

## **2. PROMISING CHOICES: HOW HEALTH WORKFORCE POLICY CHOICES DICTATE HEALTH OUTCOMES**

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### **MEASUREMENT, DIVERSITY, AND POLICY CHOICE**

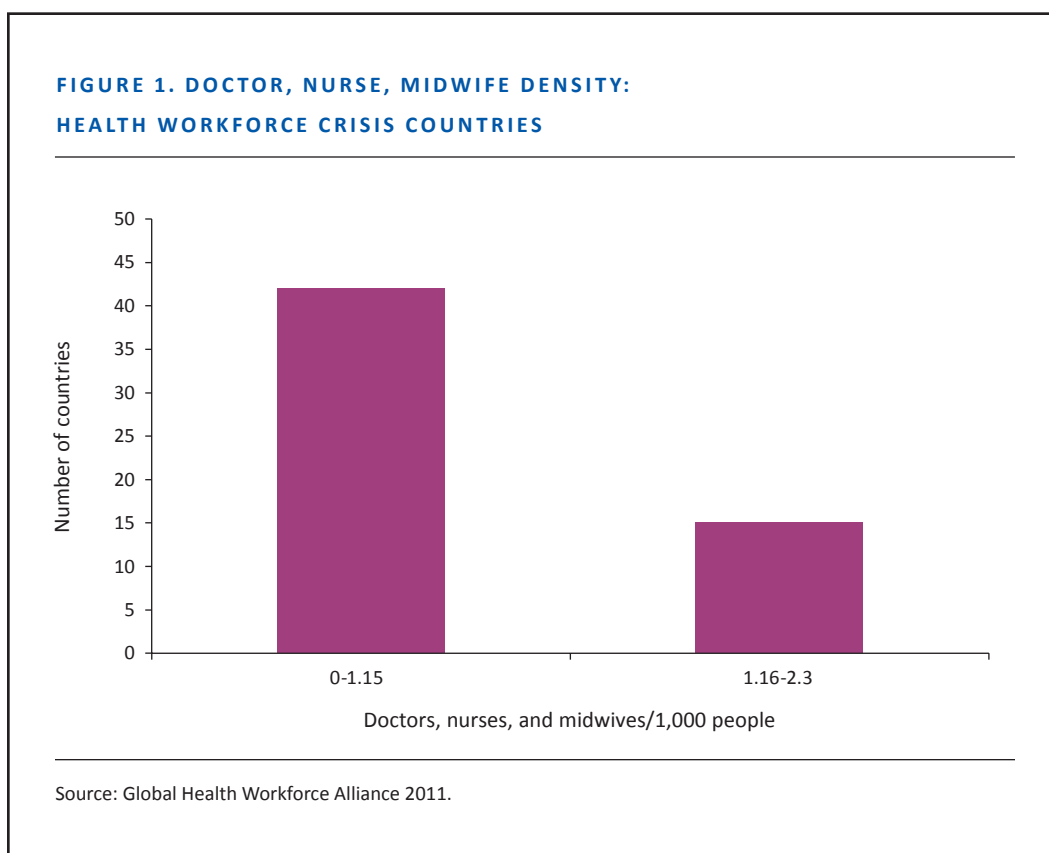
Quite properly, much attention has been given to the countries identified as having a health workforce crisis in the 2006 World Health Report (World Health Organization 2006). That report and many subsequent documents have argued that lack of access to health workers fundamentally inhibits progress toward the health-related Millennium Development Goals (MDGs) and other indicators of health progress. In this paper, we argue that this premise must be substantially refined in two ways. First, the conventional definition of which countries are in crisis, per the World Health Report, depends exclusively on the density of doctors, nurses, and midwives. However, this criterion does not take into account the much broader array of health workers who provide services that can dramatically affect health outcomes. A more comprehensive indicator or indicators of access to health workers yields a very different portrait of access to health care. There is much greater diversity in access to health care among the health workforce crisis countries than just considering doctors, nurses, and midwives might suggest. A second refinement, flowing from the first, is that countries have responded to a low density of doctors, nurses, and midwives in very different ways, yielding strikingly different health outcomes. Countries have substantial latitude to make policy choices that will mitigate shortages of high-level health professionals.

### **HEALTH WORKFORCE SHORTAGES: A BARRIER TO HEALTH PROGRESS**

Health workers are the living bridge between the vast body of medical and public health knowledge and populations in need of health care. Access to skilled, empowered, and supported health workers has been the foundation for the improvements in child survival, maternal health, access to anti-retroviral treatment, and other health gains that have been achieved in recent years. Unfortunately, access to health workers and the skills they bring remain denied to millions of people. In this paper, we will show that countries of modest means and limited access to health professionals can still achieve major gains in health by the policy choices they make to overcome health worker deficits.

The 2006 World Health Report (WHR) identified fifty-seven countries that are deemed to have a health workforce crisis, defined as those having fewer than 2.3 doctors, nurses, and midwives (DNM) per 1,000 people (World Health Organization 2006). By late 2011, only one of the fifty-seven countries, Indonesia, had surpassed the 2.3 DNM/1,000 threshold. Of the health workforce crisis countries, forty-two have a health worker density of less than half the threshold (figure 1), according to a report released by the Global Health Workforce Alliance at the January 2011 Second Global Forum on Human Resources for Health (Global Health Workforce Alliance

2011). The report shows an average density among the crisis countries of only 0.88 DNM/1,000. These data suggest that the health workforce crisis countries tend to be clustered toward the low end of access to health workers, if one considers only DNM.



The WHO estimates a shortage of 2.4 million DNM globally, with the greatest deficit being in sub-Saharan Africa (World Health Organization 2006). According to the WHO, 24 percent of the global burden of disease lies in the African region, which hosts only 3 percent of the world’s doctors, nurses, and midwives and accounts for less than 1 percent of global health expenditures (ibid.). Despite the urgency for reforms that will lower child and maternal mortality, sub-Saharan Africa is having the most difficulty reaching the health-related MDGs, in large part because of an insufficient number of high-quality frontline health workers and an unsuccessful system of retention (Bhutta et al. 2010). By frontline health workers we mean those health providers directly engaged in service delivery, especially to people who are traditionally underserved, including rural, remote, and marginalized populations.

The global absolute shortage of DNM is compounded by maldistribution of health workers

