By Fiona J. Walsh, Mutinta Musonda, Jere Mwila, Margaret Lippitt Prust, Kathryn Bradford Vosburg, Günther Fink, Peter Berman, and Peter C. Rockers

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Improving Allocation And Management Of The Health Workforce In Zambia

ABSTRACT Building a health workforce in low-income countries requires a focused investment of time and resources, and ministries of health need tools to create staffing plans and prioritize spending on staff for overburdened health facilities. In Zambia a demand-based workload model was developed to calculate the number of health workers required to meet demands for essential health services and inform a rational and optimized strategy for deploying new public-sector staff members to the country's health facilities. Between 2009 and 2011 Zambia applied this optimized deployment policy, allocating new health workers to areas with the greatest demand for services. The country increased its health worker staffing in districts with fewer than one health worker per 1,000 people by 25.2 percent, adding 949 health workers to facilities that faced severe staffing shortages. At facilities that had had low staffing levels, adding a skilled provider was associated with an additional 103 outpatient consultations per quarter. Policy makers in resource-limited countries should consider using strategic approaches to identifying and deploying a rational distribution of health workers to provide the greatest coverage of health services to their populations.

Many low- and middle-income countries, especially those in sub-Saharan Africa, are facing escalating demands for health services that are rapidly outpacing available financial and human resources.[1] Governments eager to scale up their health workforces are further challenged by macroeconomic policies that make it difficult to expand recurring wage expenditures without evidence-based staffing plans for public-sector health facilities.[2] Under these conditions, ministries of health must be equipped with persuasive data when negotiating with ministries of finance and labor to maximize funding for health workers during governmental budgetary revisions. As financial pressures increase, health planners are seeking tools that can be used to calculate short-term staffing targets that are tailored to the country's demands for health services and that reflect what can realistically be afforded in an annual budget cycle. In turn, health managers at the central and facility levels can use these types of planning tools to identify opportunities to deploy and manage their existing workforces more effectively.

More detailed, evidence-based workforce targets for health workers may be more likely to garner the support of ministries of finance and labor for increased funding, compared to general population-based estimates.[3] The 2006 clinician-to-population ratio (22.8 to 10,000) of the World Health Organization (WHO) was designed to serve as a rallying call to the international community to support a dramatic scale-up of the human resources for health needed to reach the United Nations (UN) Millennium Development Goals by 2015.[4] However, for thirty-

Fiona J. Walsh (fwalsh@clintonhealthaccess.org) is a senior technical adviser on the Swaziland MaxART Early Access to ART for All trial with the Clinton Health Access Initiative in Boston, Massachusetts.

Mutinta Musonda was assistant director of human resources, management, and development at the Ministry of Health in Lusaka, Zambia, at the time this work was conducted. She is currently a director in the Cabinet Office in Zambia.

Jere Mwila is director of special duties in the Cabinet Office of the Government of Zambia, in Lusaka.

Margaret Lippitt Prust is a senior technical adviser on the Applied Analytics Team at the Clinton Health Access Initiative.

Kathryn Bradford Vosburg was director of human resources for health for Zambia at the Clinton Health Access Initiative at the time this work was completed. She is currently a management analyst at the San Mateo (California) County Health Department.

Günther Fink is a professor in the Department of Global Health and Population at the Harvard T. H. Chan School of Public Health, in Boston.

Peter Berman is a professor in the Department of Global Health and Population at the Harvard T. H. Chan School of Public Health.

Peter C. Rockers is an assistant professor of global health in the Department of Global Health at the Boston University School of Public Health, in Massachusetts.

three low-income countries, the WHO's needs-based estimates have proved to be an unrealistic immediate goal for national health staffing targets, as meeting the WHO's ratio would require a doubling of each country's total health expenditure.[5] Building a health workforce requires a focused investment of time and resources, and ministries of health urgently need tools to create pragmatic staffing plans and prioritize spending for health facilities that are struggling to meet demands for services.

