

Health workforce in India: assessment of availability, production and distribution

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ABSTRACT

Background: India faces an acute shortage of health personnel. Together with inequalities in distribution of health workers, this shortfall impedes progress towards achievement of the Millennium Development Goals. The aim of this study was to assess health-workforce distribution, identify inequalities in health-worker provision and estimate the impact of this maldistribution on key health outcomes in India.

Materials and Methods: Health-workforce availability and production were assessed by use of year-end data for 2009 obtained from the Indian Ministry of Statistics and Programme Implementation. Inequalities in the distribution of doctors, dentists, nurses and midwives were estimated by use of the Gini coefficient and the relation between health-worker density and selected health outcomes was assessed by linear regression.

Results: Inequalities in the availability of health workers exist in India. Certain states are experiencing an acute shortage of health personnel. Inequalities in the distribution of health workers are highest for doctors and dentists and have a significant effect on health outcomes.

Conclusion: Although the production of health workers has expanded greatly in recent years, the problems of imbalances in their distribution persist. As India seeks to achieve universal health coverage by 2020, the realization of this goal remains challenged by the current lack of availability and inequitable distribution of appropriately trained, motivated and supported health workers.

Key words: Availability, distribution, health workers, inequalities, production

INTRODUCTION

In low-income countries, despite the availability of effective interventions for many priority health problems and enhanced developmental assistance, progress towards the health Millennium Development Goals is impeded by the shortage of trained, motivated and supported health workers.^[1,2] Health workers play a central role in ensuring the appropriate management of all aspects of the health system: From logistics and facility management to finances and health-care interventions.^[3] Furthermore, because a society's health and its development are strongly linked, health workers have an indirect but crucial role in the achievement of sustainable human and economic

development.^[4] There have been efforts to expand the health workforce to meet demand. However, these efforts have been hampered by increases in factors such as population size, purchasing power for health services within communities, life expectancy and the prevalence of noncommunicable diseases and other chronic conditions.^[5]

India is a conglomeration of states with diverse levels of socioeconomic status, governance, health systems and health situations. As elsewhere, India has shortages and maldistribution within its health workforce that have contributed to inequities in health outcomes. India's health workforce is a combination of both registered, formal health-care providers and informal medical practitioners,

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the latter being the first point of contact for a large proportion of the population.^[6]

The country is unique because an expanding private for-profit sector is juxtaposed against a vast network of public sector health facilities, which compete for a common pool of health human resources. Moreover, despite an increasing shortage of local health professionals, India has emerged as the most important source country in the global health-workforce market. According to the 2006 World Health Report, India had 0.60 doctors, 0.80 nurses, 0.47 midwives, 0.06 dentists and 0.56 pharmacists, respectively, per 1000 population. In absolute terms, reversal of the country's shortfall in health workers was estimated to require an investment of almost US\$ 2 billion per year by 2015.^[7]

In addition to the known shortage of health workers, there is a common perception that large in-country inequalities exist in their distribution. To date, the evidence to support this proposition has been limited, owing to a lack of reliable disaggregated data at the country level. This study therefore used the most up-to-date data available to assess the production, employment and distributional patterns of health workers in India. Inequalities in health-worker distribution at the state level and the impact of this maldistribution on key health outcomes were also assessed.

DATA AND METHODS

No ethics committee approval was required for this research

Although WHO defines health workers^[7] as “all people engaged in actions whose primary intent is to enhance health”, the term “health worker” in this study was restricted to three categories: Doctors, dentists and nurses/midwives. Year-end data for 2009 on these health workers at the state level were obtained from the Indian Ministry of Statistics and Programme Implementation's 2011 Report on Health and Family Welfare.^[8] In this report, estimates on health-worker stock were derived from three databases: (i) allopathic medical practitioners registered with state medical councils; (ii) dental surgeons registered with the central/state dental councils; and (iii) information on registered nurses and midwives available to the Indian Nursing Council and Central Bureau of Health Information, Directorate General of Health Services, Government of India. In addition, national and state data on the number of educational institutions in medicine, dentistry and nursing/midwifery, as well as the number of admitted students, were extracted from the Medical Council of India (MCI), Dental Council of India (DCI) and Indian Nursing Council (INC) databases.^[9-11] Ministry of Health and Family Welfare documents were used to assess the employment of health personnel and number

of vacant health-worker posts.^[12] This latter analysis was limited to the public sector, since data on private-sector employment were not available.

