The health worker shortage in Africa: are enough physicians and nurses being trained?

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Objective To estimate systematically the inflow and outflow of health workers in Africa and examine whether current levels of pre-service training in the region suffice to address this serious problem, taking into account population increases and attrition of health workers due to premature death, retirement, resignation and dismissal.

Methods Data on the current numbers and types of health workers and outputs from training programmes are from the 2005 WHO health workforce and training institutions' surveys. Supplementary information on population estimates and mortality is from the United Nations Population Division and WHO databases, respectively, and information on worker attrition was obtained from the published literature. Because of shortages of data in some settings, the study was restricted to 12 countries in sub-Saharan Africa.

Findings Our results suggest that the health workforce shortage in Africa is even more critical than previously estimated. In 10 of the 12 countries studied, current pre-service training is insufficient to maintain the existing density of health workers once all causes of attrition are taken into account. Even if attrition were limited to involuntary factors such as premature mortality, with current workforce training patterns it would take 36 years for physicians and 29 years for nurses and midwives to reach WHO's recent target of 2.28 professionals per 1000 population for the countries taken as a whole – and some countries would never reach it.

Conclusion Pre-service training needs to be expanded as well as combined with other measures to increase health worker inflow and reduce the rate of outflow.

Une traduction en français de ce résumé figure à la fin de l'article. *Al final del artículo se facilita una traducción al español.* الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

Introduction

Recently, considerable attention has been focused on the apparent shortage of health workers in countries with the poorest health indicators, and the potential impact of the shortage on countries' ability to fight diseases and provide essential, life-saving interventions.[1–3] According to recent WHO estimates, the current workforce in some of the most affected countries in sub-Saharan Africa would need to be scaled up by as much as 140% to attain international health development targets such as those in the Millennium Declaration.[4] The problem is so serious that in many instances there is simply not enough human capacity even to absorb, deploy and efficiently use the substantial additional funds that are considered necessary to improve health in these countries.

Health worker shortage in sub-Saharan Africa derives from many causes, including past investment shortfalls in pre-service training, international migration, career changes among health workers, premature retirement, morbidity and premature mortality.[5,6] Yet the dynamics of entry into and exit from the health workforce in many of these countries remain poorly understood. This limits the capacity of national governments and their international development partners to design and implement appropriate intervention programmes. In this paper, we fill some of this information gap by providing the first systematic estimates of health worker inflow and outflow in selected sub-Saharan African countries.

For reasons of data availability, our analysis is restricted to two groups of health workers – nurses and midwives combined, and physicians – and to 12 countries for which the relevant data were available.

Methods

The analysis required information on the stock of health workers in each country, as well as annual inflows and outflows. Inflows are associated with the number of new workers hired each year, either graduates of training institutions, migrants or people re-entering the workforce. Outflows are caused by premature deaths among health workers, dismissals, resignations (e.g. to migrate or change career) and retirement. Much of this information is not available in many countries, so this study focuses on 12 African countries where information was available on the size, age and sex distribution of the health workforce as well as on graduations from training institutions: Central African Republic, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Kenya, Liberia, Madagascar, Rwanda, Sierra Leone, Uganda, the United Republic of Tanzania and Zambia.

Baseline health worker numbers by age and sex were obtained from a WHO survey of health workers conducted in African countries in 2005[7]. This survey is also the source of the data on health worker training institutions, including the number of trainees by type of worker and year of graduation.

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We use the number of graduates as the maximum possible level of new domestic graduates hired each year. No data on in-migration of health workers or on the number rejoining the workforce annually were available for any of the countries, though we expect in-migration to be limited to those countries whose health workers are recruited by richer countries.

Information on the outflow of health workers is also difficult to obtain. There are patchy data available on the mobility and mortality of health workers as distinct from the rest of the population, but they are limited in scope and rigour.[8,9] Thus, we preferred to use age- and sex-specific mortality rates for the population as a whole, as they are usually of good quality,[10] and to assume these rates also applied to health workers. These data were also used to estimate the numbers of health workers retiring each year. In the absence of country-specific information on retirement ages in the public and private sectors, we applied an age of 60 years to all settings on the assumption that all health workers who survive to that age then retire.