A rational approach for calculating optimal staffing targets has been needed for many years, and several demand-based methods have been put forward. In 1998 the WHO developed the Workload Indicators of Staffing Need to determine the health staffing levels required to deliver a specific package of health services to a given population. This approach has been successfully applied to determine the number of health workers required to deliver maternal and child health services in one district in India[6] and to calculate the staffing norms for health facilities in Uganda.[7] Similar activity-based efforts have been used to inform health worker staffing plans to deliver antiretroviral therapy[8] and hypertension management services.[9] However, because these methods focus on a specific task or cadre of health worker, they cannot provide a comprehensive analysis that reflects the full range of tasks performed by a health worker. Excluding data related to patient demands for other types of basic health services from the staff in place makes it difficult for ministries of health to adjust their facility-level staffing plans and establish equitable distributions of their health workforces across their national health systems.

Background On Workforce Planning In Zambia

The health system in Zambia is decentralized, with services provided in primary (district), secondary (provincial), and tertiary (central) facilities. Inefficiencies in workforce planning impose significant economic and human costs on the health system as a whole. In 2006 the Zambian Ministry of Health began to implement an aggressive strategy to address its severe shortage of human resources for health. Despite the gains made through this strategy, in 2009 the country was still struggling to serve a population of 12.7 million with just 9,623 doctors, nurses, and midwives—or 7.6 clinicians per 10,000 population.[10,11] In 2009 Zambia needed an additional 28,906 doctors, nurses, and midwives, or nearly twice its existing workforce, to meet the WHO's threshold of 22.8 doctors, nurses, and midwives per 10,000 population.[4]

Not only did Zambia have a severe staffing shortage, but a maldistribution of the workforce left rural areas with seven clinicians per 10,000 people, compared to sixteen clinicians per 10,000 in urban areas.[12,13] This shortage of health workers made it impossible to deliver adequate and equitable health care and was recognized by the government as a critical challenge that was preventing the country from achieving the Millennium Development Goals.[14]

The systems used to plan and deploy Zambia's health workforce were cumbersome, which posed further challenges to efforts to close the country's staffing gaps. In particular, the centralized health worker recruitment process in the public sector was often lengthy and inefficient, leaving some newly trained workers waiting for more than a year to be employed. Bottlenecks in the recruitment and deployment processes affected the Ministry of Health's ability to recruit new workers and assign them to vacant positions efficiently. As a result, the ministry was often unable to spend all of its approved annual personnel budget. In 2007 only 1,400 of Zambia's 1,700 newly funded positions were filled, leaving 18 percent of the approved budget for new recruits unspent.[2]

In recognition of these challenges, the Ministry of Health identified the need for an evidence-based planning tool that could be used to maximize the immediate impact of public- and private-sector investments and scale up the country's health workforce in a way that comprehensively addressed the public's health service demands. In November 2008 the Ministry of Health invited the Clinton Health Access Initiative to create a system to identify where workload pressures on staff were especially great, as a result of population demands for facility-level health services. This would enable the Ministry of Health's Department of Human Resources to prioritize the placement of clinicians in the districts where health workers were most in demand. The resulting workforce optimization model used current service delivery data to calculate the numbers of physicians, clinical officers, midwives, nurses, and pharmacy staff members required at each of the country's health facilities to meet actual health demands. (Clinical officers in Zambia receive three years of post-secondary training to diagnose and manage common health conditions and can perform minor surgeries.) Based on the resulting calculations, the Ministry of Health—with assistance from the Clinton Health Access Initiative—reorganized its deployment strategy for new health workers to prioritize staffing at the rural districts where the workload pressures were great.

Study Data And Methods

This analysis of the Zambian health workforce is presented in two stages. First, we discuss the findings from the workforce optimization model developed in 2009 and the resulting policy recommendations that were used to improve the allocation and distribution of the national health workforce. Second, we analyze the impact of staffing changes on the use of health services.

CALCULATING DEMAND-BASED WORKFORCE TARGETS FOR ZAMBIA The workforce optimization model was structured to answer several key questions for policy makers: Which districts had the highest demand for health services, and what specific types of clinicians were required to meet those demands? How can national investments in public-sector health staffing and skill mix be aligned with the population's demand for health services? Finally, when financial resources are limited, how can national planners prioritize investments in different cadres of health workers when scaling up the workforce?

