

The costs of eliminating critical shortages in human resources for health.

*Paul Verboom, Tessa Tan-Torres Edejer, David Evans
Health Systems Financing, World Health Organization*

Introduction

The World Health Organization (WHO) has calculated in the 2006 World Health Report (WHR) the minimum number of Health Workers (HW) required for supplying sufficient health care to the population in developing countries. (more explanation on this . What is this minimum, and what is the necessary health care). Health workers are defined as medical doctors (MD), nurses and midwives (MW). WHO has calculated this minimum number of HW as 2.28 per 1,000 of population. In this paper, we will describe how we calculated the costs that are necessary for bridging the gap that exists between the current availability of HW and the required HW in the year 2015. It will take into account the costs for educating these health workers and the salaries to pay for them.

Methodology

Quantity and Kind categories of Health Workers Needed

The starting point for the calculation was the assessment of the current situation of countries. The 57 countries which currently have a gap between the existing number of HW per 1,000 population and the necessary 2.28 per 1,000 are identified in the WHR 2006. It is assumed that the other countries which currently don't have a gap will be able to maintain the minimum ratio of HW to population through the years. Another assumption is that the minimum ratio will not change through the years, even with changes in technology or services.

For calculating the shortage in 2015 we need the expected population in 2015 for these 57 countries. We acquired these estimates from the database of the U.S. Census Bureau. (accessed 2006-02-17, <http://www.census.gov/ipc/www/idbsprd.html>). These countries with their respective current shortage and the expected shortage or HW gap in 2015 can be found in table 1.

Note that this shortage is a shortage in HW and does not yet differentiate between the various categories of HW (MD, nurses, MW). As there is still no convincing evidence on the most efficient ratios of MD: nurse: MW (cite ref in WHR), the existing regional distribution of HWs in countries that had the minimum number of HW per 1,000 population was taken as default target. The regional default target of HW ratios was then applied to the HW gap of the countries in that region. The regional default targets of HW ratios can be seen in table 2. The table shows a relatively low percentage of midwives in all regions, especially in the EMRO, AMRO and ARFO region. This is probably due to the fact that most countries don't differentiate between a nurse and a midwife.

Education

The calculated gap in HW for individual countries have to be filled to be able to provide health care for their populations. This gap can be filled in two ways. First, by hiring HW from other countries and second, by producing (educating) new HWs in the country itself. However, adjustments have to be made to account for the attrition of students during the course of their studies.. For our study we used an average yearly attrition rate of 12.5% of students during their training to become a health worker. The number of years of training were 6 and 3 for physicians and nurses / midwives respectively. Training was staggered evenly through the 10 years so that the gap could be filled without unnecessarily stretching training facilities. The number of the different kinds of students by categories of HW can be found in table 2. These numbers of students will generate enough graduated HW to close the gap in HW for individual countries by 2015.

Costs

To calculate the costs for closing the gap it is necessary to calculate the costs for the education and the costs for paying the salaries for the necessary HW. A search for literature on costs of education of HW was done and from the figures obtained, the median cost in the range was taken for MDs and for nurses (it was assumed that the cost of training a midwife was the same as the cost of training a nurse). To extrapolate this cost to the other countries, the average estimate was expressed as a % of GDP.

On average, the education of a MD and a nurse/midwife was 36.9 and 17.6 times per capita GDP Applying these average estimates on the per capita GDP of each of the 57 countries (ref to NHA website), we calculated the cost per country to educate a physician and a nurse / midwife. These were then multiplied by the number of students needed to close the gap.

To calculate the recurrent costs consisting of salaries and allowances, we obtained estimates of salaries by profession by country from the WHO-CHOICE database and multiplied this with the number of incoming HW graduates. Another analysis was done at double the current salary. The increase in salaries was also applied to existing staff.

Results

The results for 2015 are shown in table 3. The total number of physicians needed would be 885,250 (AFRO: 255,535), the total number of nurses and midwives 2,627,274 (AFRO: 998,749). The grand total for health workers would thus be 3,512,524 (AFRO:1,234,283). As can be seen, the total cost for the education of students necessary to close the gap is calculated as USD 77,699,691,990 for all countries, this is an average of USD 1,363,157,228 per country . For the African countries the total amount would be USD 18,531,718,525 averaging USD 514,769,959 per country. These amounts may seem insurmountable but these are investment costs and are actually spread through a 10 year period. The annual training costs range from a low of USD 1.6 million per country per year to almost USD 2 billion in a large country like India.

