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## Health Policy

journal homepage: [www.elsevier.com/locate/healthpol](http://www.elsevier.com/locate/healthpol)



# Health workers at the core of the health system: Framework and research issues

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### ARTICLE INFO

#### Article history:

Received 1 February 2011

Received in revised form 24 October 2011

Accepted 25 October 2011

#### Keywords:

Health system

Health worker

### ABSTRACT

This paper presents a framework for the health system with health workers at the core. We review existing health-system frameworks and the role they assign to health workers. Earlier frameworks either do not include health workers as a central feature of system functioning or treat them as one among several components of equal importance. As every function of the health system is either undertaken by or mediated through the health worker, we place the health worker at the center of the health system.

Our framework is useful for structuring research on the health workforce and for identifying health-worker research issues. We describe six research issues on the health workforce: metrics to measure the capacity of a health system to deliver healthcare; the contribution of public- vs. private-sector health workers in meeting healthcare needs and demands; the appropriate size, composition and distribution of the health workforce; approaches to achieving health-worker requirements; the adoption and adaption of treatments by health workers; and the training of health workers for horizontally vs. vertically structured health systems.

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## 1. Background

In this paper we present a framework that places health workers at the center of the health system, and use it to identify research issues concerning the health workforce. Existing health-system frameworks either do not include health workers as a critical feature of system functioning or treat them as one among several components of equal importance. Table 1 provides an overview of the major health-system frameworks and the role assigned to health

workers in each framework [1–11]. None of these frameworks places the health worker at the center.

An example of the problems that arise by not properly locating the role of the health worker in the health system occurs in the WHO 2007 framework [10]. The framework has six “essential” building blocks which are presented as being distinct [10]. Yet it would seem that one of its building blocks, i.e. “health workforce”, is largely redundant given the presence of another building block placed parallel to it, i.e. “service delivery”. Service delivery would be difficult to perform independently of the health workforce; and the health workforce in the main performs service delivery.

The “service delivery” building block is characterized by WHO as follows: “Good health services are those which deliver effective, safe, quality personal and non-personal health interventions to those who need them, when and where needed, with minimum waste of resources” [10]. However, if good “service delivery” has been assured,

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**Table 1**

Role of the health worker in existing health-system frameworks.

Reference	Health-system framework	Role of the health worker
Evans [1] Hurst [2]; OECD [3] Frenk [4] Cassels [5]	Markets Flow of funds and payments Actors and their interactions Institutional components	Health workers are one of the “transactors” in healthcare markets Health workers are a recipient of payments in the health system Health workers are one of five “actors” in the health system Health workers are one of six “institutional components” of the health system
Murray and Frenk [6]	Systems performance	Health-worker staffing pattern and skills in healthcare organizations are determinants of service provision and system performance
Hsiao [7]; Roberts et al. [8]	“Control knobs”	Health workers are recipients of financial incentives and agents of behavior change. Health workers are not included as one of the five “control knobs” used to influence the health system
Mills et al. [9]	Strengthening capacity to improve performance	Changes in the management of health workers is one approach to strengthen the health system
WHO [10] Atun and Menabde [11]	Building blocks System dynamics	Health workers are one of six health-system “building blocks” Health workers are one of several “resources” to be allocated, and are recipients of payments. Health workers are not included as one of the four “levers” available to influence the health system

the separate building block of a well-performing “health workforce” is not “essential” or even necessary. WHO characterizes this building block as follows: “A well-performing health workforce is one which works in ways that are responsive, fair and efficient to achieve the best health outcomes possible, given available resources and circumstances (i.e. there are sufficient staff, fairly distributed; they are competent, responsive and productive)” [10]. Note that the characterization of “minimum waste of resources” in the service delivery building block is much the same as “best health outcomes possible, given available resources” in the health workforce building block.

In our opinion, putting health workers at the center of a system is essential because all health systems work through health professionals to achieve their goals. In Section 2 of this paper, we describe the rationale and implications of this view and propose a new health-system framework which places the health worker at the center. In developing our framework we follow a long tradition in health system research [11] of depicting and analyzing relationships among identified components of the health system. In Section 3 of this paper, we apply our framework to examine health-system research issues concerning the health workforce. The set of research issues we identify does not constitute a review of past work, which is a backward-looking exercise usually focused on a particular topic. Hence this paper does not follow the formal rules of systematic reviews [12]. Instead, our proposed investigation of health-worker research issues is forward-looking. Our framework generates a set of research issues based on the inter-relationships between health workers and different components of the health system. Section 4 discusses limitations of our paper. Section 5 is in conclusion.