For state-wise analysis, population projections published by the Registrar General of India^[13] were adjusted for differences in the projected and estimated populations from the 2011 census.^[14] Densities of health workers were calculated from the workforce data described above and census data on populations. National time trends for health-worker densities were calculated for 2000–2009. Where subnational data were available, Lorenz curves and Gini indices were calculated to assess geographical inequalities in doctor, dentist and nurse/midwife densities. The Gini coefficient and Lorenz curve are measures of inequality and have been used in previous studies of health workforce inequality.^[15,16] This inequality analysis was based on the density at the first administrative division below national level, which is equivalent to the state level in India.

Spearman's rank correlation coefficient was calculated to assess the relation between health-worker density and gross domestic product (GDP) at the state level. GDP data were derived from Reserve Bank of India Handbook of Statistics on Indian Economy.^[17] The relation between health-worker density and selected health outcomes was assessed by linear regression of data on infant mortality, maternal mortality, mortality in children younger than 5 years and measles immunization coverage from the 2010 Government of India Annual Report to the People on Health^[18] against the density of health professionals. All variables were transformed into natural logarithms. Data analyses were done with STATA version 10.0.

RESULTS

Health-worker availability

Table 1 shows the absolute numbers and category-wise density (per 1000 population) of doctors, dentists and nurses including midwives at the national and state levels. In 2009, India had 761 806 doctors, 104 603 dentists and 1 650 180 nurses and midwives. At the national level, the aggregate density of doctors, nurses and midwives was 2.08 per 1000 population, which was lower than WHO's critical shortage threshold of 2.28.^[7] There were gross inequalities in the availability of these health workers at the subnational level. For example, states such as Bihar, Uttar Pradesh, Uttarakhand, Jharkhand and Chhattisgarh had especially severe shortages of health workers [less than 1 per 1000 population; Table 1].

The 1993 World Development Report^[19] recommended that the ratio of nurses to doctors should exceed 2:1 as a minimum, with 4:1 or higher considered best for cost-effective quality care. In 2009 the ratio of nurses

Table 1: State-wise availability of doctors, dentists, nurses and midwives – 2009

States	Population (million) ^a	Health-worker numbers ^a				Health-worker density per 1000 population				Ratio of nurses and midwives per doctor
		Doctors	Dentists	GNTMs	ANMs	Doctors	Dentists	Nurses and midwives	Combined ^e	
Andhra Pradesh	83.11	62 349	6510	136 477	112 269	0.75	0.078	2.99	3.74	3.99
North-east states ^b	49.84	19 324	944	20 285	23 375	0.39	0.019	0.88	1.26	2.26
Madhya Pradesh	70.28	25 662	2002	96 574	27 566	0.37	0.028	1.77	2.13	4.84
Bihar	100.94	36 559	2807	8883	7501	0.36	0.028	0.16	0.52	0.45
Chhattisgarh	24.85	2746	407	3945	1900	0.11	0.016	0.24	0.35	2.13
Goa	1.37	2716	687	N/A	N/A	1.99	0.503	N/A	N/A	N/A
Gujarat	58.76	45 058	2684	88 258	36 427	0.77	0.046	2.12	2.89	2.77
Haryana ^c	24.51	4132	2059	17 821	13 727	0.17	0.084	1.29	1.46	7.64
Himachal Pradesh	6.72	705	772	8550	10 152	0.10	0.115	2.78	2.89	26.53
Jammu and Kashmir	12.22	10 906	1090	N/A	N/A	0.89	0.089	N/A	N/A	N/A
Jharkhand	32.06	2933	NA	1998	3405	0.09	NA	0.17	0.26	1.84
Karnataka	59.86	83 177	25 612	136 421	48 509	1.39	0.428	3.09	4.48	2.22
Kerala	32.90	37 835	6655	85 624	28 378	1.15	0.202	3.46	4.61	3.01
Maharashtra	109.27	134 859	18 159	93 032	33 158	1.23	0.166	1.15	2.39	0.94
Orissa	41.20	16 734	537	63 167	49 170	0.41	0.013	2.73	3.13	6.71
Punjab ^c	27.07	38 434	7348	45 801	18 152	1.42	0.271	2.36	3.78	1.66
Rajasthan	66.42	27 654	364	37 667	22 239	0.42	0.005	0.90	1.32	2.17
Tamil Nadu ^d	71.20	84 525	11 609	186 972	54 124	1.19	0.163	3.39	4.57	2.85
Uttar Pradesh	192.62	55 355	5572	21 042	27 328	0.29	0.029	0.25	0.54	0.87
West Bengal	89.65	58 059	2054	48 470	56 302	0.65	0.023	1.17	1.82	1.80
Uttaranchal	9.82	3085	451	92	700	0.31	0.046	0.08	0.39	0.26
Delhi	15.83	8999	6280	26 547	2160	0.57	0.397	1.81	2.38	3.19
India	1183.56	761 806	104 603	1 127 626	576 542	0.64	0.088	1.44	2.08	2.24

