

Improving Human Resource Forecasting for Healthcare Services: Global Implications of a Next-Generation Planning Solution

Accurately predicting the future supply of and demand for healthcare workers is essential if policymakers are to make good decisions about investments in human resources for health (HRH) and efficiently allocate scarce funds. HRH planning models have become increasingly sophisticated over the past two decades, but existing models have remained limited in several ways. They have often included unrealistic or simplistic assumptions, such as constant increases in the supply of healthcare workers. Using predictive models that are not comprehensive and potentially inaccurate risks that national policymakers will overestimate or underestimate future demand for and supply of healthcare workers, which can result in misspent or wasted funds.

As countries plan the health workforce of the future, they will need to account for their societies' economic, epidemiologic, and demographic (EED) transitions—their improvements in development, the effects of changes in patterns of illness, and the increases in lifespan and aging of populations (see box). Existing HRH planning models have mostly focused on only one or two of these EED transitions (such as economic and demographic transitions), and often on only one or two elements within each (such as population age 65 or over) but none of the others as shown in Table I on the following page.

The USAID-funded HRH2030 Program has produced a comprehensive new analysis and planning tool that takes into account all three types of EED transitions to predict HRH demand and that recognizes and accounts for likely future shifts in the labor market and dynamic changes in HRH supply over time. The Comprehensive HRH Assessment, Modeling, and Planning Solution (CHAMPS) is based on accepted labor market principles and uses EED data to predict the demand for HRH in the near and medium term, for example, from 2020 to 2030. Selecting 2030 as a reference year aligns with many international initiatives, first and foremost the Sustainable Development Goals, the World Health Organization's (WHO) HRH strategy, and the 95-95-95 targets for controlling the HIV epidemic.

For the first time, CHAMPS offers HRH decision and policymakers in low- and middle-income countries (LMICs) a methodology that provides more robust and country-specific estimates of healthcare worker demand and supply. Moreover, CHAMPS' ability to project the demand and supply of community health

Transitions Defined

Economic transitions are changes in wealth and resources of a country, especially in terms of the production and consumption of goods and services. As people become wealthier and their needs grow, so will the demand for healthcare workers.

Epidemiologic transitions are the shift in health and disease patterns in a population. As income increases in a country, non-communicable diseases gain in relative importance over infectious diseases. Changes in population health impact the demand for healthcare workers in numbers and by type.

Demographic transitions are the decline from high to low birth and death rates and population growth. They also relate to an increasing aging population and urbanization. As demographics change, so do populations' healthcare needs and the demand for healthcare workers with specific skills.



workers (CHWs) is without precedence and entirely aligns with estimates derived by others through different means. CHWs are key to universal health coverage. They provide primary health care to a large number of underserved and hard to reach populations. While knowing CHW numbers has been a challenge in the past, it is vital for formalizing and strengthening CHWs' role within countries' health systems.

CHAMPS, which is grounded in an analysis of data from 84 low- and middle-income countries (LMICs), produces reliable estimates of HRH supply and demand because of the number of EED factors considered and the large amount of data included, and gives policymakers a general sense about the most influential EED factors. Besides factors such as the changing epidemiology of disease, CHAMPS can address factors such as increased productivity through technological advances and shifts in health care delivery models. Application of the same methodology at the country level can help identify the factors that drive more local HRH demand and supply issues, which are likely to differ from those seen in a multi-country analysis.

Background

When workforce planning was in its infancy, country governments' decision-making on HRH was often fragmented and based on siloed budgets. Ministries of health tried to determine health workforce needs using a fixed ratio of population to healthcare workers, which could imply a need for far more healthcare workers than were available.

Worse, roles and objectives between different stakeholders in HRH planning would be misaligned in terms of budget allocations and recruitment. For example, finance ministries and civil service commissions would allot HRH funding and workers based on civil service plans, with health just one among many other sectors, such as education or agriculture. Labor unions representing government workers are often sector- and profession-specific, and their advocacy efforts might not always have been aligned with a country's health workforce but rather the interests of specific professions. Ministries of education planned intake of healthcare students based on their own goals and resources, frequently with no connection to MOH planning or patterns of healthcare worker shortages.