## 2. The health system with health workers at the core

In our framework, we place health workers at the core of the health system – see Fig. 1. We believe this focus allows a better understanding of health-system functions and performance in relation to health-system goals. We take these goals to be population health outcomes and patient satisfaction. An important consequence of this

framework is that health-worker research issues are readily identified.

The components of Fig. 1 are briefly described below (abbreviations in parentheses refer to the components). Starting at the center of the figure, health workers perform several activities such as providing curative and preventive services to patients, and information about symptoms, diagnoses and treatment options. Health workers also choose the treatment technologies (e.g. drugs, surgical procedures and medical equipment). Moreover, health workers are involved in healthcare spending decisions in several ways. First, they effectively make spending decisions when patients are financially covered and agree to a recommended treatment. Secondly, health workers directly decide on the equipment and instruments to purchase in some situations, e.g. in private practice. In other situations, health workers recommend recurrent spending items and the purchase of capital equipment to their managers, e.g. in public practice.

The health workforce (HWF), which provides healthcare activities, may be distinguished by its size, composition, and (geographic) distribution. These characteristics govern access to treatment by different groups.

The size and composition of the health workforce are determined by existing stocks, which are a function of education and training in the past; by education and training of new health workers (E2); and by health worker (HW) inflows into the system (F1) minus HW outflows (F2). The inflow of workers (F1) arises from immigration and entry from other domestic sectors, and the outflow (F2) from emigration, retirement, death, and movement to other sectors [13]. The (geographical) distribution of health workers depends on the incentives (M1) to serve in particular areas and, in some contexts, on regulation (M2).

The education and training of new health workers (E2) follow from estimation of the size, composition and geographic distribution of workers required to meet health needs and demands (E1). To fulfill this function, policy makers must attempt to match healthcare needs and demands to health-worker requirements – by geographical location.

The healthcare financing function (R1) allocates funds to pay for workers’ salaries and other inputs (e.g. drugs and diagnostic and surgical equipment). Furthermore, for

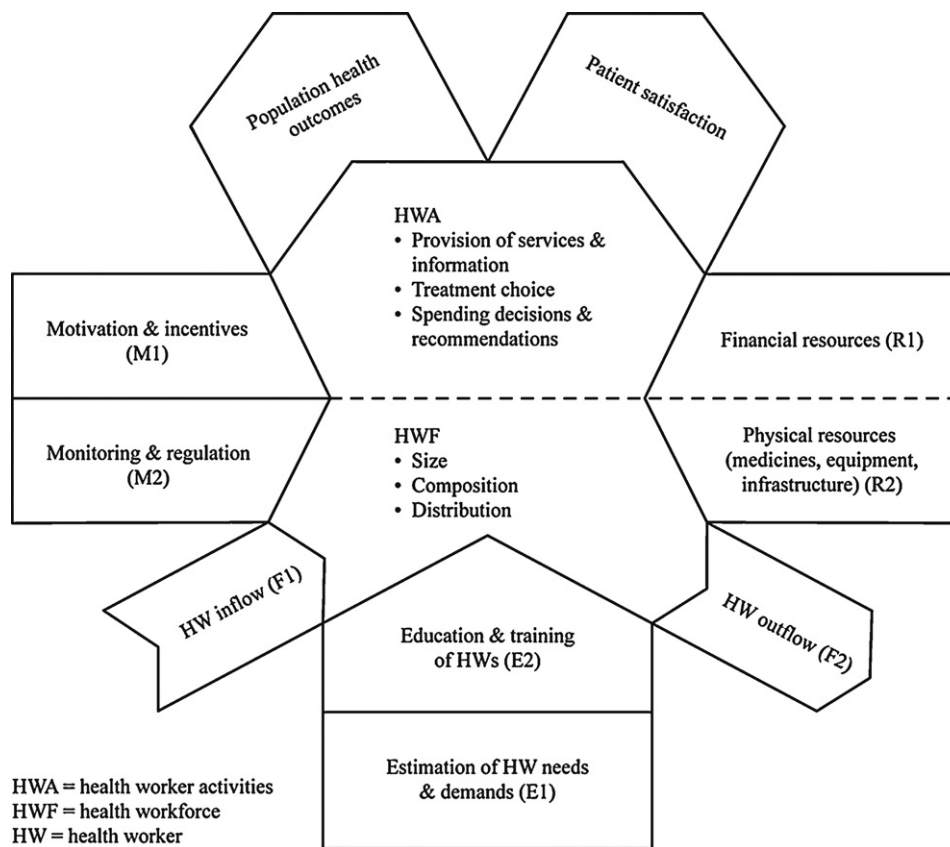


Fig. 1. A system framework centered on the health worker.

health workers to care for patients, the health system must ensure the delivery of medicines and technology and the availability of infrastructure (R2), such as information management systems and clinics and hospitals.