The resulting Excel-based model used a comprehensive range of government data, including payroll data collected from the Ministry of Health's Payroll Management Establishment Control system, the government-approved numbers for funded or budgeted health workforce positions, results of interviews with clinical experts in the Ministry of Health and clinicians at health facilities, and data on the volume of each type of health service provided by each facility from the ministry's Health Management Information System. The model included five cadres of providers—physicians, clinical officers, midwives, nurses, and pharmacists—that the ministry determined were high priorities. The ministry's Directorate of Human Resources and Administration was the Clinton Health Access Initiative's primary partner on this project, providing support by helping design the approach, gathering data necessary to complete the analysis, and reviewing and disseminating the final results. The Clinton Health Access Initiative obtained permission from the Ministry of Health to conduct interviews with health workers in the field about their workload and how much time they spent on each activity.

The calculations of the optimal health workforce required for each health facility in Zambia were based on the following basic formula: number of services provided multiplied by the time required per service and then divided by the time available per health worker. Additional information about each input is in Appendix 1.[15]

ANALYSIS OF HEALTH WORKER DISTRIBUTION AND USE OF SERVICES The outcome of the workforce optimization model was a list of health facilities and the number and type of health workers required to meet each facility's demand for health services. The ministry used these recommendations to guide the deployment of new health workers in 2009–11.

We measured changes in staffing using staffing reports from the Ministry of Health's payroll system for each health facility in Zambia in October 2009 (before the implementation of a new deployment process based on the results from the workforce optimization model) and in December 2011 (after the model had been in use for an extended period). To understand whether the recommendations produced by the model informed actual staffing decisions, we also investigated the relationship between optimal facility-specific staffing levels estimated in 2009 and the probability of a facility's gaining staff by December 2011. Specifically, we charted the probability of gaining staff by 2011, stratified by estimated staffing shortages in 2009 based on the optimization model. We focused on nurses and midwives for this analysis because the numbers of workers in these cadres were sufficient to provide the necessary sample size. If the restructuring followed the recommendations, we would expect to see a positive relationship between estimated optimums and the probability of receiving additional staff by 2011.

Finally, we analyzed the impact of the redistribution of skilled staff resulting from uptake of the optimization model on population use of health services. Data on health services were collected from the Ministry of Health's Health Management Information System. In 2009 health facilities in Eastern and Lusaka Provinces did not report service output data to the system, so we excluded from this analysis health facilities in these provinces.

To construct the final data set, we summed monthly service use data within quarters and merged these data with quarterly facility staffing data. Around 2 percent of monthly service use data during the study period were not recorded in the Health Management Information System. Before summing within quarters, we imputed these missing monthly observations as the average of the remaining months in the same quarter for which data were available. When all months in a given quarter were missing, data for that quarter were coded as missing in the final data set. We fitted a series of ordinary least squares regression models to investigate associations between changes in health worker staffing and changes in service outputs. All statistical analyses were conducted using Stata, version 12.

LIMITATIONS This demand-based workload modeling approach has several limitations that should be recognized. First, the purpose of this analysis was to prepare demand-based staffing

targets for public health facilities throughout Zambia. However, the facility-level targets should be interpreted with some caution, since demand-based indicators may be imprecise.

Second, the model relied on clinical experts to provide data on how much time different types of health workers needed to perform various essential health care services. Since patient management is not an exact science, these approximations were subjective.

Third, data from the Health Management Information System were not available for 170 facilities, and some facilities did not report data for a full year. The facilities without any data were removed from the analysis. When one or more months of data were missing for a facility, values were imputed using an average of the available months. Fourth, underreporting of data was a possibility, in which case the true demand for human resources could have been higher. Fifth, if demand for services observed in 2009 was dampened at certain facilities by staffing shortages—that is, if observed demand was lower than undampened demand—the model would likely underestimate optimal staffing levels for those facilities.

Sixth, the model did not include facility-level data for attrition, absenteeism, or retirement, information that has implications for the interpretation of the outputs. The demand requirements calculated by the model were intended to identify facilities where the services patients demanded required more time than the health workers had available, and to provide central-level planners with more information about which facilities needed more resources to avoid health worker burnout and other causes of voluntary and involuntary attrition.