Early HRH models introduced 10–15 years ago were based on *supply* and *need*, but they usually ignored *demand*. In the context of HRH, the World Health Organization has defined demand as the number of healthcare workers that public and/or private health systems can support in terms of funded positions or economic demand for services, supply as the healthcare workers available in a country or region, and need as the number of such workers required to attain a health system's objectives (Cometto et al., 2016).

Table 1. Economic, Epidemiologic, and Demographic (EED) Transitions Included in CHAMPS

Economic	Epidemiologic	Demographic
Gross Domestic Product (GDP) per capita	Disability Adjusted Life Years (DALYs)	Life Expectancy at birth
Out of pocket expenditure for healthcare (OOP) per capita	Cardiovascular disease (CVD) Incidence	Death rate per 1000 people
Access to Electricity (%)	Malaria Incidence	Fraction of Urban Population (%)
	Human Immunodeficiency Virus (HIV) Incidence	Fraction of Population aged 65+ (%)
		Fraction of Population aged 15-64 (%)
		Modern Contraceptive Prevalence Rate (mCPR)

HRH Demand and Supply Measures

Physicians, Nurse-midwives, CHWs (each per 1000 population)

The absence of demand estimates for healthcare workers and EED transitions in early HRH models likely resulted in HRH plans for thousands of new doctors and nurses that countries had no hopes of paying for. As computer databases overtook paper filing systems in developing country health systems, planners were able to harness available data to automate some HRH planning functions. Dedicated HRH planning software (such as *iHRIS Plan*) aggregated data from diverse sources, such as medical school graduations, payroll records, civil service rolls, and professional medical associations. Yet these database models projected supply and need linearly, assuming that they would steadily change at the same rate but ignoring the likelihood that growth rates would shift over time because of countries' fiscal and policy constraints.

In early 2017, the *Human Resources for Health* journal published an estimation model for HRH need, demand, and supply incorporating data from 165 countries (Liu et al., 2017). This methodology, henceforth referred to as the 'Liu et al. Labor Market Projections,' was the first to take demand into account along with need and supply. While it represented substantial progress in HRH planning, it had several drawbacks as well—for example, it used a fixed physician-to-nurses ratio instead of HRH data specific to nurse-midwives or community health workers (CHWs), and it included a limited set of five EED factors compared to CHAMPS' 13 EED factors.

In the same year, USAID commissioned HRH2030 to conduct research that would build on these earlier successes and take HRH planning to the next level, reflecting sensitivity to changes in the labor market. The research happened in three phases:

- A literature review thoroughly researched existing HRH planning/projection models and methods, as well as their effectiveness.
- A conceptual framework and econometric model, which is at the core of CHAMPS, were developed to estimate demand and supply and make HRH projections.
- A three-step data analysis plan was implemented, in which HRH2030 used CHAMPS to analyze data from 84 LMICs to show how EED factors determine the demand for healthcare workers. Only LMICs were selected to ensure a group of countries that share similar health labor market constraints and for which sufficient HRH and EED data were available. The demand for CHWs was analyzed for a subset of 11 countries with the necessary data. Lastly, CHAMPS was applied to data from Ghana to illustrate how CHAMPS can be applied at country-level for estimating the demand for and supply of physicians, nurses-midwives, and CHWs (see separate brief). Any country can use CHAMPS that, like Ghana, has sufficient data for the analysis.

The ensuing methodology, CHAMPS, results in more realistic estimates of the demand and supply of healthcare workers that tend to be lower than previous projections, because CHAMPS makes fewer simplifying assumptions than the earlier methods such as linear trends. While lower demand would be easier to reach for countries, this may be offset by a lower supply of healthcare workers. It should be noted that these estimates have a wide margin of error, and the gap between demand and supply could be considerably narrower. As illustrated in the case of Ghana, an application of CHAMPS at the country level may yield very realistic HRH projections that are well within the means of a country. The earlier HRH projection methods are not suited for a country level application and could lead to misleading estimates.