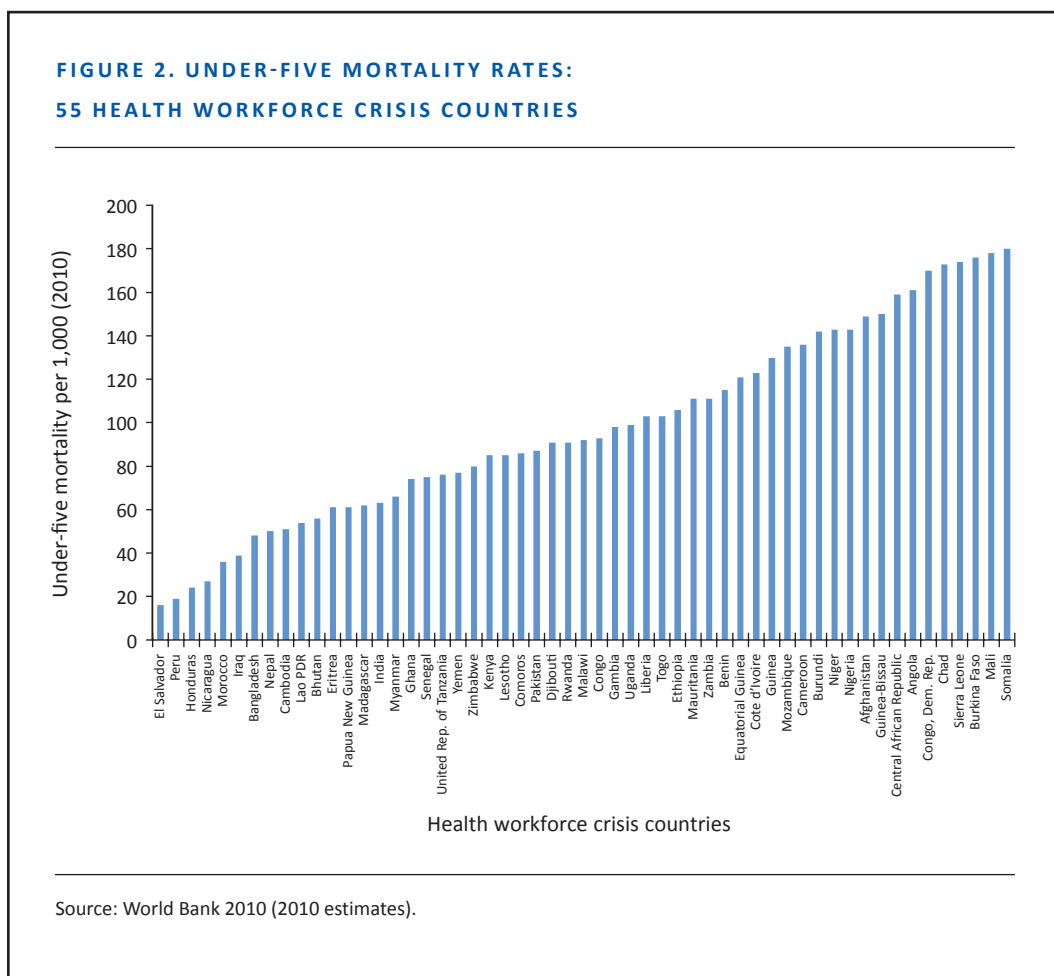
and poor quality of care. In Ghana, for example, 52 percent of the population is urban, but 87 percent of general practitioners live in urban areas (Dussault and Franceschini 2006; Foreit and Raifman 2011). Educational institutions in low-income countries often lack the capacity to produce the number of qualified health professionals needed to provide essential care (Anarfi, Quartey, and Agyei 2010; Buchan and Dovlo 2004; Foreit and Raifman 2011). Furthermore, emigration of trained professionals to North America and Europe stymies the growth of the health sector and limits the availability of health workers (Anarfi, Quartey, and Agyei 2010; Buchan and Dovlo 2004; Foreit and Raifman 2011).

### **ACCESS TO HEALTH WORKERS IMPROVES HEALTH OUTCOMES**

Access to health workers has been shown to affect health outcomes. The WHR 2006 describes the positive impact of health worker density and quality on infant, child, and maternal survival (Bhutta et al. 2010). The report also indicates that increases in DNM density account for improvement in rates of cardiovascular diseases and decreases in the costs of TB and malaria. Conversely, there is evidence that a lack of access to community health workers is linked to poor health outcomes, especially in the developing world (ibid.); for example, staff cutbacks have been associated with a worsening of child malnutrition (World Health Organization 2006). Sudhir and Barnighausen (2004) examined the relationship between DNM density and infant mortality, under-five mortality, and maternal mortality. Controlling for the effects of income, female adult literacy, and absolute income poverty, they found a significant, negative relationship between DNM density and all three mortality rates. In a study of health interventions, Speybroeck and colleagues (2006) demonstrated a significant positive relationship between DNM density and both measles immunization coverage and use of skilled birth attendants. Following this, Sudhir and Barnighausen (2007) also examined the relationship between DNM density and measles vaccination, along with diphtheria, pertussis, and tetanus (DPT3) vaccination and poliomyelitis (polio3) vaccination. More recently, Castillo-Laborde (2011) presented evidence of a significant negative relationship between DNM density and the burden of disease, controlling for income, income distribution, health expenditure, and percentage of the rural population with access to an improved water source. In a longitudinal analysis of the relationship between health sector resources and infant mortality, Farahani, Subramanian, and Canning (2009) found a significant, negative effect in the short run and an even larger negative effect in the long run. In this study, doctor density alone was used as a proxy for all health sector resources, as data for nurse and midwife density and other health sector inputs were not available over a sufficiently long time period to measure long-run effects.

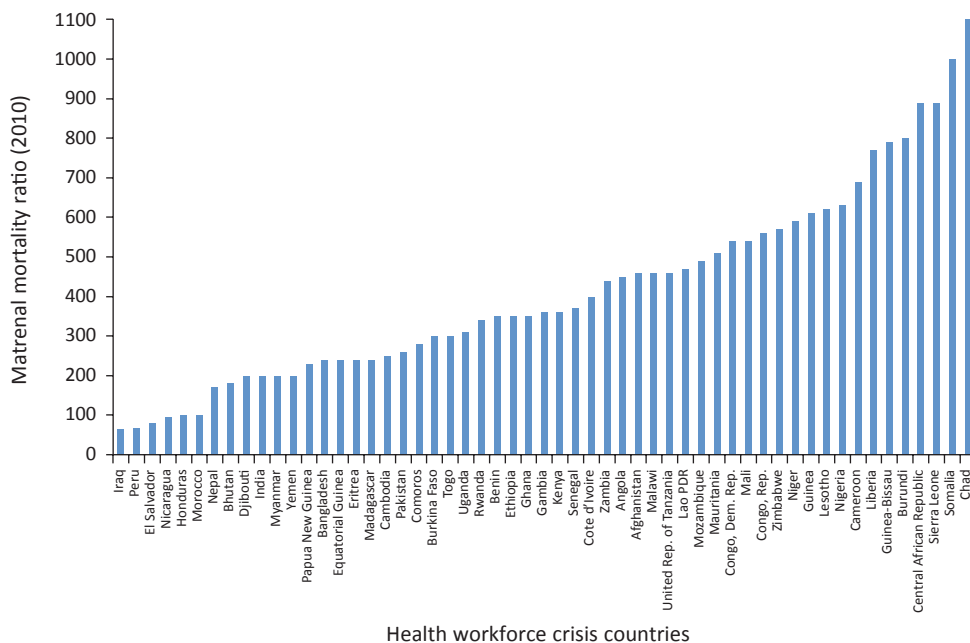
## SURPRISING DIVERSITY AMONG HEALTH WORKFORCE CRISIS COUNTRIES

Given the strong relationship between DNM density and health outcomes, one might expect that the health workforce crisis countries would exhibit correspondingly poor health outcomes. However, there is great variance among the health workforce crisis countries on key health indicators, as depicted in figures 2, 3, and 4 (see appendix 1 for data and sources).



In figure 2, the health workforce crisis countries are arrayed along the horizontal axis and the child mortality rate (number of child deaths per 1,000 children aged zero to five) is shown on the vertical axis. The child mortality rates among the health workforce crisis countries range from 16 per 1,000 to 180 per 1,000 (World Bank 2010).

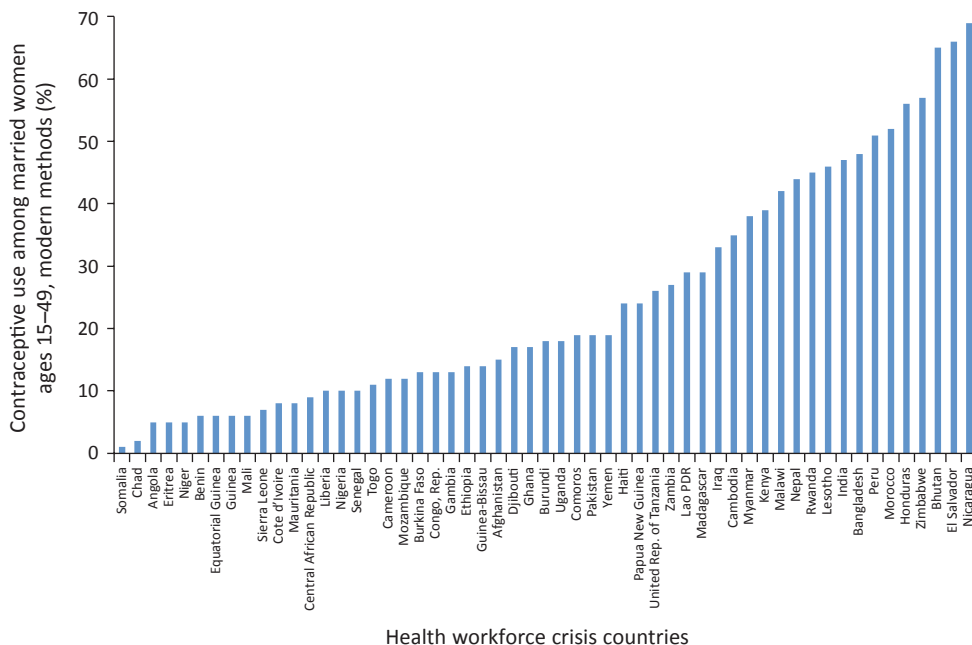
**FIGURE 3. MATERNAL MORTALITY RATIOS:  
55 HEALTH WORKFORCE CRISIS COUNTRIES**



Source: World Health Organization et al. 2012.