Finally, it must be emphasized that the optimal staffing levels for each facility produced by the model were meant to reflect the numbers of health workers needed to meet the health demands of average patients. For this reason, the model did not incorporate extraneous variables such as the physical distance to the nearest health center, use of services, age distribution, availability of medical equipment, and disease incidence by district. Additionally, since the most recently updated data from the Health Management Information System were used to determine demand frequencies, the outputs of the model reflected the numbers of health workers required to meet only the current demand for health services, not the future demand. To adjust for future changes to health demands in Zambia, the model was designed as a tool that could be easily and regularly updated with new data from the Health Management Information System and staffing information.

Study Results

WORKFORCE OPTIMIZATION MODELING The workforce optimization model was used to calculate the numbers of health workers required to meet demand for health facilities in all nine of Zambia's provinces. In 2009 Zambia had a total workforce of 11,323 physicians, clinical officers, nurses, midwives, and pharmacy staff members serving a population of 12.9 million people. The model determined that the country required an additional 9,059 of these five high-priority cadres to meet existing demand for services.

Furthermore, the country had severe shortages in three of the five priority cadres. When we compared the optimal numbers of staff members from the model outputs to the 2009 numbers of health workers nationally, the greatest difference was for pharmacy staff members (440 versus 2,130, for a vacancy rate of 79 percent), clinical officers (1,200 versus 3,708, a vacancy rate of 68 percent), and doctors (607 versus 1,858, a vacancy rate of 67 percent) (Exhibit 1). There were also substantial vacancy rates for midwives (45 percent) and nurses (23 percent). The vacancy rate for doctors was greater than 78 percent for six of the nine provinces—all provinces except the most urban ones.

Variability in vacancy rates across the country confirmed the maldistribution of the workforce and highlighted opportunities for improved staff allocation to increase access to underserved areas. For example, Copperbelt Province had 1,583 nurses, while—based on 2009 demand—the optimal number of nurses for its health facilities was 1,275 (data not shown). Thus, it had 24 percent more nurses than were required to meet demand. Yet Northern Province had only 42 percent of the optimal number of nurses (484 out of 1,143).

Variations in staff vacancy rates also existed by facility type. Nationally, hospitals had 120 percent of the physicians and 196 of the nurses needed, while rural health facilities had only 30 percent of the staff required to meet the demand for health services (data not shown).

IMPACT ON STAFFING ALLOCATION Building on the analysis provided by the optimization model, the Ministry of Health used the numbers provided by the workforce optimization model to determine the funds needed—and where to allocate them—to meet staffing needs. The level of detail provided by the model equipped the ministry with the data needed to build a detailed and rational budget request to submit to the Ministry of Finance. The clarity of this request improved the Ministry of Health's ability to advocate for more funds from the Ministry of Finance for the health workforce during national health-sector budget negotiations.

For the 2011 budget the Ministry of Health secured an increase in funding of 13 billion kwacha (approximately US $2.5 million), which was a 30 percent increase on the budget from the previous year. These additional funds were used to deploy heath workers to the facilities that had been identified as having the most critical staff shortages relative to the demand for health services.

To prioritize the deployment of health workers based on the demand for health services, the Clinton Health Access Initiative used the model's results to rank Zambia's seventy-two districts from high to low by their vacancy rates for each type of provider. After identifying the districts with the highest vacancy rates, the Ministry of Health prioritized recruitment strategies for districts most in need and reorganized its recruitment and hiring processes so that newly trained workers could be quickly absorbed into the public-sector workforce and deployed accordingly. The ministry also organized recruitment fairs, which were used to mobilize 2,063 newly trained workers to join the health workforce through a streamlined hiring process.

The result was an increase in the number of health workers deployed to remote provinces. Between 2009 and 2011 the Ministry of Health's efforts to strategically deploy health workers to districts that were struggling to meet demands for health services resulted in a 25.2 percent increase in health workers (or 949 new workers) in districts that previously had fewer than one health worker per 1,000 people, compared to an increase of only 12.8 percent for the rest of the country. Twenty-one doctors were posted to fifteen districts that had previously had no doctors. The targeted deployment of sixty newly trained midwives to the fifteen districts most in need of this type of provider reduced these districts' midwife vacancy rates by 19 percent. These results summarize overall changes between 2009 and 2011 and include negative outflows of staff during this period.