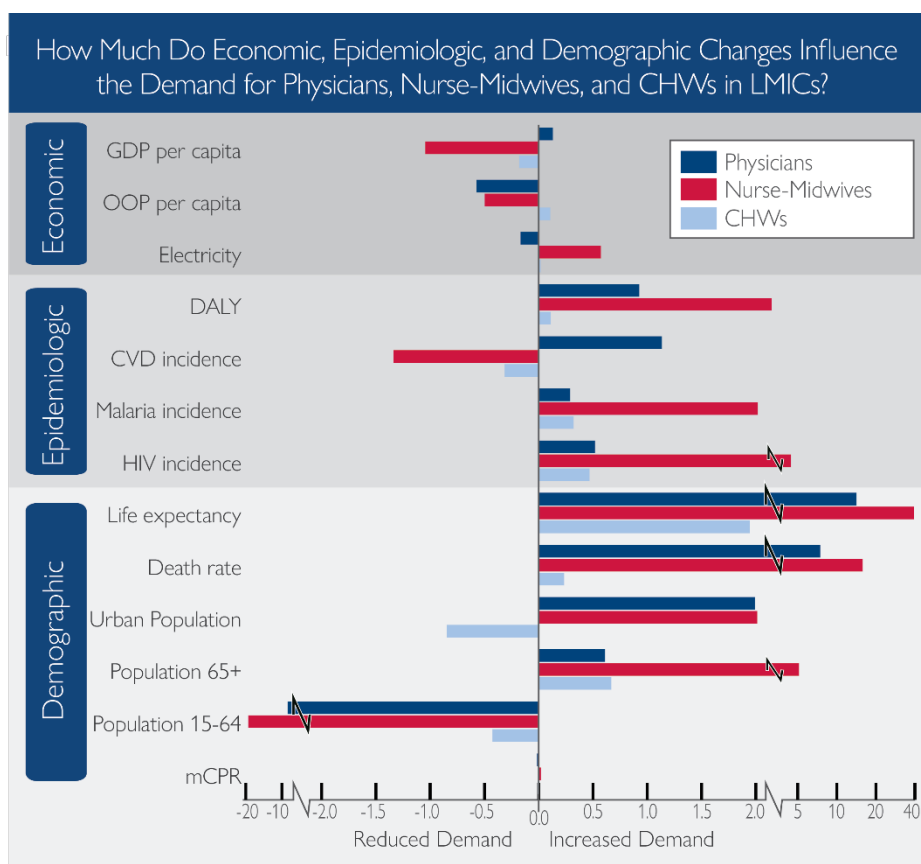
Unlike earlier HRH projection models, CHAMPS includes all data available for physicians, nurse-midwives, and CHWs. Other health professionals such as pharmacists or laboratory technicians are not yet included, because of insufficient data reported to the WHO HRH Observatory, which is the most comprehensive source for HRH data and was used to develop CHAMPS. Once data become available for more types of healthcare workers, they can be included in CHAMPS.

This brief describes some of the overall outcomes from CHAMPS; the full report about the creation and application of the CHAMPS and a brief about the application of CHAMPS in Ghana are [available on the HRH2030 web site](#).

The Impact of EED Factors on HRH Demand

Using CHAMPS to analyze data from 84 LMICs indicates that EED factors had widely varying influences on the demand for healthcare workers (defined as the number of healthcare workers per 1,000 population). Figure 1 shows how different EED factors affect societies' demand for physicians, nurse-midwives, and CHWs. (Note that the numerical results shown in Figure 1 below do not represent *actual* demand for healthcare workers, but instead simply show the relative influence of each factor on demand.)

Figure 1: How Much Do Economic, Epidemiologic, and Demographic Changes Influence the Demand for Physicians, Nurse-Midwives, and CHWs in LMICs?



Note: All EED factors shown have a highly statistically significant influence on the demand for healthcare workers. CHW estimates are based on a smaller dataset than the estimates for physicians and nurse-midwives.

- Economic transitions.** Rising GDP per capita appears to increase the demand for physicians but decrease the demand for nurse-midwives and CHWs, suggesting that as people become wealthier, they become more likely to seek and afford higher levels of care. In contrast, when people have to make more out-of-pocket expenditures for their healthcare, they will look for less expensive providers; as a result, demand for physicians and nurse-midwives will decrease, while demand for CHWs will increase. This supports the observation that when health systems

ask people to pay more for care, clients will seek out care from providers who charge less and are closer to home. Electricity access in health facilities may also impact aspects of health service delivery including quality (for example, proper vaccine storage, lighting for maternal deliveries) and hours of operation, as well as health worker motivation and retention.¹ Facilities where most services are provided by nurse-midwives may benefit more from access to electricity than facilities where services are primarily provided by physicians, who most likely already work in electrified facilities. Therefore, we see an increased demand for nurse-midwives and CHWs, but not for physicians.