GNTM=General Nursing and Midwifery, ANM=Auxiliary Nurse Midwifery, N/A=data not available aPopulation data and health-professional statistics for 2009 from references 9-14; binclude Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim; cinclude data from Chandigarh proportionate to state populations, dincludes the Union Territories, i.e., Chandigarh, Puducherry, Daman and Diu, Lakshwadeep, Andaman and Nicobar and Dadar Nagar Haveli; eincludes doctors, nurses and midwives

to doctors in India was 1.5:1, while the ratio of nurses/midwives to doctors was 2.2:1. There was substantial variation at the state level, the ratio being lower than the national average in six out of the eight Empowered Action Group states^a [Table 1]. In the decade between 2000 and 2009, both the absolute numbers and the densities of doctors, dentists and nurses/including midwives have steadily increased. Figure 1 illustrates the trend in densities.

Health-workforce production

Review of the available data on training of health workers highlights three important developments. First is the recent rapid expansion in the training capacity of health workers. Between 1991 and 2013, the number of admissions to medical colleges increased from 22 438 to 49 508, i.e. by 121%, while within the same period admissions to dental institutions expanded from 3100 to 23 800, i.e. by 668%.^[9,10] Similar increases occurred in nursing. In 1997, there were 659 General Nursing and Midwifery and 485 Auxiliary Nurse Midwifery institutes,

a. States with poor health outcomes identified on a priority basis by the National Rural Health Mission in India: Bihar, Chhattisgarh, Uttar Pradesh, Madhya Pradesh, Orissa, Jharkhand, Uttarakhand and Rajasthan.

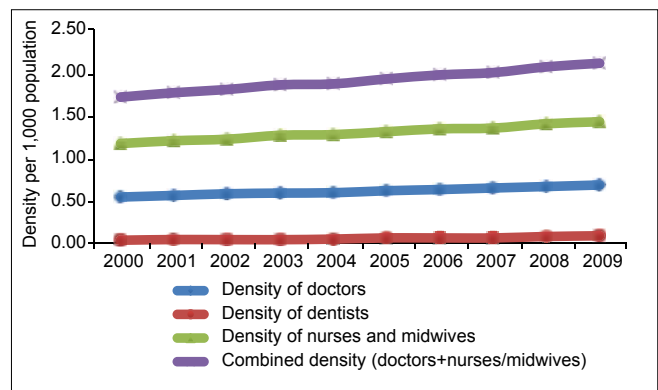


Figure 1: Density of health professionals per 1000 population – 2000–2009

which increased more than threefold to 2487 and 1307 institutes, respectively, in 2012. Likewise, the number of recognized nursing institutes offering the Bachelor of Science in Nursing (BSc) degree has increased from 165 in 2004^[20] to 1507 in 2012 [Table 2].^[11] There were clear inequalities in the distribution of these training institutions among states. Although the Empowered Action Group states account for almost half of the country’s population, they house only approximately one-fifth of the medical colleges and a quarter of the dental and nursing institutes.

Table 2: State-wise production capacity of nurses and midwives – 2012

States	Number of institutions or schools			Annual production capacity		
	GNM	ANM	BSc	GNM	ANM	BSc
Andhra Pradesh	249	46	221	10 924	1315	11 481
North-east states ^a	53	29	18	1543	829	883
Madhya Pradesh	201	115	106	7950	3765	5245
Bihar	10	40	1	426	1198	40
Chhattisgarh	29	66	48	1046	2205	2260
Goa	2	1	3	70	20	130
Gujarat	79	60	37	3155	2040	1695
Haryana	53	53	23	2140	1830	1065
Himachal Pradesh	31	6	12	1170	185	540
Jammu and Kashmir	11	8	4	470	285	180
Jharkhand	21	23	5	735	685	230
Karnataka	543	44	336	25 214	1325	18 133
Kerala	225	16	121	7015	390	6630
Maharashtra	119	347	85	3624	7493	3820
Orissa	51	80	14	1860	2230	690
Punjab	181	129	86	8893	4440	4170
Rajasthan	185	39	144	8760	1170	6296
Tamil Nadu	196	17	157	5540	435	8790
Uttar Pradesh	160	112	38	7520	3800	1760
West Bengal	54	58	16	2021	2555	705
Uttaranchal	12	12	7	380	315	320
Delhi	17	4	12	705	150	605
Union Territories ^b	5	2	13	160	40	935
India	2487	1289	1507	101 321	38 700	76 603