The incentive structure of the system (M1) is intended to motivate the workforce to provide the desired health worker activities (HWA), including appropriate care and treatment. Health workers can be motivated by financial incentives and non-financial incentives, such as working and living conditions. Incentives can also influence health-worker training decision, and location decisions such as whether to practice in underserved areas. In addition to incentives, health-worker actions can be influenced by regulation (M2), such as licensure for professional practice. Finally, the monitoring function detects inadequate performance (M2), allowing corrective action to be taken.

Our framework enables a direct understanding of health expenditures in the system. For example, according to a background paper for the WHO 2006 *World Health Report*, health workers receive 68.9% of total health expenditures through wages, salaries and associated payments [14]. Furthermore, most non-wage or non-salary recurrent expenditures result from decisions taken by health professionals, such as drug prescriptions, spending on laboratory testing, diagnostic imaging, hospital admissions and surgery. Thus, to understand or influence health

expenditures, our focus on the health worker at the center of the health system is apt. It is clear that most functions of a health system are either directly undertaken by, or depend for their implementation on, the health worker.

### 3. Research issues

A consequence of placing health workers at the center of the health system is that the identification of research issues on the health workforce becomes more apparent. In the following, we discuss research topics which deal with questions that are important for improving population health and patient satisfaction. How should the capacity of the health system to achieve its objectives be measured? To meet health-system goals, what are the relative contributions of health workers in the private and public sectors? What size, composition and distribution of the health workforce are necessary to satisfy healthcare needs and demands? What is an appropriate expansion path of the health workforce? How do health workers decide whether to adopt a new treatment or whether to modify existing treatments? How should health-worker training be organized, in horizontally and in vertically structured systems? In subsequent sections, we apply our framework (Fig. 1) to examine these questions. References to the framework are shown in parentheses.

### 3.1. Metric of health-system capacity

The evaluation of a health system with health workers at its center requires an assessment of the size, composition and distribution of the health workforce. In contrast, other health-system frameworks might use financial variables as the basis for evaluation. For example, in some analyses health spending per capita [15] or the population density of hospital beds [16] are considered as appropriate metrics for the capacity of a health system. In our framework, the number of health workers, their education and training, and their geographic distribution will be relevant. A simple metric might be total health-worker density, i.e. the total number of health workers per capita. This indicates the broad capacity of the health system to deliver healthcare services.

However, total health-worker density is too crude a measure because it takes no account of the differences in medical training of health workers or the diverse services that they perform. An alternative, restricted to specialized training, could be physician density rather than overall health-worker density. If doctors were viewed as the most critical category of health worker, and other health workers could not easily substitute for them in expanding the provision of healthcare services, then this metric might be preferred to aggregate health-worker density. However, what we need may be a *weighted* average of the different types of health workers, where the weights represent the contribution of each to the goals of the health system. Such a set of weights, of course, requires identifying and estimating the relative contributions of different types of health workers. The contributions could be assessed in terms of the marginal productivity of each type of worker, or in terms of the tasks that they perform.

### 3.2. Meeting healthcare needs and demands

Healthcare needs and demands are in general met by health workers. Needs may be expressed or not expressed, and demands may be based on needs or not. Needs arise from a variety of demographic and health conditions – such as infancy, pregnancy and illness. In most countries, governments assume responsibility to meet needs but not necessarily demands. In general, we expect the private sector of a health system to meet demands and the public sector to meet needs.

The government will tend to put priority on meeting healthcare needs as opposed to healthcare demands. Health workers contribute to meeting healthcare needs not only through health-service provision but also by helping to generate demand for unexpressed needs – e.g. by informing people about their objective health conditions and risks. Such supplier-induced demand can clearly improve individual and population health. This should be distinguished from demand created mainly to generate profit for the supplier without contributing to meeting needs [17].