- *Epidemiologic transitions.* Overall poor population health, as reflected in higher death rates and higher Disability Adjusted Life Years (DALYs)², increases the demand for all three cadres substantially. Similarly, in places where infectious diseases such as HIV and malaria are common, demand increases for all cadres. As would be expected, rising cardiovascular diseases (CVDs) increase the demand for physicians, who often provide more specialized care, and decrease the demand for nurse-midwives and CHWs.
- *Demographic transitions.* As life expectancy rises, the demand for all three types of healthcare workers increases substantially. With increasing urban population, the demand for physicians and nurse-midwives rises and demand for CHWs appears to shrink. The latter is likely attributable to data limitations and to the fact that most CHWs work in rural areas. Though relatively fewer CHWs are found in urban settings,³ they play an important role as frontline healthcare workers in both rural and urban areas.

These relative influences would be expected to appear in most LMICs to a varying degree. Thus, any individual country seeking to assess the influence of each EED factor on HRH demand and to identify factors unique to that country should run its own CHAMPS analysis. As an example, when we ran the model for [Ghana](#), the results showed that the introduction of a national health insurance scheme turned out to have a major influence on supply and demand.

CHAMPS Projections of HRH Demand and Supply

When we used CHAMPS to estimate the global demand for and supply of healthcare workers in 2020 and 2030, the model predicted that by 2030 the demand for physicians and nurses in LMICs will be 20.3 million, while the supply will only be 14.3 million (Figure 2). Thus, the model estimates a shortage of almost 6 million physicians and nurse-midwives. Likewise, CHAMPS predicts a gap of almost 2 million CHWs, which matches the number advocated by the One Million Community Health Worker Campaign and UNAIDS for 2020.⁴ The Campaign and UNAIDS derived their estimates through a review of available data, established coverage benchmarks, and literature regarding the health workforce gap. It

¹ World Health Organization, (NDA). Energy Access and Resilience. Accessed online August 20, 2019 at <https://www.who.int/sustainable-development/health-sector/health-risks/energy-access/en/>

² The Disability-Adjusted Life-Year (DALY) is the primary metric used by the World Health Organization to assess the global burden of disease. It is the sum of years of potential life lost due to premature death, and the years of productive life lost due to disability.

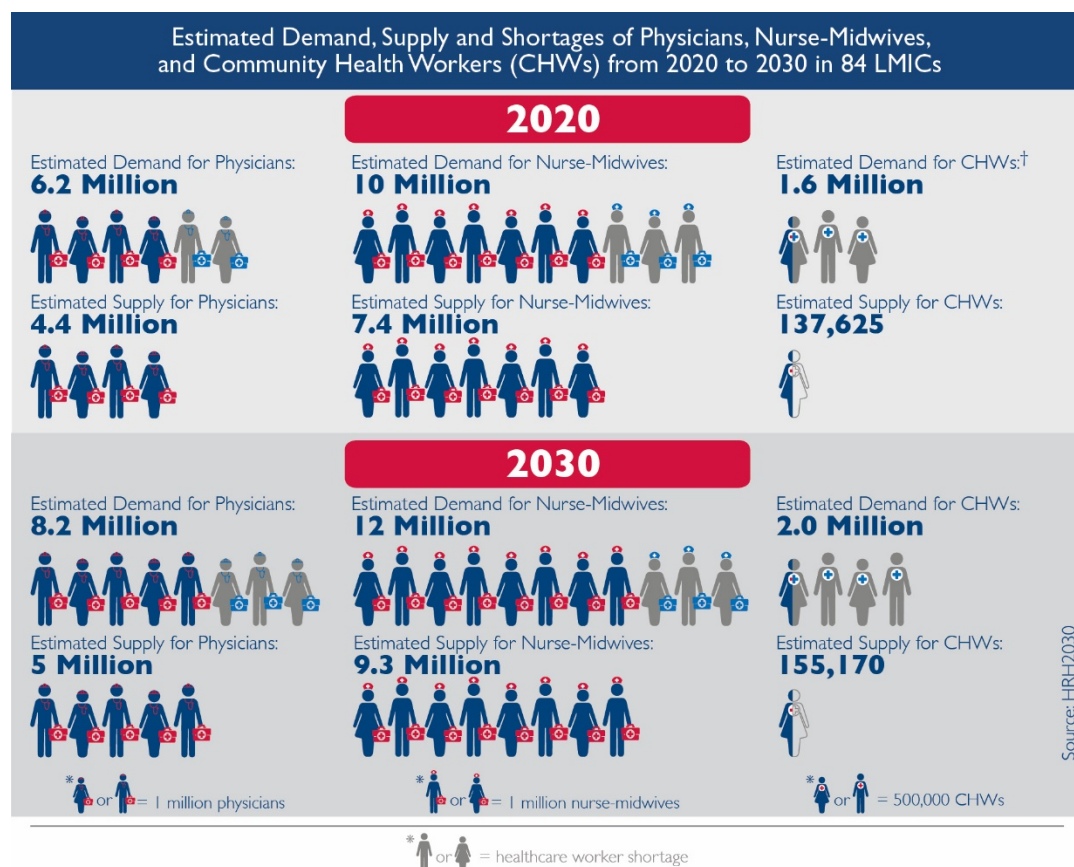
³ Data on CHWs come only from a subset of 11 countries among the 84 LMICs which had adequate data available on CHWs. For global projections of demand for healthcare workers, we extrapolated CHW demand for all 84 countries based on the proportion of physicians and nurse-midwives represented in the 11 countries compared with all 84 countries, while estimates of CHW supply were based only on the 11 countries with CHW data.