GNM=General Nursing and Midwifery, ANM=Auxiliary Nurse Midwifery (include Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh and Sikkim; binclude Chandigarh, Puducherry, Daman and Diu, Lakshwadeep, Andaman and Nicobar and Dadar Nagar Haveli. Data source: Indian Nursing Council, 2012

Second, there has been a notable increase in the private sector's involvement in medical education. Prior to 1991, there were 144 medical colleges in India, 101 (70%) of which were public colleges. By 2013, the number of institutions recognized or approved by the MCI had increased to 371. There has been a disproportionate increase in the number of nongovernment colleges; 152 (67%) of the 227 new institutions are private.^[9] Similarly, before 1991, there were 49 dental colleges, of which 23 (47%) were government owned. As of 2013, 246 new dental institutions recognized or approved by the DCI have been added to the existing list, of which almost all (229) are in the private sector [author's calculation based on data from reference 10; Table 3].

Third, despite the consistent increase in health-worker production, posts in public-health facilities remain unfilled. Between 2007^[21] and 2009,^[22] the stock of health workers, i.e. doctors, dentists, nurses and midwives increased by 264 225. Over the same period, however, the total number of vacant posts in government health staff positions improved little or increased. For instance,

vacant posts for medical officers at primary health centres and specialists at community health centres, increased by 43.6% and 17.5%, respectively, during 2005–2010, with Empowered Action Group states contributing to two-fifths of these vacancies.^[13,23] Even when allowance for staff attrition and creation of new posts is made, the trends in vacancies do not match production patterns.

Distribution of health workers

Intra-state differences in health-worker availability, which may be associated with the urban–rural divide and corresponding economic disparities, could not be assessed owing to lack of access to district-level data. The analysis was therefore limited to inter-state inequalities in availability of doctors, dentists, nurses and midwives in 2009. Overall inter-state inequalities were very high, with Gini coefficients of 0.424 for doctors, 0.569 for dentists and 0.412 for nurses (note that these Gini coefficients are calculated across population groups – states with an average population of 33 815 979 individuals – rather than across individuals themselves).

There was a positive correlation between state GDP and density of doctors, dentists, nurses and midwives (Spearman's rho = 0.353; $P = 0.116$), implying that low-income states are disadvantaged in terms of concentration of health workers.

Table 4 presents the regression results of selected national health outcomes and worker density. The results indicate that the density of doctors, nurses and midwives is associated with the variation in rates of maternal mortality, infant mortality, under-5 mortality and measles immunization. The effect of increased density was greater in reducing maternal than in reducing child mortality.

DISCUSSION

As India strives to achieve universal health coverage, improvement in health-care delivery through the availability of skilled and motivated health workers is essential.^[8] A clear understanding of the health-workforce situation is critical to the development of effective policies to develop and manage a responsive workforce. Human resource shortages hinder scale-up of health services and limit the capacity to absorb additional financial resources.^[24]

The primary data used in these analyses are the numbers of health personnel registered with the respective professional councils and therefore have several limitations. These councils do not maintain live registers, except for doctors in Delhi. The information they provide may be inaccurate owing to nonadjustment for deaths, migrations and retirements, or double counting of workers registered in more than one state. Furthermore, not all state councils follow the same procedure for registration, which may