Data on out-migration, resignation before retirement age and dismissals were also not available for most of the countries under study. Migration data, for example, are not collected routinely by occupation in either "supplier" or recipient countries and, even when pieces of the puzzle are available, they tend to be either incomplete or of indeterminate time scale.[11–13] As a result, for the present analysis we adopted rates obtained from two separate case studies in Mozambique and Zambia that provide time-specific data on spatial and career mobility.[14–16] Both studies focused on public sector health workers. In Mozambique, 2.3% of the workforce left service each year due to resignation (including for migration) or dismissal, while in Zambia only 1.5% left. Because we cannot say if these rates are typical of other countries, we report two sets of figures based on the two rates.

Finally, taking into account available information on inflows and outflows, we compared the estimated net growth rates of the health workforce to population growth rates estimated for the respective countries by the United Nations Population Division.[17] This allowed us to assess two important outcomes given current trends. The first was whether the net growth rate of the health workforce is faster than that of the population, allowing health worker density to increase over time. The second was the extent to which the workforce would need to grow in each country to attain the minimum density of 2.28 health workers per 1000 population. This was the yardstick developed and reported as being necessary to achieve desired levels of coverage of key health interventions in the World Health Organization's *The world health report 2006*.[1]

Table 1. **Density of physicians and estimated annual physician inflows and outflows for 12 African countries**[a]

Country	Physicians per 1000 population	Inflow per 1000 physicians	Outflow per 1000 physicians	
			Scenario I[b]	Scenario II[c]
Central African Republic	0.08	68	54	62
Côte d'Ivoire	0.12	140	52	60
Democratic Republic of the Congo	0.11	33	48	56
Ethiopia	0.03	73	47	55
Kenya	0.14	49	47	55
Liberia	0.03	83	64	72
Madagascar	0.29	86	45	53
Rwanda	0.05	51	47	55
Sierra Leone	0.03	65	68	76
Uganda	0.08	49	43	51
United Republic of Tanzania	0.02	97	48	56
Zambia	0.14	29	48	56
Total	**0.09**	**59**	**48**	**56**

[a] Authors' calculations were based on a WHO survey (available at: http://www.afro.who.int/hrh-observatory/documentcentre/questionnnare/quesb_health_training_institutions.xls).
[b] Scenario I uses country-specific estimates of outflows due to mortality and retirement and an additional outflow estimate of 1.5% per annum due to resignation and dismissal obtained from a Zambian case study.
[c] Scenario II follows a procedure similar to the one used for Scenario I but uses a higher rate of outflow (2.3%) due to resignation and dismissal obtained from a Mozambican case study.

Results

Table 1 presents the estimates of the density of physicians per 1000 population and the annual inflows and outflows per 1000 physicians currently employed. Rates of inflow (also known as workforce regeneration rates) were obtained by dividing the annual number of medical graduates by the total stock of physicians in each country. This is a useful way to understand the proportion of the current workforce that is being regenerated each year. The rate of outflow includes all causes. As explained, premature mortality and retirement rates are country-specific. Scenario I then adds the rate obtained from the Zambian study to calculate resignations and dismissals, while scenario II uses the higher rates observed in Mozambique. Table 2 reports the same estimates for nurses and midwives.

The results for all 12 countries combined show that, for every 1000 physicians practicing in these countries, 59 medical graduates are produced each year. The rate is slightly higher for nursing and midwifery, at 66 new graduates per 1000 practicing nurses and midwives.