In many developing countries private-sector health workers deliver the bulk of medical care and medicines [18,19]. However, the contributions of public-sector health workers are likely to be better understood than those of their private-sector counterparts. There is greater

availability of information about, and more direct and extensive regulation in, the public than the private sector. In the public sector, health workers practice in facilities and use inputs (R1 and R2) that are directly funded and monitored by the government. The scope of the treatments they provide is publicly known. For example, public-sector physicians in certain hospitals are not able to deliver intensive care, because the hospitals simply do not have wards with the necessary equipment. Information on actual treatment is also available through a range of records, including patient files, drug purchase volumes, and hospital occupancy rates. In terms of regulation (M2), public-sector health workers are commonly required to follow specified guidelines in their practice; in the private sector, physicians are often not constrained in this way. Hence, the contribution of private-sector health workers is more difficult to determine and measure.

On the other hand, the private sector may help to overcome constraints faced by the public sector [20]. For example, a treatment that is not available in the public sector may be offered in the private sector. Thus, life-saving HIV antiretroviral treatment (ART) was provided to thousands of patients by private-sector physicians in South Africa before it became available in the public sector [21].

In many developing countries, health workers practice in both the public and private sectors. There are disadvantages and advantages associated with this arrangement. Dual practice can reduce access to needed treatment for poorer patients because they may be sent to the private clinics of public-sector physicians instead of receiving the treatment to which they are entitled in the public sector. On the other hand, dual practice allows health workers to earn the higher incomes that may be necessary to keep them in the public sector performing needed services [22].

There are unexplored issues about the extent to which the government should plan and provide for the private healthcare sector. To address this question, we need to understand the relative contributions of health workers in the public and private sectors in achieving the goals of the health system. In our view, this question has not been adequately investigated.

### 3.3. Determining health-worker requirements

We must identify healthcare needs and demands in order to determine the appropriate size and composition of the health workforce (E1). Simple population ratios, such as 2.5 health workers per 1000 population proposed in the 2006 WHO *World Health Report* [23], or between 0.1 and 0.2 physicians per 1000 population suggested for a “minimum package of essential clinical service” in the 1993 *World Development Report* [24], are unlikely to be credible because they lack a proper theoretical or empirical justification.

Past studies estimating health-worker requirements have included approaches based on healthcare needs, demands, and service targets. For the needs-based approach, experts use epidemiological information to estimate the future occurrence of disease cases in a population, and the number and type of health workers necessary for each case. The demand-based approach takes current healthcare utilization as the basis for projecting future

demand for health workers. This is done by estimating relationships for utilization against variables such as population size and composition, and per-capita income, and using these relationships to predict healthcare utilization by projecting the explanatory variables. The service-targets approach declares that certain services should be delivered and estimates the requirements for their delivery.

The needs-based approach requires the prediction of future disease occurrence and the unit health-worker requirements for treatment. These are subject to uncertainties of projection, like the variables in the demand-based approach. On the other hand, the service-targets approach can be based on an arbitrary selection of services chosen for delivery.

All three approaches are based on forecasting future needs or demands, or specifying future service targets. These have to be assessed in the context of ageing populations, epidemiologic and health transitions, increasing longevity, etc., which will affect requirements for numbers, education and training of health workers. However, the health-worker requirements associated with these factors are not straightforward. For example, the total health-worker requirements for an ageing population will depend on a trade-off. A population that ages is by definition one that is healthier, and for this reason may require less healthcare per life-year. But this needs to be balanced against increased healthcare requirements over a longer lifespan.

Health-worker requirements also depend on the financial and technical resources available as well as the healthcare infrastructure (R1 and R2), which influence the outcomes that workers can achieve. Some resources (such as diagnostic equipment, drugs and surgical supplies) will be necessary for health workers to perform clinical activities. Other resources (such as electronic patient charts or cell-phone based support systems) may not be necessary, but can improve the efficiency of HWA.

It is also likely that requirements for one type of health worker depend on the availability of other types of health workers. For instance, if more nurses are available to work in clinics, fewer doctors will be needed per patient because nurses can substitute for doctors in performing some tasks. We need to understand much better the combinations of health workers that are substitutable for attaining given health outcomes.