We also looked at the maternal mortality ratio among the health workforce crisis countries. As can be seen in figure 3, there is once again enormous diversity among the health workforce crisis countries, which belies any simplistic notion that DNM density alone drives health outcomes.

**FIGURE 4. MODERN METHOD CONTRACEPTIVE PREVALENCE:  
55 HEALTH WORKFORCE CRISIS COUNTRIES**



Note: Data are from the most recently available national-level surveys, such as Demographic and Health Surveys, Reproductive Health Surveys, Multiple Indicator Cluster Surveys, regional survey programs, national surveys, and the UN Population Division World Contraceptive Use 2011.

Source: Population Reference Bureau 2011.

Similar variation exists with regard to the use of contraception. Figure 4 again shows the health workforce crisis countries arrayed along the horizontal axis, while the percent of married women of reproductive age using a modern contraceptive is on the vertical axis. In this instance, modern contraceptive prevalence among married women aged 15–49 ranges from 1 percent to 69 percent (Population Reference Bureau 2011).

The findings presented in figures 2, 3, and 4 are surprising. The health workforce crisis countries are spread among a wide continuum with regard to the bellwether indicators of child mortality, maternal mortality, and contraceptive prevalence. How can it be that countries with strikingly similar limits on access to doctors, nurses, and midwives have radically different health outcomes?

In the following sections, we argue that this diversity of health outcomes is attributable to variances in the deployment of health providers other than doctors, nurses, and midwives coupled with greater equity of access to health providers. The DNM variable alone is not a very good measure of access to health workers and is not a particularly powerful predictor of health outcomes.

## **THINKING BEYOND DOCTORS, NURSES, AND MIDWIVES**

Doctors, nurses, and midwives represent only a fraction of the health workforce in any country. Moreover, the national ratio of doctors, nurses, and midwives says nothing about equity of access to health workers. The same number of DNM could be concentrated in one city (as is often the case) or equitably distributed across the country without altering the ratio. There are many types of health workers, including community health workers, health educators, pharmacists, clinical officers, medical assistants, and others who can have an impact on health interventions and outcomes. In many countries, these other types of health providers may significantly exceed doctors, nurses, and midwives in number and coverage. However, robust, cross-national data on the density of these types of health workers are not available.

Good indicators about the health workforce, broadly defined, are essential to health policy and planning. It is very difficult for countries to set meaningful goals, make wise investment decisions, or assess progress without basic data about how many health workers there are, where they are working, and whom they are serving.

In the absence of better data, a proxy for access to a broad array of health workers is needed. Save the Children–UK developed the Health Workers Reach Index (HWRI) as a more comprehensive measure of access to health workers (Save the Children 2011). This index combines the conventional DNM/1,000 measure of access with two other indicators that serve as proxies for access for health workers. The first indicator is DPT3 coverage, which serves as a measure of access to the broader array of health workers who are generally involved in ensuring immunization coverage. Immunization usually requires the involvement of many kinds of health workers, including community health workers, health educators, social workers, and virtually any class of health workers trained to inform about or provide immunizations.

The second indicator is the percentage of births attended by a skilled birth attendant, which serves as a proxy for equity of access. High coverage by skilled birth attendants must parallel the distribution of the population in a way that the DNM/1,000 indicator does not. Women give births everywhere in a country and birth rates tend to be higher in rural areas. High levels of coverage by skilled birth attendants suggest equity of access, which the DNM ratio alone does not.

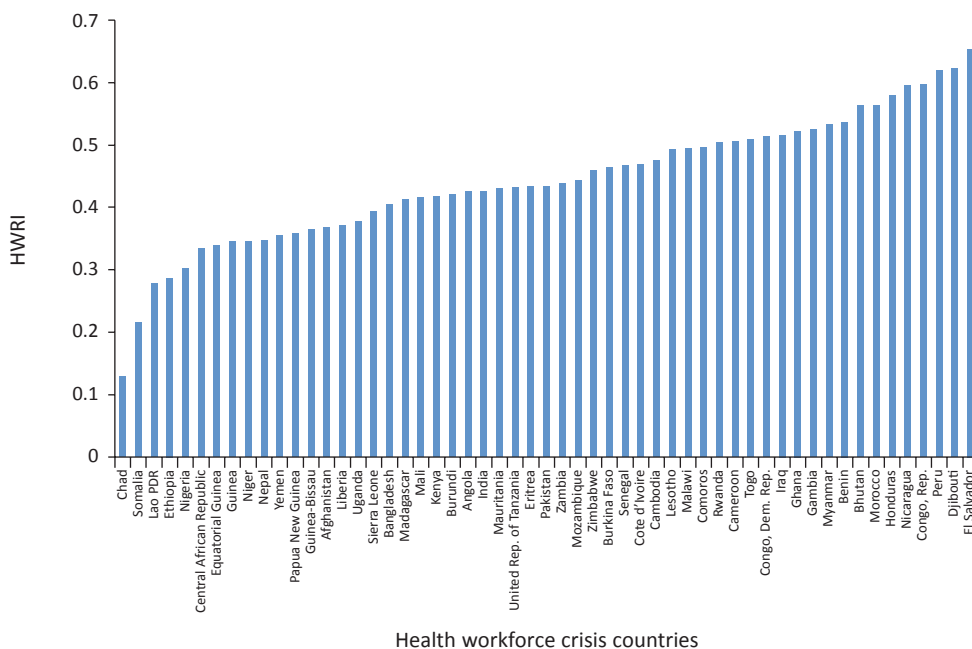
The three indicators each contribute up to a third of the HWRI score, which has a minimum value of zero and a maximum value of one. The HWRI therefore offers a more holistic measure of

access to health workers than density of doctors, nurses, and midwives alone.

Save the Children–UK derived HWRI scores for 161 countries. These scores range from .13 for Chad to .98 for Switzerland (ibid.). Figure 5 shows the HWRI scores for the fifty-five health workforce crisis countries for which data are available. The HWRI scores range from .13 for Chad to .65 for El Salvador. Countries at the higher end of this range have HWRI scores comparable to those of a number of countries that are not considered to be health workforce crisis countries, such as Costa Rica, Panama, Jamaica, Colombia, and the Dominican Republic. That is, once one considers a more comprehensive measure of access to health workers, the DNM density indicator does not appear to be truly indicative of health workforce coverage.