The regional average, however, masks the diverse patterns in the study countries. For instance, in 9 of the 12 (the exceptions are the Democratic Republic of the Congo, Ethiopia and Sierra Leone) the rate at which new graduates enter the system is actually higher for physicians than for nurses and midwives. Moreover, countries that have a relatively high graduation rate for one type of health worker do not necessarily have a relatively high rate for the other. For example, Côte d'Ivoire has the highest graduation rate for physicians (14%) but ranks only 7th in the regeneration rate for nurses and midwives (2.7%).

Generally, in all countries outflows are slightly lower for nurses and midwives than for physicians because age-specific death rates are typically lower

for women than men and the proportion of females is higher among nurses and midwives than among physicians. For the 12 countries as a whole, each year the health sector is expected to lose some 2.4% of its physicians and 2.1% of its nurses and midwives to premature mortality, and about 4–6% of both due to all causes combined.

Although the 12 countries as a whole are training sufficient physicians to replace outflows when inflows and outflows are considered together, this is not the case in at least one of the outflow scenarios for 6 countries. The situation is even worse when it comes to nurses and midwives, with only 3 countries (Ethiopia, Liberia and Sierra Leone) unequivocally training sufficient workers to replace those leaving the workforce.

However, even in the countries where training is above replacement rates, it is not clear that they will soon be in a position to meet current unmet needs or the increasing demands of an expanding population. Table 3 shows current density per 1000 population for physicians, nurses and midwives combined, with the net rates of increase (or decrease) under the two scenarios and the rate of population growth. Only 6 countries (Côte d'Ivoire, Ethiopia, Liberia, Madagascar, Sierra Leone and the United Republic of Tanzania) show net rates of increases under both scenarios. In the others, the absolute numbers of physicians, nurses and midwives seem to be declining. This decline is even more serious when considered alongside the relatively high rates of population growth in most of these countries.

Even among countries with positive net growth rates, only two (Côte d'Ivoire and Ethiopia) stand a chance of meeting some of the current unmet demands in the future by virtue of unequivocally having a faster-growing number of health workers than inhabitants. Nonetheless, the rate of health worker increase is much slower than that required to increase the density to the WHO target of 2.28 health workers per 1000 population in a relatively short time. The column on the right shows the rate of health workforce growth required for each country for the target to be achieved by 2015, the year set for the achievement of the United Nations' Millennium Development Goals. Not even these 2 countries are expanding health worker supply fast enough to achieve this aim.

Table 2. **Density of nurses and midwives and estimated annual nurse/midwife inflows and outflows for 12 African countries**[a]

Country	Nurses and midwives per 1000 population	Inflow per 1000 nurses and midwives	Outflow per 1000 nurses and midwives	
			Scenario I[b]	Scenario II[c]
Central African Republic	0.44	23	45	53
Côte d'Ivoire	0.60	27	40	48
Democratic Republic of the Congo	0.53	46	44	52
Ethiopia	0.21	105	43	51
Kenya	1.14	20	46	54
Liberia	0.30	71	44	52
Madagascar	0.32	49	50	58
Rwanda	0.43	22	36	44
Sierra Leone	0.36	66	46	54
Uganda	0.72	16	45	53
United Republic of Tanzania	0.35	40	48	56
Zambia	2.01	24	44	52
Total	**0.55**	**66**	**45**	**53**

[a] Authors' calculations are based on a WHO survey (available at: http://www.afro.who.int/hrh-observatory/documentcentre/questionnnare/quesb_health_training_institutions.xls).
[b] Scenario I uses country-specific estimates of outflows due to mortality and retirement and an additional outflow estimate of 1.5% per annum due to resignation and dismissal obtained from a Zambian case study.
[c] Scenario II follows a procedure similar to the one used for Scenario I but uses a higher rate of outflow (2.3%) due to resignation and dismissal obtained from a Mozambican case study.

Discussion

Previous work on health workers in sub-Saharan Africa has focused on the numbers available and on the numbers leaving the workforce at a particular point in time.[2,5,6] The results have clearly shown that the current number of health workers is insufficient to meet population health needs at that point in time. This study, which was the first to examine whether current pre-service training can improve the situation, took into account population increases and attrition due to premature death among health workers, retirement, resignation and dismissal. Although each of these components requires separate and careful analysis, the larger picture of workforce dynamics emerges only when they are considered together.