### 3.4. Achieving health-worker requirements

In many developing countries, resource constraints and training lags will prevent the achievement of health-worker requirements. Even if current or short-term requirements cannot be met, it will be important to determine an optimal expansion path for the health workforce. The gap between current availability and future requirement needs to be closed taking account of various trade-offs. For example, in terms of skill composition, the optimal expansion path may not be a proportional increase of all types of health workers over time. In certain situations, it may be more appropriate initially to expand lower-skilled cadres, such as community health workers,

to ensure that basic healthcare needs are met, and then to increase higher-skilled workers, such as doctors and nurses.

The size of the health workforce is determined by education and training of new workers (E2), and by HW inflow (F1) and HW outflow (F2), but little is known about individual policies that affect the latter flows. For instance, we have inadequate understanding of the effectiveness of different policies to reduce health-worker emigration from developing countries. These policies include: selective admission into medical school of those students who are likely to remain in the country [25]; education curricula geared to the healthcare needs of developing countries [26]; compulsory service in the home country if medical education is publicly subsidized; 'ethical recruitment' provisions in receiving countries [27]; and visa restrictions [28].

Novel approaches to health-worker education, such as distance learning or computer-aided study, should be evaluated to assess the training of physicians, nurses, public health professionals, and allied health workers in developing countries. Recently a forceful argument has been presented that narrowly defined occupational curricula in training health professionals may not be optimal in producing health workers to meet the goals of the health system. Interprofessional and team-based education may be necessary to serve better the health-system goals of patient satisfaction and population health [29].

### 3.5. Adoption and adaptation of treatment technologies

New treatment technologies in developing countries carry the potential to lead to substantial improvements in population health. The health worker is clearly crucial to choosing such technologies for treatment [30]. However, health workers sometimes fail to adopt the best treatment that is available. For instance, oral rehydration therapy (ORT), which has been the standard first-line treatment for dehydration caused by diarrhea among children since the early 1980s [31], was not always adopted. As demonstrated in a 1996 study in Nigeria, large numbers of physicians prescribed inappropriate alternative treatments for childhood diarrhea, such as intravenous fluids. Moreover, whereas all physicians interviewed in this study knew of ORT and believed it to be an effective treatment for childhood diarrhea, almost half did not know how to prepare the rehydration solution [32].

We have inadequate understanding of how health workers in developing countries learn of new treatments, and how they decide whether or not to incorporate the treatment in their practice. These decisions are important because they directly affect population health outcomes and patient satisfaction.

If health workers decide to adopt a treatment technology, they may modify it to suit their patients, work patterns and institutional context [33,34]. Yet, there are examples where health workers modify treatments inappropriately (such as in the Nigerian study where physicians added spasmolytics or antibiotics to ORT [32]). To reduce undesirable outcomes and promote appropriate adoption (e.g. through M1 and M2), a better understanding of the

mechanisms of health-worker adoption and adaptation of treatment technologies is necessary.

### 3.6. Health-system structures and health-worker education

Health systems with health workers at the core can be 'vertically structured' or 'horizontally structured'. A vertically structured system is one that compartmentalizes health worker activities by different diseases. For example, in a vertically structured system the workforce and facilities to treat HIV infection will be different from those to treat malaria. In a horizontally structured system the treatment of different diseases is delivered by the same workers in the same facilities [35,36].

Depending on the degree of 'verticality', health workers' education and training (E2), and work experience, can be more or less specialized. If the number of specialisms is restricted to dealing with a few diseases only, then the flexibility of the health system in responding to different health needs and demands is compromised.

The minimum training requirements of health workers in a vertically structured system are more limited than in a horizontally structured system, because a smaller range of clinical skills is required to function in the former. Also, fewer non-clinical skills are likely to be required for the health worker to function in a vertical than in a horizontal structure. For example, the ability of health workers to practice in multidisciplinary teams and to communicate with each other and with different types of patients is essential for effective service delivery in horizontal structures, but it may not be so important in vertical programs. Hence, the need for interprofessional education and training will increase with the degree to which the system is horizontally structured.

As noted above, a disadvantage of vertically structured systems is the loss of flexibility in meeting healthcare needs and demands if these change in the future. An interesting approach to achieving flexibility is through the design of a 'diagonal' system [37,38]. In particular, horizontal systems could be strengthened through vertical approaches.