The incremental yearly salary costs for these extra HW would come to USD 17,754,559,764 (AFRO: 5,150,939,554) averaging USD 311,483,505 (AFRO: 143,081,654) per country. These are the incremental yearly salary costs calculated at current salaries. If HW receive double their salary, the incremental salary costs would come to USD

53,107,494,605 (AFRO:12,609,490,924) averaging USD 931,710,432 (AFRO: 350,263,637) per country. The additional annual cost of employing the new doctors, nurses and midwives once training has been fully scaled up is just over USD 311 million per country in 2004 prices.

Overcoming the workforce shortage will require substantial financial commitments to train and pay the additional health workers. Assuming that scaling up takes place over a 20-year period – which many observers might argue is more realistic – the required annual investment in training is US\$ 88 million per country. Additional salary costs when the workforce is fully staffed would be higher under this scenario (because the population will increase substantially between 2015 and 2025 and so will the need for health workers), reaching in excess of US\$ 400 million per country. (table 4)

Discussion

The calculations in this article are meant for the global health community to get a general idea of the resources required over a 10 year period. It is clear that to fill the gap, considerable resources need to be invested. The robustness of these estimates is very dependant on the availability of quality data. However, the countries that seem to need these planning exercises often lack this data. Most of the data used for this calculation had to be taken from a number of country-specific studies which were then extrapolated using simple adjustments as in the case of education costs, and regressions for salary costs. .

It has been commented that there are relatively few midwives produced in relation to the other types of health workers. This is a results of using current HW ratios in countries without any HW gaps. However, because the same costs were used for the training of midwives and nurses, the actual ratio of nurses and midwives produced can be adjusted.

Putting numbers into perspective

In the 57 countries with severe shortages of health workers governments are currently spending, on average, US\$ 33 per person per year on health. To educate and pay the salaries of the four million health workers needed to fill the gap, health budgets will have to increase at least US\$ 10 per person per year--to an average of US\$ 43. To meet that target within 20 years is an ambitious but reasonable goal, the Report concludes. These funds must increase by US\$10 per person per year by 2025 in the 57 countries with the most serious shortages of health workers. This represents the cost of training sufficient health workers to fill the gap and paying their salaries.

It must also be noted that no adjustments were made for migration out of the health sector or out of the country. This might be expected to occur especially if one takes current salaries of HWs in developing countries. Doubling the salaries will not in any way guarantee the retention of HWs but could help alleviate this problem.

Finally, it is assumed that there is enough training capacity in these countries to produce the needed graduates if spread over 10 years. No capital investments in training facilities have been included. If training facilities need to be upgraded or expanded, then this will add to the total costs estimated in this paper. It needs to be emphasized that since this paper takes an investment perspective of 10 years to fill the HW gap, yearly capacity is boosted but there will not be a "complete" cadre of health workers to provide basic services until 2015.

References:

1. Namate D. The cost of registered nurse-midwifery education in Malawi. *Journal of Advanced Nursing*, 1995, 22:410-415
2. Bhargava A. The AIDS epidemic and Health Care Infrastructure in Africa: a socioeconomic perspective. *Journal of Acquired Immune Deficiency Syndrome*. 2005; 40 (2): 241
3. Matsiko C and Kiwanuka J. A review for human resources for health in Uganda. *Health Policy and Development*. 2003, 1(1) 15-20.
4. Bicknell WJ, Beggs AC, Tham PV. Determining the full costs of medical education in Thai Binh, Vietnam: a generalizable model. *Health Policy Plan*. 2001 Dec;16(4):412-20.
5. EIP/OSD/HRH. Literature Review on the Cost of Education of Human Resources for Health. 2003 (unpublished).
6. Lehmann U, Sanders D. Chapter 5. The production of doctors. *South African Health Review* (5th); 1999; pp187-200
7. Mulligan J, Fox-Rushby J, Adam T, Johns B, Mill A. Unit costs of health care inputs in low and middle income regions. DCPD Working paper No. 9. (revised June 2005)
<http://www.fic.nih.gov/dcpp/wps/wp9.pdf>