Training capacity insufficient

Our analyses suggest that workforce shortages in the countries under study are even more alarming than suggested by the existing literature. Not only are current numbers insufficient to meet health needs but, in at least 6 of the 12 countries, pre-service training is insufficient to maintain absolute numbers even at their current levels. Current rates of training are sufficient to increase health worker densities in the other 6 countries but, in 4 of them, not enough to keep pace with population growth. This will lead to a drop in health worker availability per person in those countries. Even the 2 countries where current rates of training will increase health worker density will not be able to meet the target level of 2.28 physicians, nurses and midwives per 1000 population until well after 2015.

Future direction

Boosting pre-service training is clearly important but is a longer-term solution because putting in place the infrastructure (human as well as physical) that is needed in these countries will take a long time. Hence, a variety of complementary, shorter-term responses must be considered. For instance, shifting some tasks from people requiring longer-term training to those requiring less intensive training will enable more services to be made available in a shorter time.[18,19] Aggressive retention policies, such as improving the remuneration and working conditions of health workers, addressing unemployment,

Table 3. **Current density of physicians, nurses and midwives and required rate of workforce growth according to population growth rates in 12 African countries**[a]

Country	Density of physicians, nurses and midwives per 1000 population	Annual net rate of growth		Population growth rate %	Required workforce growth per annum %
		Scenario I[b]	Scenario II[c]		
Central African Republic	0.52	−0.7	−2.3	1.8	13.4
Côte d'Ivoire	0.73	7.5	5.9	2.2	10.4
Democratic Republic of the Congo	0.64	−1.3	−2.9	2.5	11.6
Ethiopia	0.24	8.7	7.1	2.6	20.4
Kenya	1.28	−2.5	−4.1	2.4	5.2
Liberia	0.33	4.6	3.0	4.6	17.7
Madagascar	0.61	4.0	2.4	3.0	12.0
Rwanda	0.48	−1.0	−2.6	4.9	14.2
Sierra Leone	0.39	1.7	0.1	2.6	16.1
Uganda	0.81	−2.3	−3.9	2.3	9.4
United Republic of Tanzania	0.37	4.1	2.5	3.2	16.4
Zambia	2.15	−3.8	−5.4	2.1	0.5
Total	**0.64**	**3.2**	**−1.6**	**2.7**	**11.6**

[a] Authors' calculations are based on a WHO survey (available at: http://www.afro.who.int/hrh-observatory/documentcentre/questionnnare/quesb_health_training_institutions.xls).

[b] Scenario I uses country-specific estimates of outflows due to mortality and retirement and an additional outflow estimate of 1.5% per annum due to resignation and dismissal obtained from a Zambian case study.

[c] Scenario II follows a procedure similar to the one used for Scenario I but uses a higher rate of outflow (2.3%) due to resignation and dismissal obtained from a Mozambican case study.

using telemedicine, and encouraging short-term in-migration from surplus to deficit countries, may also be possible, perhaps with donor support.[20–22] Preventing AIDS will reduce premature mortality among health workers in the longer-term, while providing antiretroviral treatment for health workers who need it will enable them to work longer. The issue of workers resigning to migrate or to change careers is also vitally important, and several international efforts are under way to address this complex issue.[23]

While these shorter-term options should be considered, it is important not to ignore the more expensive, longerterm issue of pre-service training. Only by addressing all of these facets together can solutions be found to the current health worker crisis in Africa. While considering the policy implications, it is also necessary to be aware of the limitations of the study, the most important of which is the difficulty in obtaining accurate figures for the numbers of health workers in a country. Ours come from a questionnaire sent to WHO country offices. The questionnaires were completed with the help of any official records that were available, including professional registers of members, though these might not be totally accurate or up to date. In addition, estimates of the annual number of graduates from training institutions were sometimes obtained by contacting each of the known institutions. The figures on outflows associated with reasons other than death were taken from two in-depth country studies. Data limitations also prevented us from focusing on other workers besides physicians, nurses and midwives.