## 4. Limitations

Some limitations of our paper may be mentioned. First, while the focus on health workers is often helpful for policy and practice – because health workers perform most of the activities critical to the functioning of the health system – in some situations other foci may be warranted. To track healthcare spending in the health system, a framework of financial flows in the national health accounts may be better suited than a framework focused on the health worker. Similarly, if we are interested in understanding how patient preferences influence the organization and delivery of healthcare services, a framework with patients at the center may be more useful than one with health workers at its core. However, patient satisfaction is influenced by the interaction of patients with health workers. Thus, if the aim is to improve patient satisfaction (subjective patient outcomes) or population health (objective

patient outcomes), our health-worker centered framework can make a valuable contribution, as described above.

Second, our paper does not provide a systematic review of health-worker research areas. Such reviews exist for specific health-worker research topics [39,40] but need to be undertaken for others, such as the effectiveness of alternative models to train health workers and the extent to which health workers influence health outcomes. The purpose of our study differs from that of a systematic review in several respects. The purpose of a systematic review is to synthesize the results of all studies conducted on a specific research question in order to provide access to the evidence, to establish consistency and generalizability of findings, to identify particular knowledge gaps, and to refine research hypotheses. The purpose of our study is to focus health-system policy and research on the health worker, and enable the identification of a broad set of research issues to improve population health and patient satisfaction through the working of the health system.

Third, in any broad identification of health-worker research issues, we necessarily have to select a subset. We have selected six issues that contribute to the health system achieving its goals. This does not preclude the examination of other issues that are important for health policy and practice.

## 5. Conclusion

In this paper, we develop a health-system framework with health workers at its core. We use our framework to identify selected health-worker research issues. Inter alia, these include metrics to measure the capacity of the health system to deliver healthcare; the contribution of public- vs. private-sector health workers in meeting health-system goals; and the appropriate size, composition and distribution of the health workforce.

As we have argued in this paper, health workers are the foundation of the health system. Every function of the health system is either undertaken by or mediated through the health worker. Health workers play a critical role in the choice of treatments, and in curative and preventive care. Much of health-system financing is directed to health workers (through salaries and associated payments) and most other spending decisions are directed by health workers (through prescriptions, referrals and equipment purchase). Health-worker numbers, skill composition, and distribution determine availability of care for different groups. Without health workers it would be impossible to meet the goals of population health and patient satisfaction. For these reasons, our framework places health workers at the core of the health system.

## References

- [1] Evans RG. Incomplete vertical integration: the distinctive structure of the health-care industry. In: Van Der Gaag J, Perlman M, editors. Health, economics, and health economics. Amsterdam: North Holland; 1981.
- [2] Hurst J. Reforming health care in seven European nations. Health Affairs (Millwood) 1991;Fall:7–21.
- [3] OECD. The reform of health care: a comparative analysis of seven OECD countries. Paris: OECD; 2001.