Acknowledgments for advice and provision of data and literature to: Pascal Zurn, Yohannes Kinfu, Mario dal Poz, Barbara Stilwell, Hugo Mercer, Sigrid Draeger; Charu Garg and Chandika Indikadahena

Tables

Table 1 Countries having a current shortage in HW

Who region	Country	Total HW	shortage	HW per 1,000 needed in 2015	Extra HW needed to reach target in 2015	HW per 1000 needed in 2025	Extra HW needed to reach target in 2025
WPRO	Cambodia	14,511	-18,545	37,294	22,784	44,028	29,517
WPRO	Papua New Guinea	3,414	-9,907	15,497	12,083	18,263	14,849
WPRO	Lao People's Dem. Republic	9,334	-3,875	17,826	8,491	21,570	12,236
SEARO	India	2,017,573	-450,369	2,801,782	784,209	3,107,956	1,090,383
SEARO	Indonesia	145,588	-362,530	625,741	480,154	685,394	539,806
SEARO	Bangladesh	85,308	-256,305	399,631	314,323	466,867	381,558
SEARO	Myanmar	67,135	-47,222	115,114	47,979	120,248	53,113
SEARO	Nepal	16,001	-42,717	77,294	61,293	91,114	75,113
SEARO	Bhutan	449	-4,858	6,249	5,800	7,520	7,071
EMRO	Pakistan	187,991	-171,085	448,502	260,511	522,294	334,303
EMRO	Afghanistan	9,995	-46,899	89,663	79,667	114,702	104,707
EMRO	Morocco	40,321	-30,584	86,354	46,033	97,129	56,808
EMRO	Yemen	20,484	-26,840	66,571	46,086	90,489	70,004
EMRO	Somalia	2,382	-21,155	25,995	23,613	33,922	31,540
EMRO	Iraq	51,014	-8,003	76,046	25,032	92,256	41,242
EMRO	Djibouti	425	-1,200	1,314	889	1,554	1,129
AMRO	Haiti	3,012	-16,246	23,428	20,416	28,826	25,814
AMRO	Peru	50,641	-12,282	71,805	21,165	78,694	28,053
AMRO	Nicaragua	8,093	-4,682	14,857	6,764	17,142	9,049
AMRO	Honduras	13,417	-2,787	19,798	6,381	22,836	9,419
AMRO	El Salvador	13,440	-1,657	18,007	4,567	20,788	7,349
AFRO	Ethiopia	17,888	-147,413	206,669	188,782	246,067	228,179
AFRO	Congo	34,609	-89,599	187,237	152,628	246,472	211,863
AFRO	United Rep. of Tanzania	14,654	-71,331	101,697	87,043	121,009	106,355
AFRO	Uganda	21,546	-39,395	89,343	67,797	129,102	107,556
AFRO	Nigeria	251,437	-38,711	372,843	121,406	470,581	219,143
AFRO	Mozambique	6,695	-37,089	49,602	42,908	53,855	47,161
AFRO	Kenya	41,627	-32,372	97,470	55,843	112,660	71,033
AFRO	Madagascar	10,866	-29,994	55,757	44,891	75,246	64,380
AFRO	Côte d'Ivoire	12,250	-26,318	47,670	35,419	55,652	43,402
AFRO	Ghana	22,959	-25,835	60,539	37,580	70,115	47,157
AFRO	Niger	3,116	-25,221	36,867	33,751	47,823	44,707
AFRO	Burkina Faso	8,036	-22,534	41,408	33,372	54,770	46,734
AFRO	Mali	8,179	-22,427	34,439	26,259	46,645	38,466
AFRO	Malawi	7,538	-20,622	36,691	29,153	45,580	38,042
AFRO	Senegal	3,877	-19,722	33,071	29,194	38,987	35,110
AFRO	Zimbabwe	11,445	-18,073	29,153	17,708	29,480	18,035
AFRO	Chad	2,851	-17,359	29,436	26,585	38,755	35,904