We acknowledge, therefore, that the estimates presented in the study might not be exact and highlight the need for more investment in collecting the basic data necessary for informed decision-making. The fact that outflow estimates for dismissal and resignation were derived from two case studies that may not be representative in themselves also calls for caution. However, to address these data problems, we have tried to make the most conservative assumptions possible. For example, we assumed that all graduates from training institutions would immediately enter the workforce. There will be some immediate loss of potential health workers at this stage, so our estimates probably overestimate the ability of current training institutions to replenish supply. It is also important to acknowledge that with current attention being focused on health worker shortages, some of the countries under study may already have scaled up training and taken other steps to alleviate them, and this would not be captured by our figures. It is, therefore, necessary for countries to take appropriate action to promote the collection and analysis of data on entry and exit from the health workforce. ■

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Yohanes Kinfu worked at WHO at the time this research was conducted.

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Résumé

Pénurie de personnel de santé en Afrique : forme-t-on assez de médecins et d'infirmières ?

Objectif Estimer de manière systématique les flux entrants et sortants de personnel médical en Afrique et déterminer si les effectifs actuellement formés dans la région avant l'entrée en activité suffisent pour répondre à ce grave problème, compte tenu de la croissance démographique et de l'attrition de la main-d'œuvre résultant des décès prématurés, des départs à la retraite, des démissions et des licenciements.

Méthodes Les données sur les effectifs actuels du personnel médical, les différents types de personnels de santé et les effectifs sortant des programmes de formation proviennent de l'enquête de 2005 de l'OMS sur la main d'œuvre au service de la santé publique et les établissements de formation. Des estimations démographiques et des données de mortalité supplémentaires ont été fournies respectivement par la Division de la population des Nations Unies et par les bases de données de l'OMS et des informations sur l'attrition de la main d'œuvre ont été tirées de la littérature publiée. En raison du manque de données pour certains pays, l'étude n'a porté que sur 12 pays d'Afrique sub-saharienne.

Résultats Les résultats obtenus laissent à penser que la pénurie de personnel de santé en Afrique est encore plus grave qu'on ne l'estimait auparavant. Dans 10 des 12 pays étudiés, les effectifs actuellement formés avant leur entrée en activité sont insuffisants pour maintenir la densité d'agents de santé existante une fois toutes les causes d'attrition prises en compte. Même si cette attrition n'était due qu'à des facteurs involontaires comme la mortalité prématurée, il faudrait, avec le rythme actuel de formation de la main d'œuvre, 36 ans dans le cas des médecins et 29 ans dans le cas des infirmières et des sages-femmes, pour atteindre l'objectif récemment fixé par l'OMS de 2,28 professionnels de santé pour 1000 habitants pour l'ensemble de ces pays - dont certains sont dans l'incapacité de réaliser un jour cet objectif.

Conclusion Il faut développer les formations avant l'entrée en activité et mettre en œuvre parallèlement d'autres mesures pour accroître le flux entrant de main d'œuvre et réduire le taux de départ.

Resumen

Escasez de personal sanitario en África: ¿se está formando a suficientes médicos y enfermeras?

Objetivo Estimar sistemáticamente el ritmo de incorporación y abandono en puestos de trabajadores sanitarios en África y determinar si el nivel actual de formación previa al empleo en la región es suficiente para afrontar ese grave problema, teniendo en cuenta el aumento de la población y la disminución natural de trabajadores sanitarios por muerte prematura, jubilación, dimisión y despido.