- [4] Frenk J. Dimensions of health system reform. *Health Policy* 1994;27:19–34.
- [5] Cassels A. Health sector reform: some key issues in less developed countries. *Journal of International Development* 1995;7:329–48.
- [6] Murray CJ, Frenk J. A framework for assessing the performance of health systems. *Bulletin of the World Health Organization* 2000;78:717–31.
- [7] Hsiao WC. What is a health system? Why should we care? Cambridge, MA: Harvard School of Public Health; 2003.
- [8] Roberts M, Hsiao WC, Berman P, Reich M. Getting health reform right: a guide to improving performance and equity. New York: Oxford University Press; 2003.
- [9] Mills A, Rasheed F, Tollman S. Strengthening health systems. In: Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, Jha P, Mills A, Musgrove P, editors. *Disease control priorities in developing countries*, 2nd ed. Washington, DC: World Bank; 2006.
- [10] WHO. Everybody's business: strengthening health systems to improve health outcomes. Geneva: WHO; 2007.
- [11] Atun R, Menabde N. Health systems and systems thinking. In: Coker R, Atun R, McKee M, editors. *Health systems and the challenge of communicable disease*. Milton Keynes, UK: Open University Press; 2008.
- [12] Higgins J, Green S, editors. *Cochrane handbook of systematic reviews of interventions*. London, UK: The Cochrane Collaboration; 2011.
- [13] Joint Learning Initiative. *Human resources for health: overcoming the crisis*. Cambridge, MA: Harvard University Press; 2004.
- [14] Hernandez P, Dräger S, Evans DB, Tan-Torres Edejer T, Dal Poz MR. Measuring expenditure for the health workforce: evidence and challenges. Geneva: WHO; 2006.
- [15] Huber M, Orosz E. Health expenditure trends in OECD countries, 1990–2001. *Health Care Financing Review* 2003;25:1–22.
- [16] Phillips A, Smallwood L. Hospital beds and the quality of a national health system. *The Australian Journal of Rural Health* 2010;18:93–5.
- [17] Leonard C, Stordeur S, Roberfroid D. Association between physician density and health care consumption: a systematic review of the evidence. *Health Policy* 2009;91:121–34.
- [18] Prata N, Montagu D, Jefferys E. Private sector, human resources and health franchising in Africa. *Bulletin of the World Health Organization* 2005;83:274–9.
- [19] Soderlund N, Tangcharoensathien V. Health sector regulation – understanding the range of responses from government. *Health Policy and Planning* 2000;15:347–8.
- [20] Nigenda GH, Gonzalez LM. Contracting private sector providers for public sector health services in Jalisco, Mexico: perspectives of system actors. *Human Resources for Health* 2009;7:79.
- [21] Adam MA, Johnson LF. Estimation of adult antiretroviral treatment coverage in South Africa. *South African Medical Journal* 2009;99:661–7.
- [22] Ferrinho P, Van Lerberghe W, Fronteira I, Hipolito F, Biscaia A. Dual practice in the health sector: review of the evidence. *Human Resources for Health* 2004;2:14.
- [23] WHO. World health report 2006: working together for health. Geneva: WHO; 2006.
- [24] World Bank. World development report. Washington, DC: World Bank; 1993.
- [25] Lehmann U, Dieleman M, Martineau T. Staffing remote rural areas in middle- and low-income countries: a literature review of attraction and retention. *BMC Health Services Research* 2008;8:19.
- [26] Ahmad OB. Managing medical migration from poor countries. *British Medical Journal* 2005;331:43–5.
- [27] WHO. Managing health workforce migration: the global code of practice. Geneva: WHO; 2010.
- [28] Stilwell B, Diallo K, Zurn P, Vujicic M, Adams O, Dal Poz M. Migration of health-care workers from developing countries: strategic approaches to its management. *Bulletin of the World Health Organization* 2004;82:595–600.
- [29] Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet* 2010;376:1923–58.
- [30] Fleuren M, Wiefferink K, Paulussen T. Determinants of innovation within health care organizations: literature review and Delphi study. *International Journal for Quality in Health Care* 2004;16:107–23.
- [31] Victora CG, Bryce J, Fontaine O, Monasch R. Reducing deaths from diarrhoea through oral rehydration therapy. *Bulletin of the World Health Organization* 2000;78:1246–55.
- [32] Okeke TA, Okafor HU, Amah AC, Onwuasigwe CN, Ndu AC. Knowledge, attitude, practice, and prescribing pattern of oral rehydration therapy among private practitioners in Nigeria. *Journal of Diarrhoeal Diseases Research* 1996;14:33–6.
- [33] Bradley EH, Schlesinger M, Webster TR, Baker D, Inouye SK. Translating research into clinical practice: making change happen. *Journal of the American Geriatrics Society* 2004;52:1875–82.
- [34] Shield RR, Goldman RE, Anthony DA, Wang N, Doyle RJ, Borkan J. Gradual electronic health record implementation: new insights on physician and patient adaptation. *Annals of Family Medicine* 2010;8:316–26.
- [35] Oliveira-Cruz V, Kurowski C, Mills A. Delivery of health interventions: searching for synergies within the vertical versus horizontal debate. *Journal of International Development* 2003;15:67–86.
- [36] Mills A. Vertical vs horizontal health programmes in Africa: idealism, pragmatism, resources and efficiency. *Social Science and Medicine* 1983;17:1971–81.
- [37] Frenk J. Bridging the divide: comprehensive reform to improve health in Mexico. Nairobi, Kenya: Commission on Social Determinants of Health; 2006.
- [38] Sepulveda J, Bustreo F, Tapia R, Rivera J, Lozano R, Olaiz G, et al. Improvement of child survival in Mexico: the diagonal approach. *Lancet* 2006;368:2017–27.
- [39] Lewin SA, Dick J, Pond P, Zwarenstein M, Aja G, van Wyk B, et al. Lay health workers in primary and community health care. *Cochrane Database of Systematic Reviews* 2005:1.
- [40] Reeves S, Zwarenstein M, Goldman J, Barr H, Freeth D, Hammick M, et al. Interprofessional education: effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews* 2009:1.