⁴ One Million Community Health Worker Campaign and UNAIDS, (NDA). 2 million African community health workers. Harnessing the demographic dividend, ending AIDS and ensuring sustainable health for all in Africa. Accessed online July 12, 2019 at https://www.unaids.org/sites/default/files/media_asset/African2mCHW_en.pdf.

lends credibility to CHW estimates that were derived from two very different approaches and yet align so closely.

While these gaps between demand and supply are daunting, closing them can still be within reach when considering that these estimates vary considerably based on data limitations. While an average shortage of 6 million physicians and nurse-midwives is expected by 2030, this prediction varies between 1.2 and 10.7 million. For CHWs, the average shortfall of 2 million by 2030 is expected to vary between 0.8 and 3.0 million. These estimates are based on 84 LMICs; for individual countries such as Ghana, closing the gap predicted by CHAMPS can be well within a country's means.

Figure 2. Estimated Demand, Supply, and Shortages of Physicians, Nurse-Midwives and CHWs from 2020 to 2030 in 84 LMICs



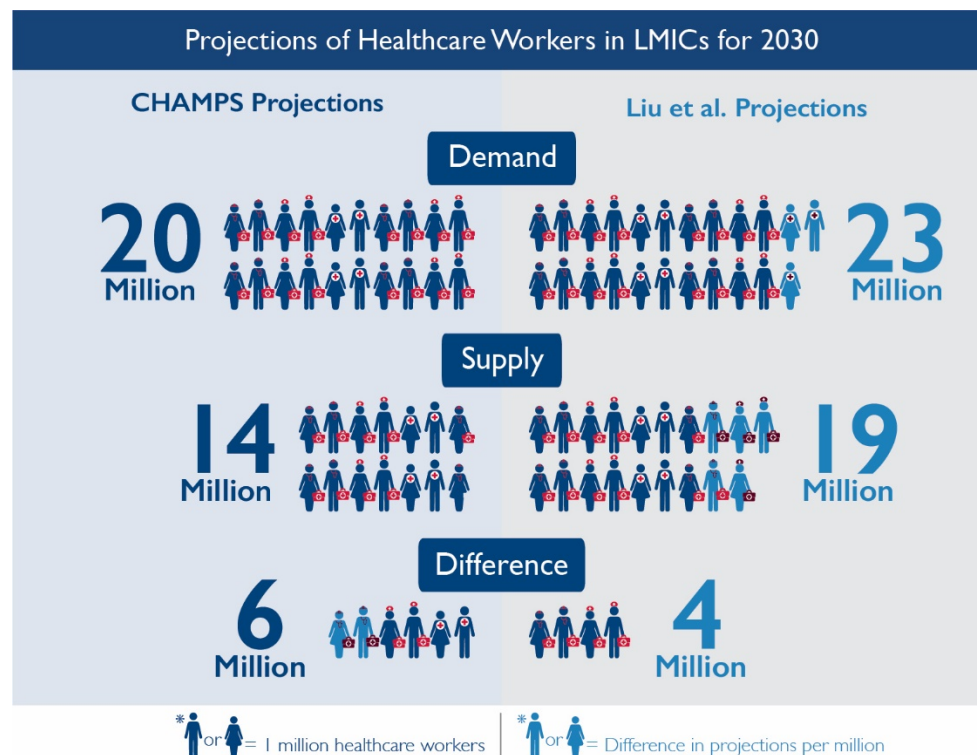
† CHW demand projected for all 84 countries based on the estimate from 11 countries; supply is based on 11 countries with CHW data only