Who region	Country	Total HW	shortage	HW per 1,000 needed in 2015	Extra HW needed to reach target in 2015	HW per 1,000 needed in 2025	Extra HW needed to reach target in 2025
AFRO	Rwanda	4,045	-15,313	24,395	20,350	29,994	25,948
AFRO	Burundi	1,548	-14,585	24,478	22,930	31,756	30,208
AFRO	Angola	17,837	-14,297	33,451	15,614	40,508	22,672
AFRO	Guinea	5,810	-13,866	27,943	22,133	36,078	30,268
AFRO	Sierra Leone	2,010	-9,786	16,816	14,806	20,863	18,852
AFRO	Benin	6,102	-9,689	22,417	16,316	27,189	21,088
AFRO	Togo	2,373	-9,078	16,116	13,743	20,512	18,139
AFRO	Cameroon	29,170	-8,026	47,072	17,902	55,375	26,205
AFRO	Eritrea	2,720	-7,088	13,530	10,810	16,535	13,815
AFRO	Central African Republic	2,042	-6,887	11,175	9,133	12,524	10,481
AFRO	Liberia	1,140	-6,819	8,945	7,804	10,832	9,692
AFRO	Mauritania	2,205	-4,597	9,338	7,133	12,079	9,874
AFRO	Congo (Brazzaville)	4,429	-4,286	10,850	6,421	14,074	9,645
AFRO	Lesotho	1,210	-2,899	4,419	3,210	4,123	2,914
AFRO	Guinea-Bissau	1,260	-2,251	3,938	2,679	4,703	3,444
AFRO	Zambia	23,508	-1,426	31,476	7,968	37,450	13,941
AFRO	Gambia	2,088	-1,249	4,747	2,659	5,992	3,904
AFRO	Comoros	703	-1,100	2,013	1,310	2,573	1,870
AFRO	Equatorial Guinea	424	-733	1,469	1,045	1,754	1,329
	TOTAL	3,350,727	-2,357,738	6,863,251	3,512,524	7,951,306	4,600,579
	Average all	58,785	-41,364	120,408	61,623	139,497	80,712
	TOTAL AFRO	590,198	-817,991	1,824,481	1,234,283	2,267,712	1,677,514
	Average AFRO	16,394	-22,722	50,680	34,286	62,992	46,598

Table 2

WHO Region	Doctors no.	Nurse no.	Midwife no.	Total
WPRO	46.5%	51.1%	2.4%	100%
SEARO	27.4%	67.8%	4.8%	100%
EMRO	28.6%	70.2%	1.2%	100%
AMRO	28.2%	71.7%	0.0%	100%
AFRO	20.7%	79.0%	0.3%	100%

Table 3: Results 2015

Who region	Country	Physicians needed	Nurses needed	Midwives needed	Total HW needed	Total costs education	Total incremental operating costs	Total incremental operating costs at 2 times the salary
WPRO	Cambodia	6,233	15,449	1,101	22,784	291,353,958	43,066,758	109,872,947
WPRO	Papua New Guinea	3,306	8,194	584	12,083	372,670,371	80,145,897	178,163,783
WPRO	Lao People's Dem. Republic	2,323	5,758	410	8,491	120,298,393	32,206,700	103,442,345
SEARO	India	214,541	531,764	37,903	784,209	18,123,240,681	3,493,703,638	16,451,346,924
SEARO	Indonesia	131,359	325,588	23,207	480,154	19,223,161,736	3,424,069,888	7,855,702,850
SEARO	Bangladesh	85,991	213,139	15,192	314,323	5,425,064,728	996,350,215	2,317,826,148
SEARO	Myanmar	13,126	32,534	2,319	47,979	212,536,406	323,217,486	1,094,239,626
SEARO	Nepal	16,768	41,562	2,962	61,293	589,141,486	180,119,520	401,638,608
SEARO	Bhutan	1,587	3,933	280	5,800	80,230,208	11,441,765	23,759,309
EMRO	Pakistan	74,470	183,007	3,034	260,511	6,086,864,405	1,194,915,613	3,574,819,140
EMRO	Afghanistan	22,774	55,966	928	79,667	551,661,098	1,133,216,620	2,437,088,037
EMRO	Morocco	13,159	32,338	536	46,033	2,115,461,936	421,206,496	1,257,404,019
EMRO	Yemen	13,174	32,375	537	46,086	1,127,718,654	199,493,720	491,956,640
EMRO	Somalia	6,750	16,588	275	23,613	679,208,134	231,807,292	484,033,660
EMRO	Iraq	7,156	17,585	292	25,032	918,787,395	294,086,745	1,219,639,129
EMRO	Djibouti	254	624	10	889	30,846,029	8,176,270	20,339,317
AMRO	Haiti	5,765	14,645	6	20,416	294,392,479	84,019,983	186,288,011
AMRO	Peru	5,977	15,182	6	21,165	1,996,716,907	301,613,930	1,612,614,254
AMRO	Nicaragua	1,910	4,852	2	6,764	222,535,606	52,636,407	166,561,889
AMRO	Honduras	1,802	4,577	2	6,381	272,005,309	42,643,870	176,839,491
AMRO	El Salvador	1,290	3,276	1	4,567	434,347,547	55,481,397	334,427,554
AFRO	Ethiopia	39,084	149,205	493	188,782	646,400,319	251,168,084	523,263,236
AFRO	Congo	31,599	120,630	399	152,628	5,487,385,054	1,758,347,090	3,896,307,893
AFRO	United Rep. of Tanzania	18,021	68,795	228	87,043	923,923,645	187,217,313	400,196,422
AFRO	Uganda	14,036	53,584	177	67,797	619,045,465	176,404,395	401,657,707
AFRO	Nigeria	25,135	95,953	317	121,406	2,041,550,575	436,263,903	1,704,126,151
AFRO	Mozambique	8,883	33,912	112	42,908	409,738,512	112,935,216	240,669,229