Interestingly, HWRI appears to have a weak to no relationship with income. There is no statistically significant relationship between the HWRI and GNI per capita (Atlas method) among the WHO health workforce crisis countries that are low-income countries. If middle-income workforce crisis countries are included in the sample, a weak but statistically significant

**FIGURE 5. HEALTH WORKERS REACH INDEX:  
55 HEALTH WORKFORCE CRISIS COUNTRIES**



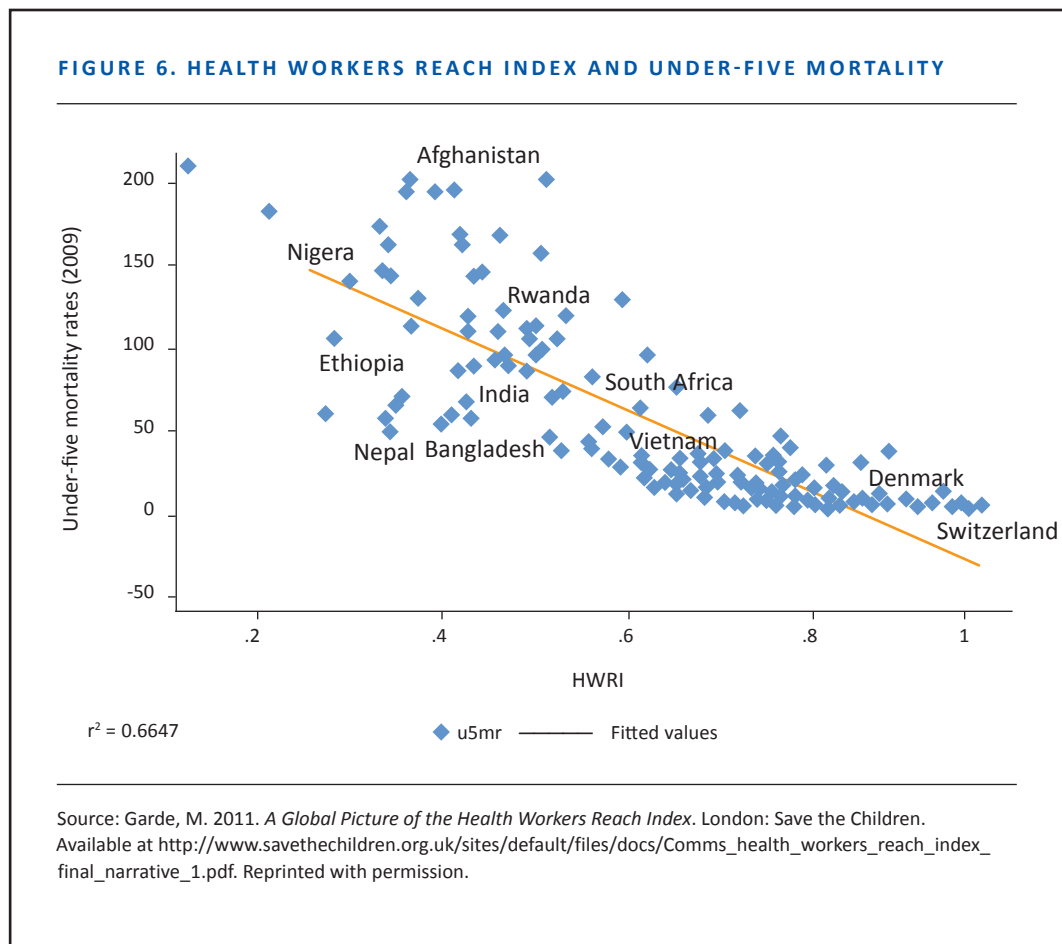
Source: Save the Children 2011.



relationship between the HWRI and per capita income does emerge ( $r^2 = .18$ ,  $p = .002$ ). In both samples, countries with similar incomes exhibit very different scores on the HWRI. This suggests that countries of similar income are making very different choices about maximizing access to basic health care. As we show in the following section, this has meaningful consequences for health outcomes.

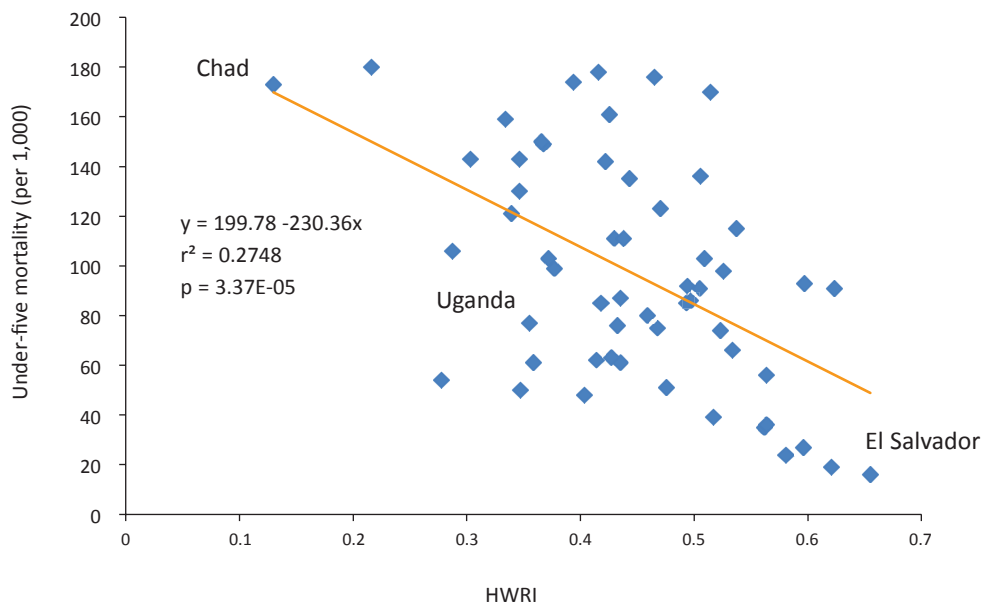
### IMPACT OF ACCESS TO HEALTH WORKERS: BEYOND DOCTORS, NURSES, AND MIDWIVES

Save the Children–UK tested the relationship between the HWRI and child mortality in 161 countries, the results of which are displayed in figure 6. This shows a strong relationship between the HWRI and child mortality.



We tested the relationship between the HWRI and both child mortality and maternal mortality in the health workforce crisis countries. These results, shown in figures 7 and 8, are in the expected direction, confirming the relationship between the HWRI and child and maternal survival in this set of countries.

**FIGURE 7. HEALTH WORKERS REACH INDEX AND CHILD MORTALITY:  
55 HEALTH WORKFORCE CRISIS COUNTRIES**



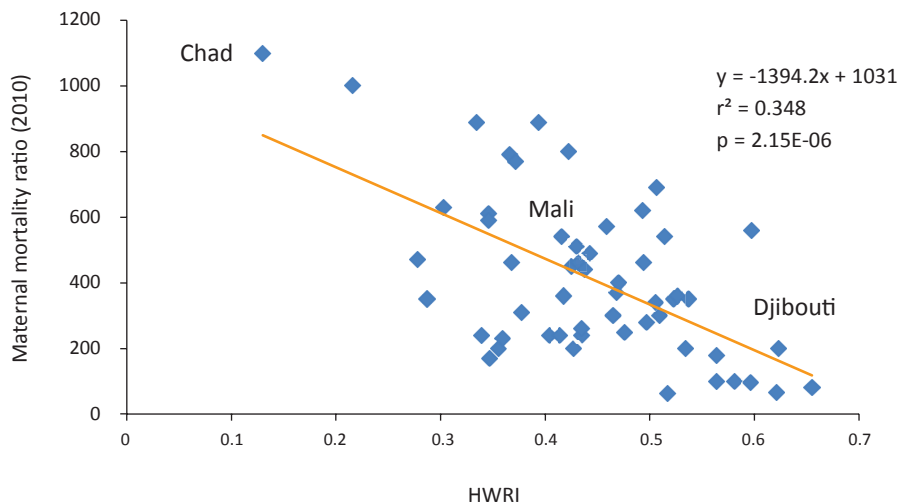
Sources: Save the Children 2011; World Bank 2010 (data are 2010 estimates).

### THE POWER OF FRONTLINE HEALTH WORKERS: FEMALE COMMUNITY HEALTH VOLUNTEERS AND CHILD HEALTH IN NEPAL

The Nepal Female Community Health Volunteer (FCHV) program has been the key to dramatic reductions in child mortality in that low-income country. Trained, equipped, and supported FCHVs have extended access to critical interventions, including vitamin A supplements, diarrhea and pneumonia management, and immunization. Between 1995 and 2010, infant mortality dropped from 72/1,000 to 39/1,000 and child mortality declined from 101/1,000 to 49/1,000.