Métodos Los datos sobre el número actual y el tipo de trabajadores sanitarios y la cantidad de personas capacitadas en los programas de formación proceden de las encuestas de 2005 de la OMS sobre el personal sanitario y las instituciones de formación. La información complementaria sobre las estimaciones de población y la mortalidad procede de las bases de datos de la División de Población de las Naciones Unidas y de la OMS, respectivamente, y la información sobre la disminución natural de los trabajadores se extrajo de diversas publicaciones. Debido a la falta de datos en algunos entornos, el estudio se limitó a 12 países del África subsahariana.

Resultados Nuestros resultados llevan a pensar que la escasez de personal sanitario en África es aún más grave de lo que se creía hasta ahora. En 10 de los 12 países estudiados, la formación previa al empleo es hoy día insuficiente para mantener la actual densidad de trabajadores sanitarios una vez consideradas todas las causas de disminución natural. Incluso si esa disminución se debiera sólo a factores involuntarios, como la mortalidad prematura, manteniendo el actual ritmo de formación habrían de transcurrir 36 años en el caso de los médicos y 29 años en el caso de las enfermeras para que pudiera alcanzarse la meta reciente de la OMS de 2,28 profesionales por cada 1000 habitantes para el conjunto de los países, y además algunos países nunca alcanzarían esa cifra.

Conclusión Es necesario expandir la formación previa al servicio y combinarla con otras medidas si se desea incrementar la incorporación de trabajadores sanitarios y reducir la tasa de abandono.

ملخص

النقص في العاملين الصحيين في أفريقيا: هل يجري تدريب عدد كاف من الأطباء والممرضات

الهدف: الوصول إلى تقدير منهجي لتدفق العاملين الصحيين من وإلى أفريقيا ودراسة ما إذا كانت مستويات التدريب السابق للخدمة في الإقليم تكفي للتصدّي للمشكلات الخطيرة فيه، مع الأخذ بالحسبان زيادة السكان وتناقص أعداد العاملين الصحيين بسبب الوفيات المبكرة والتقاعد والاستقالة والصرف من الخدمة.

الطريقة: استمدت المعطيات حول الأعداد والأنماط الحالية للعاملين الصحيين ومخرجات برامج التدريب، من تقرير القوى العاملة الصحية لعام 2005، الذي أَعَدَّته منظمة الصحة العالمية، ومن مسوحات المعاهد التدريبية، كما استمدت المعلومات التكميلية حول تقدير عدد السكان ووفياتهم من قواعد المعطيات الخاصة بشعبة السكان في الأمم المتحدة ومنظمة الصحة العالمية. كما استمدت المعلومات حول تناقص عدد العاملين الصحيين من النشريات الطبية. وبسبب شح المعطيات في بعض المواقع، فقد تم قصر الدراسة على 12 بلداً من البلدان الواقعة جنوب الصحراء الأفريقية.

الموجودات: تشير نتائج الدراسات إلى أن النقص في العاملين الصحيين يمثِّل وضعاً أكثر حرجاً مما كان عليه سابقاً. ففي عشرة من البلدان الإثني عشر التي خضعت للدراسة كان الوضع الراهن للتدريب السابق للخدمة غير كاف للمحافظة على كثافة العاملين الصحيين عندما يؤخذ بالحسبان جميع أسباب تناقص عدد العاملين الصحيين. وحتى عندما كان تناقص عدد العاملين محدوداً في ظل عوامل لا إرادية مثل الوفيات الباكرة، فإن الوضع الراهن لأنماط تدريب القوى العاملة يتطلب 36 سنة بالنسبة للأطباء و29 سنة

بالنسبة للممرضات والقابلات حتى يمكن الوصول إلى الهدف الذي وضعته منظمة الصحة العالمية في الوقت الحالي وهو 2.28 من المهنيين الصحيين لكل ألف من السكان ككل، ولن تتمكن بعض البلدان من الوصول إلى هذا الهدف.

الاستنتاج: ينبغي توسيع نطاق التدريب السابق للخدمة وأن يقترن مع أساليب أخرى، من أجل زيادة عدد الوارد من العاملين الصحيين وتقليل عدد المفقود منهم.

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