Table 3: Results 2015 continued

Who region	Country	Physicians needed	Nurses needed	Midwives needed	Total HW needed	Total costs education	Total incremental operating costs	Total incremental operating costs at 2 times the salary
AFRO	Kenya	11,561	44,136	146	55,843	975,169,875	206,655,169	548,567,250
AFRO	Madagascar	9,294	35,480	117	44,891	531,157,943	126,296,643	293,445,903
AFRO	Côte d'Ivoire	7,333	27,994	93	35,419	1,056,467,784	273,707,911	637,712,337
AFRO	Ghana	7,780	29,701	98	37,580	516,133,226	142,745,667	365,645,199
AFRO	Niger	6,988	26,675	88	33,751	233,700,755	95,052,433	197,932,413
AFRO	Burkina Faso	6,909	26,376	87	33,372	432,949,544	115,686,695	255,490,700
AFRO	Mali	5,436	20,754	69	26,259	336,676,821	91,452,615	208,664,499
AFRO	Malawi	6,036	23,042	76	29,153	158,607,975	54,424,801	119,949,578
AFRO	Senegal	6,044	23,073	76	29,194	640,860,131	116,543,413	247,512,760
AFRO	Zimbabwe	3,666	13,995	46	17,708	339,541,589	85,594,355	224,794,348
AFRO	Chad	5,504	21,011	69	26,585	253,865,856	79,186,310	165,963,715
AFRO	Rwanda	4,213	16,083	53	20,350	156,389,215	40,560,932	88,104,841
AFRO	Burundi	4,747	18,123	60	22,930	74,152,967	30,286,018	62,416,565
AFRO	Angola	3,233	12,341	41	15,614	545,918,284	129,379,390	379,861,960
AFRO	Guinea	4,582	17,493	58	22,133	339,342,803	86,797,648	195,355,435
AFRO	Sierra Leone	3,065	11,702	39	14,806	108,716,784	27,757,106	58,714,296
AFRO	Benin	3,378	12,895	43	16,316	278,706,012	75,702,755	174,262,263
AFRO	Togo	2,845	10,862	36	13,743	151,631,190	60,384,132	129,753,975
AFRO	Cameroon	3,706	14,149	47	17,902	591,865,979	113,752,723	390,018,435
AFRO	Eritrea	2,238	8,543	28	10,810	76,081,144	33,963,522	75,121,926
AFRO	Central African Republic	1,891	7,218	24	9,133	103,887,343	32,859,273	72,664,955
AFRO	Liberia	1,616	6,168	20	7,804	40,677,752	87,867,178	186,744,357
AFRO	Mauritania	1,477	5,637	19	7,133	110,989,943	29,916,039	68,336,988
AFRO	Congo (Brazzaville)	1,329	5,075	17	6,421	25,651,698	5,415,132	14,397,516
AFRO	Lesotho	665	2,537	8	3,210	72,172,192	15,838,589	36,657,270
AFRO	Guinea-Bissau	555	2,117	7	2,679	16,304,993	10,707,706	26,089,730
AFRO	Zambia	1,650	6,297	21	7,968	115,492,635	35,381,074	156,670,830
AFRO	Gambia	551	2,102	7	2,659	25,796,869	5,512,915	14,655,612