Comparison of HRH Projections by CHAMPS and Earlier Models

These CHAMPS estimates of global demand for HRH are specific to LMICs and differ from earlier estimates from Liu et al. Labor Market Projections. Figure 3 compares the CHAMPS estimates for 84 LMICs with Liu et al. Labor Market Projections for 73 LMICs. The CHAMPS prediction for demand for healthcare workers is lower by 3 million than the Liu et al. estimate, which is more realistic, because CHAMPS considers the influence of a much larger number of EED factors together. CHAMPS also predicts a substantially lower supply than the Liu et al. Labor Market Projections—almost 6 million fewer healthcare workers, because it uses a more conservative approach that reduces the risk of

overestimating healthcare worker supply. As a result, CHAMPS forecasts a more severe healthcare worker shortage by 2030 than the Liu et al. Labor Market Projections model (5.9 million vs. 3.7 million).⁵

Figure 3. Projections of Healthcare Workers in LMICs for 2030



Implications for HRH Policymakers and Planners

The comparison of the results obtained with CHAMPS and from earlier HRH projection methodologies may invite questions about which methodology is ‘better.’ However, methodological advances such as CHAMPS are not about being better or worse or right or wrong. They are about improvements that result in more realistic and robust estimates of HRH demand and supply. These methodological improvements rely less on simplifying assumptions and include vastly more information, which reduce the risk of overestimation. The new, more realistic HRH demand and supply estimates produced by CHAMPS, especially when applied at a country level, help HRH policymakers and planners find solutions to healthcare worker shortages and shape the composition and skills mix of the future health workforce.

⁵ This difference can be partly attributed to a change in methodology, but the inclusion of new HRH and EED data contributes to the differences as well. Another reason is that the Liu et al. Labor Market Projections and CHAMPS analysis include different sets of countries. The Liu et al. Labor Market Projections are based on World Bank country groupings by income of 73 low and lower-middle income countries. The 84 LMICs included in the analysis for physicians and nurse-midwives using CHAMPS are composed of low, lower-middle and upper-middle income countries (11 low and lower-middle income countries for CHWs). However, the difference in country composition seems much less important than methodological improvements and the availability of new data, because the Liu et al. Labor Market Projections method would have predicted a much higher demand based on the inclusion of upper-middle income countries in our analysis than the lower demand actually estimated by CHAMPS.

Both proven and promising policy changes for addressing HRH shortages are plentiful and well known. Indeed, the WHO *Global Strategy on Human Resources for Health* offers dozens of policy options in four broad categories: HRH production, inflows and outflows, distribution, and regulation of the private sector. CHAMPS offers a more comprehensive data analysis than has been done in the past, allowing the consideration of more specific policy actions, including production of specific cadres and skills mixes in response to EED changes, reducing out-of-pocket payments via insurance, and assessing the extent to which the private sector can respond to demand (where such data are available).

Policy actions based on a multi-country analysis may not all apply at the individual country level. Our CHAMPS analysis using Ghana-specific data suggests that the shortage of physicians in Ghana projected for 2030 is much lower than the shortage noted from the global data (5% vs. 43%, respectively). This difference may be explained by a number of factors, such as the rapidly growing younger population (which is healthier and associated with fewer DALYs). Projected higher out-of-pocket expenses also may impact demand for physicians negatively, although this should be counteracted by Ghana's national health insurance, which was introduced in 2003. Policymakers may need to investigate the intended vs. actual effects of national health insurance and whether it is reaching its intended beneficiaries (the lower socioeconomic strata), and if not, what policy changes may be needed to achieve its goals. If, on the other hand, out-of-pocket payments are rising because relatively more well-off people are willing to pay for services not covered under the basic national health insurance coverage, then more attention may need to be given to needs-based targeting, the basic benefits package, and the role of private healthcare providers.

