001 UK Census Commissioned Table CO435 (received October 28, 2005). Crown copyright 2005. Crown copyright material is reproduced with the permission of the Controller of HMSO, license number C02W0007736. "Physicians" are International Standard Classification of Occupations 1988 (ISCO88) code 222, and "professional nurses" are ISCO88 codes 223 and 323.

Domestic health worker stocks: Taken from Africa Working Group, Joint Learning Initiative (2004), *The Health Workforce in Africa: Challenges and Prospects*, WHO, World Bank, Rockefeller Foundation, and Global Health Trust, Table 3, page 89. (Data for table in source were taken from from World Health Organization Africa Regional Office database – May/June 2004.) The dates of the stock measurements are as follows: 1995 for Central African Republic, Rep. of Congo, Guinea, Kenya, Lesotho, Mauritius, Senegal, Tanzania, and Zambia; 1996 for Cameroon, São Tomé and Príncipe, Sierra Leone, and Swaziland; 1997 for Angola, Comoros, Gabon, Gambia, Liberia, Libya, Namibia, Somalia, and Tunisia; 1999 for Botswana, Djibouti, Ghana, Malawi, and South Africa; 2000 for Chad, Egypt, Eritrea, Ethiopia, Mali, Mozambique, and Sudan; 2001 for Benin, Burkina Faso, Equatorial Guinea, Madagascar, Morocco, and Togo; 2002 for Algeria, Côte d'Ivoire, Mauritania, Niger, Rwanda, and Uganda; 2003 for Burundi, Cape Verde, Dem. Rep. of Congo, Guinea-Bissau, Seychelles, and Zimbabwe. The following error in the original data was corrected: For Botswana, original says 53 physicians in 1999, corrected to 530 based on WHO Global Atlas of Infectious Disease estimate of 488 in 1999. The following countries with missing data in the original source were taken from the WHO Global Atlas of Infectious Disease, http://www.who.int/GlobalAtlas, accessed July 19, 2005: Physicians: Djibouti, Egypt, Libya, Morocco, Somalia, Sudan, and Tunisia. Nurses: Algeria, Djibouti, Egypt, Libya, Morocco, Somalia, Sudan, Swaziland, and Tunisia. The nurse stock for Nigeria in the original source was atypically outdated (1992), so a more recent figure (1996) was obtained from Federal Republic of Nigeria, *Social Statistics in Nigeria 1995-1996*, Federal Office of Statistics, Abuja: Table 4.1, "Health Manpower in Nigeria 1993-1996".