Table 3: Results 2015 continued

Who region	Country	Phy needed	Nurses needed	Midwives needed	Total HW needed	Total costs education	Total incremental operating costs	Total incremental operating costs at 2 times the salary
AFRO	Comoros	271	1,036	3	1,310	20,987,533	5,981,686	15,002,659
AFRO	Equatorial Guinea	216	826	3	1,045	73,778,117	13,193,722	32,761,970
	TOTAL	885,250	2,534,458	92,816	3,512,524	77,699,961,990	17,754,559,764	53,107,494,605
	Average all	15,531	44,464	1,628	61,623	1,363,157,228	311,483,505	931,710,432
	TOTAL AFRO	255,535	975,522	3,227	1,234,283	18,531,718,525	5,150,939,554	12,609,490,924
	Average AFRO	7,098	27,098	90	34,286	514,769,959	143,081,654	350,263,637

Table 4: Results 2025

Who region	Country	Physicians needed	Nurses needed	Midwives needed	Total HW needed	Total costs education	Total incremental operating costs	Total incremental operating costs at 2 times the salary
WPRO	Cambodia	8,075	20,015	1,427	29,517	377,463,610	55,795,136	135,329,704
WPRO	Papua New Guinea	4,062	10,069	718	14,849	457,974,914	98,491,357	214,854,701
WPRO	Lao People's Dem. Republic	3,347	8,297	591	12,236	173,345,139	46,408,558	131,846,061
SEARO	India	298,303	739,378	52,701	1,090,383	25,198,984,406	4,857,728,540	19,179,396,728
SEARO	Indonesia	147,678	366,037	26,090	539,806	21,611,369,020	3,849,462,379	8,706,487,831
SEARO	Bangladesh	104,385	258,731	18,442	381,558	6,585,515,724	1,209,474,971	2,744,075,661
SEARO	Myanmar	14,531	36,015	2,567	53,113	235,280,633	357,806,064	1,163,416,782
SEARO	Nepal	20,549	50,933	3,630	75,113	721,971,823	220,730,030	482,859,629
SEARO	Bhutan	1,935	4,795	342	7,071	97,813,964	13,949,414	28,774,608
EMRO	Pakistan	95,564	234,846	3,894	334,303	7,811,021,421	1,533,385,801	4,251,759,516
EMRO	Afghanistan	29,932	73,556	1,220	104,707	725,050,929	1,489,392,249	3,149,439,295
EMRO	Morocco	16,239	39,907	662	56,808	2,610,641,541	519,800,975	1,454,592,977
EMRO	Yemen	20,011	49,178	815	70,004	1,712,980,116	303,026,623	699,022,445
EMRO	Somalia	9,016	22,157	367	31,540	907,236,678	309,631,271	639,681,618
EMRO	Iraq	11,790	28,973	480	41,242	1,513,780,695	484,533,027	1,600,531,693
EMRO	Djibouti	323	793	13	1,129	39,199,323	10,390,453	24,767,685
AMRO	Haiti	7,290	18,517	8	25,814	372,230,264	106,234,984	230,718,013
AMRO	Peru	7,922	20,123	9	28,053	2,646,567,850	399,777,117	1,808,940,630
AMRO	Nicaragua	2,555	6,491	3	9,049	297,703,596	70,415,912	202,120,900
AMRO	Honduras	2,660	6,757	3	9,419	401,498,546	62,945,286	217,442,322
AMRO	El Salvador	2,075	5,271	2	7,349	698,886,419	89,272,277	402,009,315
AFRO	Ethiopia	47,240	180,342	596	228,179	781,299,734	303,585,180	628,097,427
AFRO	Congo	43,862	167,447	554	211,863	7,617,042,771	2,440,762,741	5,261,139,197
AFRO	United Rep. of Tanzania	22,019	84,058	278	106,355	1,128,916,500	228,755,606	483,273,009
AFRO	Uganda	22,267	85,007	281	107,556	982,073,415	279,853,543	608,556,002