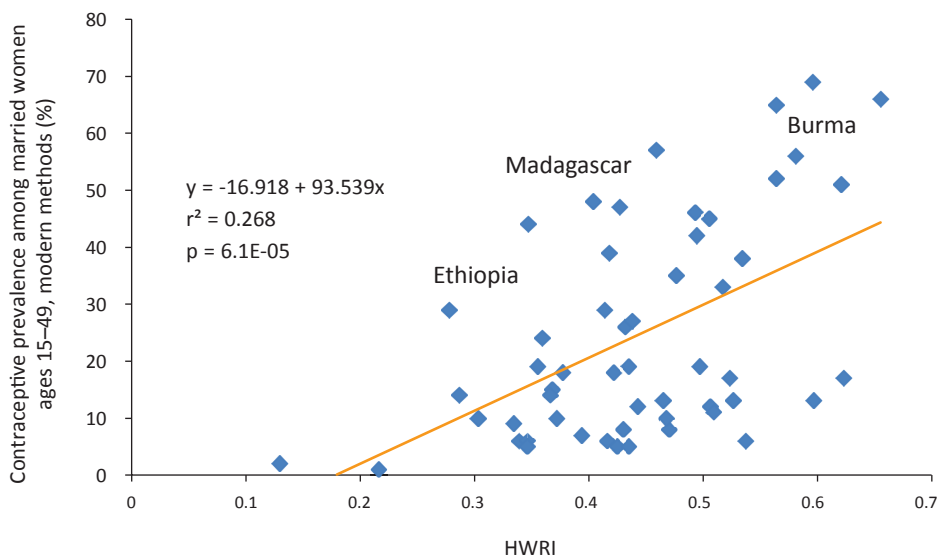
Sources: Joshi 2008; United Nations Population Division 2010.

### FIGURE 8. HEALTH WORKERS REACH INDEX AND MATERNAL MORTALITY: 55 HEALTH WORKFORCE CRISIS COUNTRIES



Sources: Save the Children 2011; World Health Organization et al. 2012.

**FIGURE 9. HEALTH WORKERS REACH INDEX AND CONTRACEPTIVE PREVALENCE: 54 HEALTH WORKFORCE CRISIS COUNTRIES**



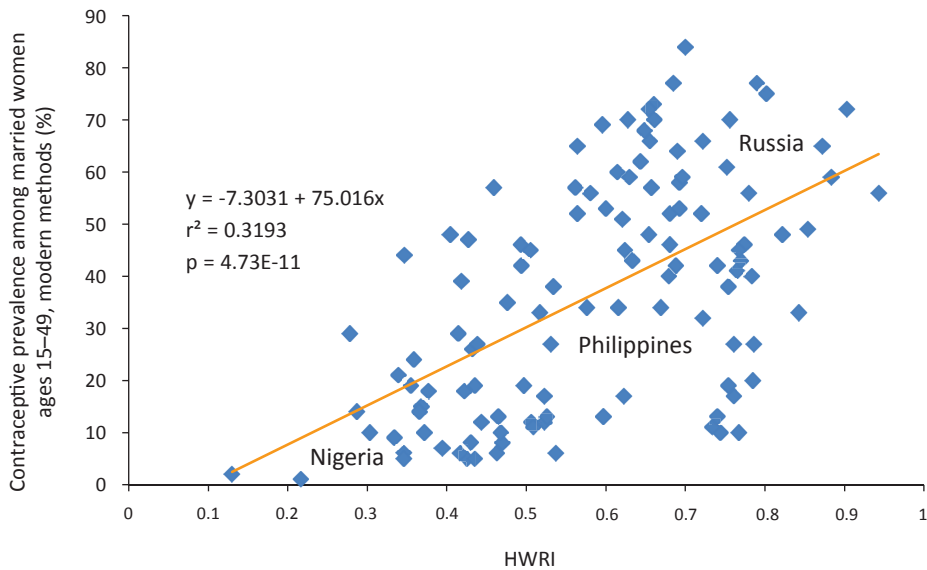
Note: Data are from the most recently available national-level surveys, such as Demographic and Health Surveys, Reproductive Health Surveys, Multiple Indicator Cluster Surveys, regional survey programs, national surveys, and the UN Population Division World Contraceptive Use 2011.

Sources: Save the Children 2011; Population Reference Bureau 2011.

We then tested the relationship between the HWRI and modern contraceptive prevalence among the fifty-four health workforce crisis countries for which data are available. The results are shown in figure 9.

As can be seen, the HWRI is strongly related to contraceptive prevalence in the health workforce crisis countries. Access to a broader and more equitably deployed array of health workers, as indicated by the HWRI, appears to increase use of family planning services.

**FIGURE 10. HEALTH WORKERS REACH INDEX AND CONTRACEPTIVE PREVALENCE: 114 LOW- AND MIDDLE-INCOME COUNTRIES**

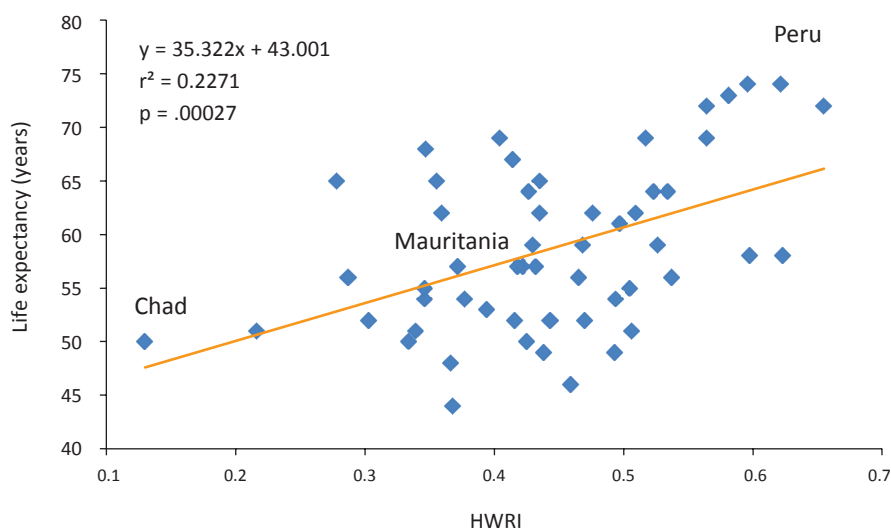


Note: Data are from the most recently available national-level surveys, such as Demographic and Health Surveys, Reproductive Health Surveys, Multiple Indicator Cluster Surveys, regional survey programs, national surveys, and the UN Population Division World Contraceptive Use 2011.

Sources: Save the Children 2011; Population Reference Bureau 2011.

The relationship also holds if the analysis is extended to all 114 low- and middle-income countries for which data are available, as can be seen in figure 10. Contraceptive prevalence is strongly related to the HWRI.

**FIGURE 11. HEALTH WORKERS REACH INDEX AND LIFE EXPECTANCY:  
54 HEALTH WORKFORCE CRISIS COUNTRIES**



Sources: Save the Children 2011; Population Reference Bureau 2011.

We also looked at the relationship between the HWRI and life expectancy, which is shown in figure 11 (data were available for fifty-four countries). As can be seen, there is a statistically and substantively important relationship between access to health workers and life expectancy.

In sum, we find that access to health workers, as measured by the HWRI, is significantly related to child mortality, maternal mortality, contraceptive prevalence, and life expectancy among the health workforce crisis countries. We believe that these findings have important methodological and policy implications.

## DISCUSSION

### Measuring Equitable Access to a Broad Array of Health Workers

Since the release of the 2006 World Health Report, the DNM density indicator has been the key indicator used to define whether or not countries have a health workforce crisis. It is, however,

proving of limited utility. DNM data can be hard to collect. DNM density at a national level says almost nothing about access to health care as it can mask great inequities in the distribution of health professionals. It does not take into account the much broader array of frontline health workers on whom many, if not most, people in developing countries depend for health services. We note, for example, that even where data collection systems exist, community health workers are routinely omitted.