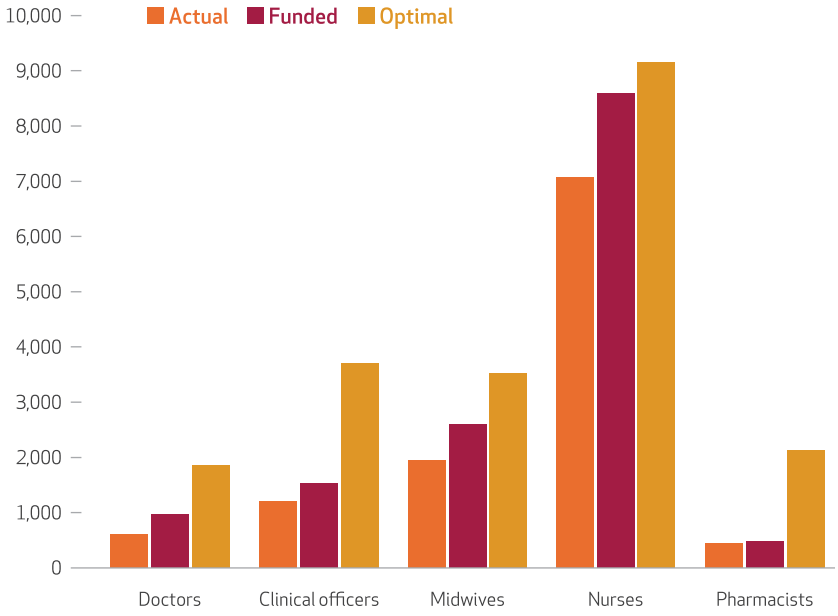
Within districts, there is evidence that facilities with the greatest demand for additional health care workers were given priority over other facilities when new workers were deployed. For example, we found a clear positive relationship between the facility-level shortages of nurses and midwives determined by the workforce optimization model in 2009 and the probability that the facilities would have gained workers of these types by 2011 (Exhibit 2).

ASSOCIATIONS BETWEEN STAFFING CHANGES AND SERVICE VOLUMES We analyzed 2011 volumes for three services: outpatient consultations, first antenatal care visits, and facility-based deliveries. For each service, we estimated the association between staffing changes and changes in volume at all health care facilities in the study and in those facilities that had no or only one skilled provider in 2009—that is, those most in need of additional skilled staff members.

When we looked at all facilities, we found that the changes in numbers of skilled providers were not significantly associated with changes in any of three service volumes (Exhibit 3). However, when we looked only at facilities with no or only one skilled provider on staff in 2009 (before reform), we found a strongly positive relationship between changes in numbers of skilled providers and outpatient consultations: One

EXHIBIT 1

Actual, funded, and optimal numbers of health workers in Zambia, by type of worker



SOURCE Authors' analysis of data from the Ministry of Health payroll and modeling results. **NOTES** Funded numbers are from the 2008 budget. Actual numbers are from May 2009. Clinical officers in Zambia are defined in the text. The optimal numbers shown here do not meet the WHO's threshold of 22.8 health workers per 10,000, but instead are the outputs of the optimization model.

EXHIBIT 2

Relationship between a Zambian health care facility's shortage of nurses or midwives in 2009 and the probability of the facility's having gained such providers by 2011

	Probability of gaining a:	
Level of staffing shortage	**Midwife**	**Nurse**
Low	30%	7%
Medium	36	9
High	53	10

SOURCE Authors' analysis of data from the Ministry of Health payroll system. **NOTES** Staffing shortage categories for midwives are as follows: low, <1; medium, 1–2; and high, >2 (estimated in 2009). Staffing shortage categories for nurses are as follows: low, <2; medium, 2–5; and high, >5 (estimated in 2009).