Table 4: Results 2025 continued

Who region	Country	Physicians needed	Nurses needed	Midwives needed	Total HW needed	Total costs education	Total incremental operating costs	Total incremental operating costs at 2 times the salary
AFRO	Nigeria	45,369	173,201	573	219,143	3,685,105,594	787,479,169	2,406,556,682
AFRO	Mozambique	9,764	37,274	123	47,161	450,355,705	124,130,433	263,059,662
AFRO	Kenya	14,706	56,141	186	71,033	1,240,425,852	262,867,446	660,991,803
AFRO	Madagascar	13,329	50,883	168	64,380	761,747,358	181,125,286	403,103,188
AFRO	Côte d'Ivoire	8,986	34,303	113	43,402	1,294,565,424	335,393,850	761,084,216
AFRO	Ghana	9,763	37,270	123	47,157	647,661,962	179,122,238	438,398,341
AFRO	Niger	9,256	35,334	117	44,707	309,561,779	125,907,168	259,641,883
AFRO	Burkina Faso	9,675	36,936	122	46,734	606,298,082	162,006,456	348,130,222
AFRO	Mali	7,964	30,402	101	38,466	493,176,755	133,963,198	293,685,666
AFRO	Malawi	7,876	30,067	99	38,042	206,968,231	71,019,157	153,138,291
AFRO	Senegal	7,269	27,749	92	35,110	770,728,411	140,160,567	294,747,069
AFRO	Zimbabwe	3,734	14,254	47	18,035	345,818,570	87,176,706	227,959,051
AFRO	Chad	7,433	28,377	94	35,904	342,862,038	106,946,165	221,483,425
AFRO	Rwanda	5,372	20,508	68	25,948	199,415,162	51,720,094	110,423,164
AFRO	Burundi	6,254	23,875	79	30,208	97,688,378	39,898,498	81,641,525
AFRO	Angola	4,694	17,919	59	22,672	792,675,512	187,859,387	496,821,955
AFRO	Guinea	6,266	23,923	79	30,268	464,075,593	118,702,001	259,164,142
AFRO	Sierra Leone	3,903	14,900	49	18,852	138,426,205	35,342,389	73,884,861
AFRO	Benin	4,366	16,667	55	21,088	360,222,428	97,844,427	218,545,608
AFRO	Togo	3,755	14,336	47	18,139	200,129,908	79,697,791	168,381,292
AFRO	Cameroon	5,425	20,711	69	26,205	866,368,536	166,510,297	495,533,583
AFRO	Eritrea	2,860	10,919	36	13,815	97,234,587	43,406,669	94,008,220
AFRO	Central African Republic	2,170	8,284	27	10,481	119,232,119	37,712,782	82,371,973
AFRO	Liberia	2,006	7,660	25	9,692	50,514,232	109,114,756	229,239,514
AFRO	Mauritania	2,044	7,804	26	9,874	153,638,080	41,411,345	91,327,600
AFRO	Congo (Brazzaville)	1,997	7,623	25	9,645	38,529,181	8,133,599	19,834,449
AFRO	Lesotho	603	2,303	8	2,914	65,515,310	14,377,700	33,735,491

Table 4: Results 2025 continued

Who region	Country	Physicians needed	Nurses needed	Midwives needed	Total HW needed	Total costs education	Total incremental operating costs	Total incremental operating costs at 2 times the salary
AFRO	Guinea-Bissau	713	2,722	9	3,444	20,961,902	13,765,961	32,206,240
AFRO	Zambia	2,886	11,018	36	13,941	202,078,387	61,906,548	209,721,779
AFRO	Gambia	808	3,085	10	3,904	37,873,096	8,093,663	19,817,108
AFRO	Comoros	387	1,478	5	1,870	29,947,941	8,535,505	20,110,296
AFRO	Equatorial Guinea	275	1,051	3	1,329	93,829,509	16,779,507	39,933,541
	TOTAL	1,155,540	3,326,670	118,369	4,600,579	100,889,480,859	23,179,720,254	63,957,815,586
	Average all	20,273	58,363	2,077	80,712	1,769,990,892	406,661,759	1,122,066,940
	TOTAL AFRO	347,297	1,325,832	4,385	1,677,514	25,692,964,247	7,091,067,829	16,489,747,474
	Average AFRO	9,647	36,829	122	46,598	713,693,451	196,974,106	458,048,541