The measurement issue is a serious challenge to the human resources for health (HRH) field, as the limitations and difficulties associated with the DNM indicator make it very hard to assess whether a country is making progress, standing still, or regressing. There is no widely accepted indicator or small set of indicators of access to health workers that is used in lieu of the DNM density indicator. There is no global program of data collection on HRH to track progress comparable to the Demographic and Health Surveys. Hence, there is a real need for a small set of indicators on which data can be (or are) collected on a regular basis to track HRH progress.

Health workforce policy and planning—which are critical to expanding access to essential services—depend on good data. We believe that heightened investment in health workforce data collection is urgently needed. This can take two forms. One would be the development of human resource information systems as part of health management information systems. While some progress has been made in this area, much greater investment and attention are needed. The second approach would be to use surveys to measure access to health workers. We strongly urge the inclusion of a few health workforce questions in the standard Demographic and Health Surveys, which would be extremely helpful in shedding light using a widely respected, rigorous, and comparable data source.

In the meantime, the HWRI is one useful proxy for assessing access to health workers. We believe that the HWRI, while imperfect, has greater explanatory power with regard to the impact of health workers than DNM alone. We ran a sensitivity analysis that tested, separately, the relationship between the dependent variables (child mortality, maternal mortality, contraceptive prevalence, and life expectancy) and each component of the HWRI (DNM, DPT3 coverage, and coverage of skilled birth attendants). In every case, HWRI explained more of the variance in the dependent variable than any of the HWRI components alone. The addition of DPT3 and skilled birth attendant coverage to DNM density as proxy measures for other types of health workers and equity of access better explains the variance in health outcomes among the workforce crisis countries presented in figures 2, 3, and 4 than DNM alone. (See appendix 2 for the sensitivity analysis results.) The raw data on the components of the HWRI that were used in the sensitivity analysis are shown in appendix 3.

We also ran multiple regressions adding per capita income and adult female literacy to HWRI as independent variables, with child mortality, maternal mortality, contraceptive prevalence, and life expectancy as the dependent variables. The HWRI remained statistically significant in all cases

after controlling for these potentially confounding variables. (See appendix 4 for the results.)

The HWRI is not without its limitations, since two of its components are more reflective of the consequences of access to health workers than health workers per se. Nonetheless, it is yielding interesting and plausible findings. It should be systematically tracked over time to see if changes are taking place. In addition, other practical proxies for measuring access to health workers should be developed and tested, given the paucity of data on the health workforce and the difficulties in collecting such data.

### **Diversity among Health Workforce Crisis Countries**

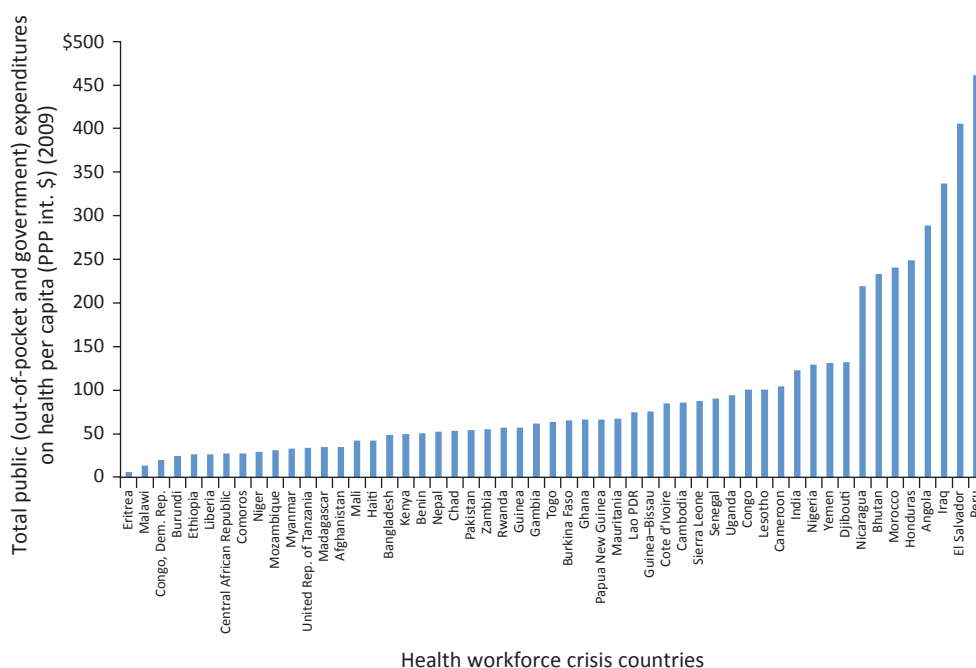
The data presented in figures 2–4 lead to the conclusion that the health status of the populations in the health workforce crisis countries varies substantially as measured by key health indicators, such as child mortality, maternal mortality, contraceptive prevalence, and life expectancy. While increased DNM density has a salutary effect, countries that score similarly on this indicator exhibit very different health outcomes. One cannot draw the simple conclusion that lower DNM scores lead to worse health outcomes at a population level, without knowing whether compensating measures have been taken.

Once a more comprehensive indicator that captures a broader array of health workers is used, it becomes evident that there is much more substantial diversity of access to health care among the health workforce crisis countries than the DNM density indicator would imply. The HWRI data lead to the conclusion that some crisis countries have, in fact, found mechanisms beyond doctors and nurses for achieving reasonably high access to care, while other countries have failed to do so.

The variance in access to health workers, as measured by the HWRI, goes a long way toward explaining why there is such diversity of health outcomes among the crisis countries. Countries can and are making deliberate choices beyond producing more doctors and nurses that substantially affect access to health care and health outcomes.



**FIGURE 12. TOTAL OUT-OF-POCKET AND GOVERNMENT EXPENDITURES ON HEALTH, PER CAPITA: 53 HEALTH WORKFORCE CRISIS COUNTRIES**



Source: World Health Organization 2012.

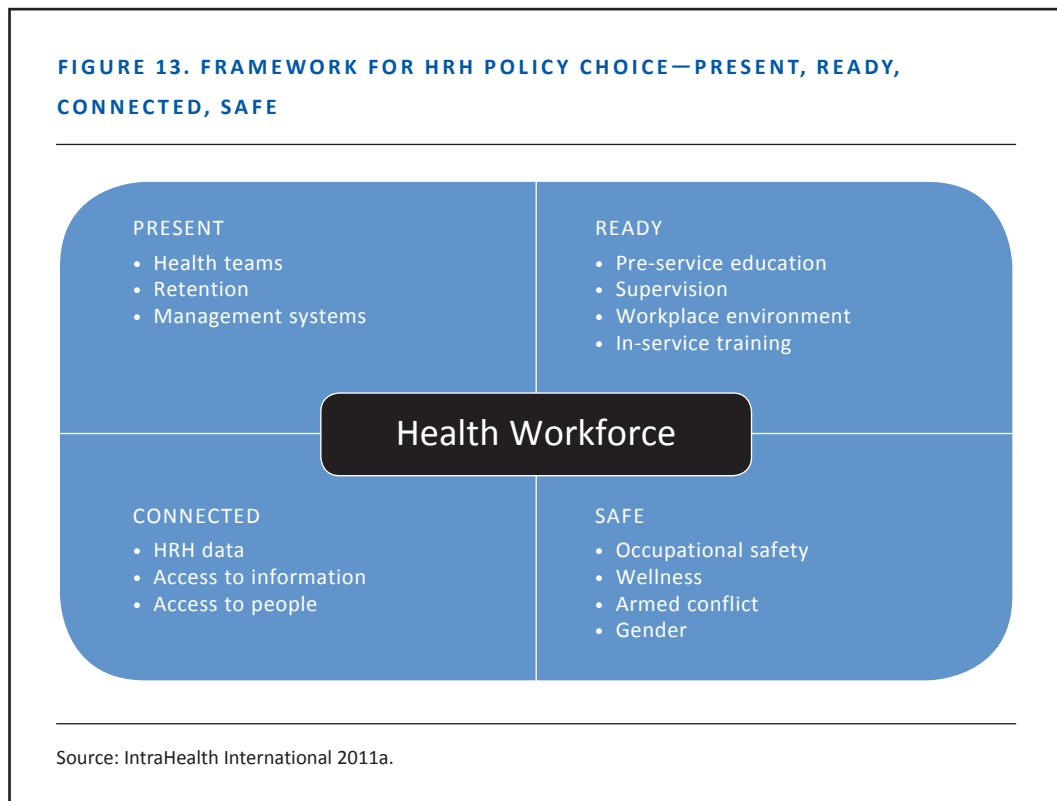
We also observe, as shown in figure 12, that twenty-eight of fifty-three of the health workforce crisis countries for which there are data have per capita health expenditures in excess of sixty dollars per capita (out-of-pocket plus government expenditures); eleven of the twenty-eight countries have government expenditures of sixty dollars per capita or more (World Health Organization 2012). This is the threshold suggested by the Taskforce on Innovative International Financing for Health Systems (2010) as the minimum needed to provide essential health care by 2015. Put another way, there are sufficient resources in the health systems of these countries to achieve access to health providers and essential services. The challenge for these nations is less an absolute dearth of resources and more the optimal allocation of available resources.