EXHIBIT 3

Associations between changes in health worker staffing and changes in quarterly service volumes in Zambian health care facilities

	Change from 2009 to 2011 in volume per quarter						
	Outpatient consultations		First antenatal care visits		Facility-based deliveries		
	All facilities	Facilities with 0 or 1 skilled provider in 2009	All facilities	Facilities with 0 or 1 skilled provider in 2009	All facilities	Facilities with 0 or 1 skilled provider in 2009	Facilities with 0 or 1 skilled provider in 2009, with interaction term
Change in skilled providers	1.45	103.28***	0.08	1.56	−0.03	−0.04	−5.40***
Change in nonskilled staff	2.65	40.99	−0.98***	−0.22	−1.13***	0.40	0.39
Rural health center	−1,379.79***	−253.73	−11.24***	9.43	2.08	9.96	0.41
Interaction term[b]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	0.07***
Constant	1,931.33***	692.24	23.43***	10.50	6.28***	−2.54	7.57
R-squared	0.14	0.12	0.21	0.27	0.14	0.01	0.05
No. of facilities	641	340	644	341	644	341	341

SOURCE Authors' analysis of data from the Ministry of Health payroll system and health management information system. **NOTES** The reform was the Ministry of Health's restructuring of the health worker deployment process in 2009. Skilled providers were doctors, clinical officers, nurses, and midwives. Clinical officers in Zambia are defined in the text. Nonskilled staff members were pharmacists, environmental health technicians, administrators, and support staff members. All models included a control variable that measured the dependent variable in 2009, before the reform. The Appendix includes Supplemental Exhibit 3, a version of this exhibit with confidence intervals (see Note 15 in text). [a]Not applicable. [b]The interaction term was between the change in the number of skilled providers and a high volume of antenatal care in 2009. ***$p < 0.01$

additional skilled provider was associated with an additional 103 outpatient consultations per quarter. This constitutes a roughly 15 percent increase in volume when compared to the average number of outpatient consultations per quarter for these facilities.

We included an interaction term to investigate whether the relationship between changes in the numbers of skilled providers and facility-based deliveries was modified by the number of antenatal care visits in 2009. We investigated this because one might expect antenatal care volume to be an indicator of unmet need for delivery care. We found a strong positive relationship between the interaction term and changes in the volume of facility-based deliveries, which indicates that at facilities that provide high volumes of antenatal care, the relationship between numbers of skilled providers and facility-based deliveries was positive. For example, at an average health center where 80 first antenatal care visits were provided per quarter, an additional skilled provider was associated with an additional 0.2 facility-based delivery per quarter. Alternatively, at a facility with 125 first antenatal care visits per quarter, an additional skilled provider was associated with an additional 3.4 facility-based deliveries per quarter. This difference can be estimated from the fact that for each additional first antenatal care visit at a facility, an additional skilled provider was associated with an additional 0.07 facility-based delivery. This increase constitutes around a 10 percent increase in volume, compared to the average number of facility-based deliveries per quarter in these facilities.

Conclusion

As demonstrated in Zambia, an effective and efficient mobilization of human resources for health is essential for resource-limited countries that seek to improve the performance of their health systems using limited dollars. A well-functioning and rational distribution system for health workers can improve access to care, particularly in underserved communities, and can strengthen capacity for projecting future health staff requirements. Central- and facility-level coordination of the recruitment and deployment of health workers will benefit from the use of evidence-based tools and strategies that allow planners to explore alternative interventions and facilitate a rational and equitable allocation of limited resources. Policy makers in resource-limited settings who are interested in designing comprehensive, evidence-based strategies to scale up the workforces to meet their populations' demand for health services need a tool that is customized to their planning needs.

The workforce optimization model offers a simple, low-cost solution that uses data sources that are often available in information-poor settings. The framework for the model can be easily adapted for other countries seeking better plan-

ning strategies for human resources for health. Zambia's successful use of this approach has been replicated by the Clinton Health Access Initiative in Malawi (in 2010 and 2014), Lesotho (2013), and Swaziland (2012 and 2014), and the approach has been used by the ministries of health in those countries to inform their strategic planning related to human resources for health.

In general, more research is needed to develop a strong evidence base for policies related to human resources for health in developing countries such as Zambia. Given the growing body of evidence that the quality of care has an important effect on health-seeking behavior, underinvestment in human resources may play an important part in constraining levels of health care use in developing countries. However, in the absence of other important investments—including those that improve health facility infrastructure, access to equipment, and supply of medicines—the impact of expanding access to skilled providers may be limited. ■

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15 To access the Appendix, click on the Appendix link in the box to the right of the article online.

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