The CHAMPS multi-country global analysis as well as the Ghana analysis also suggest that as GDP per capita rises, demand for physicians increases more than for nurses or CHWs. With higher income, we would expect people to afford higher out-of-pocket payments for services, much of this benefiting the private sector. While not without controversy, policies about allowable dual practice may have the advantage of meeting an anticipated increased demand for physicians, but also may help reduce physician turnover in the public sector, as MOH doctors may seek relatively greater financial incentives from working in the private sector.

Data from the multi-country analysis and for Ghana also show that increasing incidence of CVD will be a key driver of demand for physicians, and less so for nurses and/or CHWs. This change will need policy attention, not only in terms of cadre mix but also with regard to medical school curricula. Training for all cadres will need to include techniques for diagnosing and treating CVDs, perhaps reducing emphasis on communicable diseases. In addition, a well-functioning system for drug and medical supplies is needed to treat CVDs and other noncommunicable diseases.

Infectious diseases such as HIV and malaria are still a heavy burden on health systems in LMICs but—unlike CVDs— their numbers are expected to decrease over the coming decade. This decline in new cases will result in a lower demand for all types of healthcare workers by 2030.

Conclusion

The analysis of data from 84 LMICs using CHAMPS projects a lower but more realistic demand and supply of physicians and nurse-midwives than the projections by Liu et al. from a few years ago. For the first time, we have projected the demand and supply of CHWs based on EED transitions and historic CHW numbers. While demand may not be as high as predicted earlier, a much lower supply of healthcare workers than was previously estimated is likely to exacerbate the gap between demand for physicians and nurse-midwives and their supply. However, it is important to remember that due to data limitations, these estimates have a considerable margin of error, so the actual gap could be smaller and

closed with the resources available. HRH planners and policymakers who are committed to closing this gap need to act now to meet the challenges brought about by the EED transitions that countries will go through in the coming decade. This will require changes that drive the demand for healthcare workers, especially to the fiscal space available to governments as well as different service delivery models where tasks are shared between more types of care providers and more services are offered in communities easing the burden on health facilities. Increasing the supply and skills mix of the health workforce will necessitate changes and investments in the educational sector. All these measures take time, require political will, and should rely on the best available evidence. CHAMPS can provide this kind of evidence.

For the first time, CHAMPS offers HRH decision and policymakers in LMICs a methodology that provides more robust and country-specific estimates of healthcare worker demand and supply. CHAMPS estimates are based on a more comprehensive data set and inclusive analysis than was feasible in the past, taking into account many different EED changes. Such estimates allow policy decisions to be more targeted in response to predicted changes in a country. As HRH data become more available and reliable, these predictive scenarios will become even more dependable.

Closing the gap between the demand for healthcare workers and the supply will be a formidable task. Even though many LMICs are likely to experience rapid economic growth and will be able to invest more in the healthcare workforce, countries still will need to carefully plan the size and composition of their future workforce and consider more efficient health service delivery models, given the limited fiscal space for the health sector, if they are to meet an increased demand for healthcare workers due to changing patterns of disease and to population dynamics. CHAMPS provides countries with a methodology for better assessing future health workforce demand and for conducting improved evidence-based HRH planning.

ABOUT CHAMPS

CHAMPS is a rigorous methodology that is designed to be applied in a country setting with a relatively small level of effort because much of the data is already included in the global database developed for this study. It is estimated that the data review and analysis could be completed in approximately 5 -10 days, depending how much additional data needs to be gathered. The report writing would take an additional 3 - 5 days. Ideal team composition would consist of a researcher with a health economics background, a research assistant, and a report writer. Applying CHAMPS on a country level would involve the following six broad steps:

- 1) Review the data for your country in the database for 84 LMICs
- 2) Identify additional data needs and sources
- 3) Prepare data for analysis
- 4) Conduct the statistical analysis
- 5) Facilitate a stakeholder workshop
- 6) Implement policy and practice changes

Each step is described in detail in the [policy brief for Ghana](#). For a copy of the full report about the creation and application of the CHAMPS model and a global and country level, [visit the HRH2030 web site](#). To get more information on applying CHAMPS in your country, contact info@hrh2030program.org

This material is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of cooperative agreement no. AID-OAA-A-15-00046 (2015-2020) in partnership with The U.S. President's Emergency Plan for AIDS Relief. The contents are the responsibility of Chemonics International and do not necessarily reflect the views of USAID or the United States Government.