These are optimistic conclusions. A country can have modest per capita income and a low density of doctors, nurses, and midwives at a national level and achieve very substantial progress on key health indicators. Countries are not trapped by either income or the DNM density. At any

level of income or DNM density, there seems to be substantial latitude for policy choices that will affect health outcomes. Importantly, national DNM density alone is a poorer measure of health outcomes than the HWRI, which includes DNM density, DPT3 coverage, and SBA coverage and appropriately reflects a more expansive collection of health workers. Health workforce crisis countries that increase equitable access to a broader array of health workers, as measured by the HWRI, do better across a range of health indicators, including child mortality, maternal mortality, contraceptive prevalence, and life expectancy. Of course, factors other than health workers influence health outcomes, but our analysis and the literature cited earlier indicate that access to health providers has an important, independent impact.

### Overcoming Shortages of Doctors, Nurses, and Midwives

What, then, are the policy choices that can help offset an unsatisfactory density of doctors, nurses, and midwives? IntraHealth International has developed an HRH policy framework called Present, Ready, Connected, Safe (IntraHealth International 2011a). This framework is depicted graphically in figure 13.



In brief, the IntraHealth framework proposes four categories of policy variables—present, ready, connected, and safe—that affect access to health workers who can provide good quality care. Here we define health workers broadly to include doctors, nurses, midwives, and the array of other providers ranging from clinical officers to health educators and community health workers.

Increasing the likelihood that health workers are present where they are most needed has three elements. The first element consists of deploying health teams composed of an array of health workers whose combined skills make the most efficient use of scarce resources to achieve the greatest public health impact (Haines et al. 1995). The allocation of responsibilities, often referred to as task shifting or task sharing, should optimize the role of each team member. Focusing on health teams gives emphasis to team members supporting each other through referral, training, supply chains, and supervision. The second element is attracting and retaining health teams where they are most needed. The WHO has developed recommendations to guide policymakers in this arena, which boil down to the observation that health worker motivations are complex and can be understood only by asking the health worker (World Health Organization 2010). The WHO report identified sixteen different types of incentives that affect retention. Appropriate incentive packages for retention can be crafted only on the basis of good evidence about health worker preferences in the context in which they are working. The third element is building effective human resource management systems that support a health workforce, including recruitment, hiring, orientation, deployment, compensation, evaluation, and performance management.

Health workers must be ready to perform. In part, this means structuring pre-service education to prepare health providers to work effectively in health teams that provide high-quality care. The report of the Commission on the Education of Health Professionals for the 21st Century (Frenk et al. 2010) emphasized that the training of health workers should reflect the fact that, in practice, they will work in teams representing health providers ranging from community health workers to physicians. Health worker readiness also requires supportive supervision that promotes good standards of performance through coaching, counseling, and training, as well as sustaining job satisfaction by helping workers manage stress and difficult situations. Health providers also need a supportive workplace environment that has the needed equipment, supplies, and other resources and the appropriate degree of latitude to make decisions within their sphere of responsibility. Regular in-service training that is responsive to the performance needs of health workers and continuously builds skills is also needed.

Health workers can also be connected to sources of support through information and communication technology (ICT). Ministries of Health and nongovernmental organizations need human resource information systems (HRIS) that maintain essential data about every health worker. A functioning HRIS is essential to staying connected with the workforce, as well

as for workforce planning and evaluation (IntraHealth International 2011b). ICT can also be used to develop peer networks among health workers that can serve as a source of support, information, professional development, and client referral. And, of course, ICT can connect health workers to vast opportunities for distance learning and accessing information resources. The increasing availability of mobile phones is making such resources accessible even to workers in remote areas.

Health providers must also be safe at work if they are to provide high-quality, accessible care. Policymakers can promote occupational safety by instituting infection prevention measures that protect health workers and establishing occupational safety standards that safeguard workers from work-related injury. Health workers and their families should also be able to access preventive and curative health care. Health workers should be protected under conditions of armed conflict. Health providers working in conflict situations are often at risk of injury or death due to violence either as a consequence of negligence or through deliberate attacks. The principle of medical neutrality must be scrupulously respected so as to ensure that health workers can serve communities in need without being imperiled. Both in the workplace and in communities, female health providers are sometimes subject to violence, harassment, and abuse, which dissuades women from accepting assignments and exacerbates attrition. Gender-based harassment and violence must be addressed through programs that detect violations of human rights and include strong measures that protect women and punish perpetrators.

More research is needed to see how these policy variables operate in different contexts and how they interact. We encourage systematic testing of the policy framework we have presented here. The model will be enriched by research exploring the relationship between the policy variables in the Present-Ready-Connected-Safe model and access to health workers, as measured by the HWRI or similar indicators. In-depth case studies comparing higher- and lower-performing countries might prove especially illuminating.

### **Implications for Donors and National Leaders**

While acknowledging the need for further research, we believe the findings presented in this paper and the policy model suggested have important implications for donors and national leaders. Effective development assistance programs for health use epidemiological data to help guide the allocation of donor resources. They provide the basis for estimating the severity and magnitude of public health problems like child mortality, maternal mortality, the unmet need for family planning, and HIV prevalence. Donor resources can then be rationally targeted to countries and populations most in need of assistance and where the potential impact is greatest.

The analyses and policy framework presented here could contribute to the same logic in appropriately targeting HRH development assistance. The diversity among the health workforce crisis countries, as measured by the HWRI, shows that access to health workers is on a scale ranging from very poor to relatively good. Constraints on access to health workers, as measured by the HWRI, are having a greater impact on health outcomes in some of the fifty-six crisis countries relative to others. Countries that are performing poorly on the HWRI (or similar indicator) would, all other things being equal, merit special attention from donors for expanding and strengthening the health workforce. The use of donors' funds could flow from an analysis based on the Present-Ready-Connected-Safe model, which could be used to highlight the areas of greatest need and opportunity for maximizing access to qualified, supported health workers.

Most importantly, the results presented in this paper show that national leaders have the power to make real choices that will affect the health of their people. Many countries of modest means have already taken a path leading to better access to health workers and essential health services. Some poor countries are choosing to make health workers present, ready, connected, and safe. Other countries have not yet done so, though most have this possibility within their reach. This should be an empowering and hopeful message for all national leaders.

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## APPENDIX 1. DATA FOR HEALTH WORKFORCE CRISIS COUNTRIES

Country	Health Workers Reach Index (HWRI)	Under-Five Mortality Rate (deaths per 1,000 children) (2010)	Maternal Mortality Ratio (deaths per 100,000 live births) (2010)	Contraceptive Prevalence in Percent among Married Women Ages 15–49, Modern Methods	Life Expectancy in Years
Afghanistan	0.368	149	460	15	44
Angola	0.425	161	450	5	50
Bangladesh	0.404	48	240	48	69
Benin	0.537	115	350	6	56
Bhutan	0.564	56	180	65	69
Burkina Faso	0.465	176	300	13	56
Burundi	0.422	142	800	18	57
Cambodia	0.476	51	250	35	62
Cameroon	0.506	136	690	12	51
Central African Republic	0.334	159	890	9	50
Chad	0.13	173	1,100	2	50
Comoros	0.497	86	280	19	61
Congo, Dem. Rep.	0.514	170	540	—	—
Congo, Rep.	0.597	93	560	13	58
Cote d'Ivoire	0.47	123	400	8	52
Djibouti	0.623	91	200	17	58
El Salvador	0.655	16	81	66	72
Equatorial Guinea	0.339	121	240	6	51
Eritrea	0.435	61	240	5	62
Ethiopia	0.287	106	350	14	56
Gambia	0.526	98	360	13	59
Ghana	0.523	74	350	17	64
Guinea	0.346	130	610	6	54
Guinea-Bissau	0.366	150	790	14	48
Haiti	—	—	—	—	—
Honduras	0.581	24	100	56	73
India	0.427	63	200	47	64
Iraq	0.517	39	63	33	69

*Continued*

Appendix 1, continued

Country	Health Workers Reach Index (HWRI)	Under-Five Mortality Rate (deaths per 1,000 children) (2010)	Maternal Mortality Ratio (deaths per 100,000 live births) (2010)	Contraceptive Prevalence in Percent among Married Women Ages 15–49, Modern Methods	Life Expectancy in Years
Kenya	0.418	85	360	39	57
Lao PDR	0.278	54	470	29	65
Lesotho	0.493	85	620	46	49
Liberia	0.372	103	770	10	57
Madagascar	0.414	62	240	29	67
Malawi	0.494	92	460	42	54
Mali	0.416	178	540	6	52
Mauritania	0.43	111	510	8	59
Morocco	0.564	36	100	52	72
Mozambique	0.443	135	490	12	52
Myanmar	0.534	66	200	38	64
Nepal	0.347	50	170	44	68
Nicaragua	0.596	27	95	69	74
Niger	0.346	143	590	5	55
Nigeria	0.303	143	630	10	52
Pakistan	0.435	87	260	19	65
Papua New Guinea	0.359	61	230	24	62
Peru	0.621	19	67	51	74
Rwanda	0.505	91	340	45	55
Senegal	0.468	75	370	10	59
Sierra Leone	0.394	174	890	7	53
Somalia	0.216	180	1,000	1	51
Togo	0.509	103	300	11	62
Uganda	0.377	99	310	18	54
United Rep. of Tanzania	0.432	76	460	26	57
Yemen	0.355	77	200	19	65
Zambia	0.438	111	440	27	49
Zimbabwe	0.459	80	570	57	46

Note: Dashes indicate missing data.

Sources: HWRI scores: Save the Children 2011; under-five mortality rate: World Bank 2010; maternal mortality ratio: World Health Organization 2012; contraceptive prevalence and life expectancy: Population Reference Bureau 2011.

## APPENDIX 2. SENSITIVITY ANALYSIS

		Health Workers Reach Index (HWRI)	DPT 3 Coverage	Percent of SBA	DNM Density (per 1,000 people)
Child mortality	$r^2 =$	0.27480396	0.165640663	0.020053547	0.215562225
	$p =$	3.37269E-05	0.002044577	0.347854091	0.000356123
Maternal mortality	$r^2 =$	0.588898	0.152786	0.062732	0.224824
	$p =$	0.000012	0.003171	0.09318	0.000255
Contraceptive prevalence	$r^2 =$	0.267998131	0.1762312	0.057139609	0.178772693
	$p =$	6.09991E-05	0.001419754	0.109617641	0.001300202
Life expectancy	$r^2 =$	0.227101938	0.194177334	0.006141303	0.174662028
	$p =$	0.000269658	0.000759877	0.604683524	0.001498863

Notes: DPT3: three doses of the diphtheria-pertussis-tetanus vaccinations; SBA: births attended by a skilled birth attendant; DNM: doctors, nurses, midwives.

Sources: DPT3 percent: UNICEF 2010; SBA percent: United Nations Population Fund 2011; DNM density: Global Health Workforce Alliance 2011.

### APPENDIX 3. HEALTH WORKERS REACH INDEX COMPONENTS

HRH Crisis Country	Percent of Children Having Received Coverage DPT3	Percent of SBA	DNM Density (per 1,000 people)
Afghanistan	66	14	0.7
Angola	91	—	1.43
Bangladesh	95	18	0.58
Benin	83	74	0.83
Bhutan	91	71	0.34
Burkina Faso	95	54	0.79
Burundi	96	34	0.22
Cambodia	92	44	1.01
Cameroon	84	63	1.79
Central African Republic	54	53	0.49
Chad	59	14	0.32
Comoros	74	62	0.89
Congo, Dem. Rep.	63	74	0.64
Cote d'Ivoire	85	57	0.62
Congo	90	—	0.91
Djibouti	88	61	0.75
El Salvador	92	—	2.04
Equatorial Guinea	33	—	0.83
Eritrea	99	—	0.63
Ethiopia	86	6	0.26
Gambia	98	57	0.61
Ghana	94	57	1.08
Guinea	57	46	0.14
Guinea-Bissau	76	39	0.6
Haiti	59	26	0.36
Honduras	98	—	1.89
India	72	47	1.85
Iraq	65	—	1.58
Kenya	83	42	1.32
Lao PDR	74	20	1.32
Lesotho	83	—	0.67

*Continued*

*Appendix 3, continued*

HRH Crisis Country	Percent of Children Having Received Coverage DPT3	Percent of SBA	DNM Density (per 1,000 people)
Liberia	64	46	0.28
Madagascar	74	51	0.48
Malawi	93	54	0.3
Mali	76	49	0.27
Mauritania	64	61	0.8
Morocco	99	63	1.34
Mozambique	74	55	0.34
Myanmar	90	57	1.34
Nepal	82	19	0.67
Nicaragua	98	74	1.44
Niger	70	33	0.16
Nigeria	69	39	2.01
Pakistan	88	39	1.16
Papua New Guinea	56	53	0.58
Peru	93	—	1.84
Rwanda	80	52	0.47
Senegal	70	52	0.48
Sierra Leone	90	42	0.19
Somalia	45	33	0.15
Togo	92	62	0.32
Uganda	60	42	1.43
United Rep. of Tanzania	91	43	0.25
Yemen	87	36	0.99
Zambia	82	47	0.77
Zimbabwe	83	80	0.88

Notes: HRH: human resources for health; DPT3: three doses of the diphtheria-pertussis-tetanus vaccinations; SBA: births attended by a skilled birth attendant; DNM: doctors, nurses, midwives. Dashes indicate missing data.

Sources: DPT3 percent: UNICEF 2010; SBA percent: United Nations Population Fund 2011; DNM density: Global Health Workforce Alliance 2011.

## APPENDIX 4. HWRI, GNI PER CAPITA, AND ADULT FEMALE LITERACY MULTIPLE REGRESSION

	Health Workers Reach Index (HWRI)	Gross National Income (GNI) per Capita	Adult Female Literacy
Child mortality rate $r^2 = 0.412187$	$p = 0.005555$	$p = 0.814929$	$p = 0.077808$
Maternal mortality ratio $r^2 = 0.588898$	$p = 0.000012$	$p = 0.011835$	$p = 0.976346$
Contraceptive prevalence rate $r^2 = 0.556266$	$p = 0.024664$	$p = 0.069966$	$p = 0.000485$
Life expectancy $r^2 = 0.259988$	$p = 0.003435$	$p = 0.526998$	$p = 0.321178$

Sources: HWRI: Save the Children 2011; GNI per Capita: World Bank 2010; adult female literacy: World Bank 2009.

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**Middleberg** conceived the paper and served as lead author. **Rangarao** carried out the data analysis and developed the graphics. **Hoemeke, Powers, Stilwell, and Tulenko** contributed critical ideas and language during successive drafts of the paper.

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