Table 3: State-wise production capacity of doctors and dentists – 2013

States	Number of institutions ^a				Annual production capacity			
	Medical		Dental		Medical		Dental	
	Government	Private ^d	Government	Private ^d	Government	Private ^d	Government	Private ^d
Andhra Pradesh	15	27	3	17	2400	3800	180	1510
North-east states ^b	9	2	2	0	876	200	90	0
Madhya Pradesh	6	6	1	14	800	900	40	1320
Bihar	9	3	1	5	940	260	40	280
Chhattisgarh	4	1	1	5	450	150	100	500
Goa	1	0	1	0	150	0	40	0
Gujarat	9	10	2	12	1530	1400	140	1090
Haryana	3	3	1	9	400	350	60	840
Himachal Pradesh	2	1	1	3	200	150	60	220
Jammu and Kashmir	3	1	2	1	400	100	100	100
Jharkhand	3	0	0	3	350	0	0	250
Karnataka	12	34	2	43	1500	5255	110	2990
Kerala	7	18	3	20	1100	2000	120	1150
Maharashtra	20	25	4	31	2740	3245	240	2760
Orissa	3	5	1	4	550	500	20	360
Punjab	3	7	2	14	400	695	80	1210
Rajasthan	7	3	1	13	1300	350	40	1210
Tamil Nadu	21	20	1	28	2665	2900	100	2570
Uttar Pradesh	14	16	3	27	1827	1500	130	2650
West Bengal	14	2	3	1	2050	300	220	100
Uttaranchal	2	2	0	2	200	250	0	200
Delhi	6	2	3	0	850	200	140	0
Union Territories ^c	3	7	2	3	325	900	140	300
India	176	195	40	255	24 003	24 205	2190	21 610

^aIncludes only recognized, approved or permitted institutes; ^bincludes Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh and Sikkim; ^cincludes Chandigarh, Puducherry, Daman and Diu, Lakshwadeep, Andaman and Nicobar and Dadar Nagar Haveli; ^dincludes societies, trusts, municipal corporations. Universities and private enterprises. Source: Medical Council of India; Dental Council of India, 2012

Table 4: Linear regression for maternal, infant and under-5 mortalities and for measles vaccination coverage by health-worker density

Independent variable	Maternal mortality			Infant mortality			Under-5 mortality			Measles vaccination coverage		
	Coefficient	t	P> t	Coefficient	t	P> t	Coefficient	t	P> t	Coefficient	t	P> t
Density of doctors	-1.01	-2.92	0.009	-0.89	-2.32	0.030	-0.92	-2.28	0.035	1.13	1.55	0.134
Density of nurses and midwives	-1.60	-3.38	0.004	-0.36	-0.65	0.521	-0.99	-2.03	0.058	2.75	2.82	0.010
Combined density of doctors and nurses	-1.32	-3.58	0.002	-0.87	-1.73	0.099	-0.93	-2.28	0.035	2.53	2.69	0.014

compromise direct comparisons. Data for health workers in some states (e.g. north-east India) are not available because there are no state-specific professional councils.^[6] In addition, the analyses were limited to the supply or availability of health workers and do not examine the factors such as the quality or adequacy of services provided. Nevertheless, the data used provide the most up-to-date information on India's health workforce, are maintained by the WHO Global Atlas^[25] and have been used extensively for both intra-country and cross-country comparisons.

Notwithstanding these limitations, this analysis has highlighted some key issues that the Government of

India and development partners should consider when addressing the health human resource crisis. There is gross inadequacy of the current stock of health workers available and significant inequalities in their distribution between the different states. Poorly performing states, in terms of health outcomes, have a greater shortfall in the number of health workers. These shortages highlight the need to develop and implement high quality, evidence-based, costed workforce plans, especially in the poorest and most fragile states.

In the past two decades, there has been tremendous progress in increasing the training capacity. This

analysis suggests three key findings regarding workforce production. First, the increase in training capacity has been largely because of the growth in private-sector involvement in medical education. This trend seems likely to increase, since incentives and regulation relaxations have been introduced to encourage private investment in medical education. While privatization of medical education has helped to overcome the shortcomings resulting from inadequate expansion of the training capacity in the public sector, it has also raised questions on the quality of medical training. An example of an initiative to standardize the quality of medical education is the MCI's decision to introduce a single National Eligibility and Entrance Test for undergraduate admissions at all government and private medical colleges. This test has not yet been implemented and there is scepticism as to how it might be transparently and fairly applied to the 800 000 students who would take the test each year.^[26] Second is the gross inequality in the distribution of the training institutes among the different states. These institutes are primarily clustered in states with high GDPs, where the issues related to shortages of health workers are relatively less acute. Third is the increased mismatch between health-worker production and vacant staff posts in the public-health systems. This finding suggests that increases in the production and overall supply of medical graduates will not necessarily address the public sector shortages. Other strategies will need to be introduced to encourage health workers to serve in the public sector.

These findings highlight major inequalities in the distribution of health workers between the states. The imbalances in the distributions of doctors and dentists were found to be higher than those for nurses. Our estimates of the inter-state inequality in the health-worker distributions were similar to previously reported estimates.^[16] The Gini index for doctors was 0.424 and for nurses and midwives was 0.412, while in a previous report^[16] it was estimated to be 0.4365 and 0.5271, respectively. These findings suggest that over a period of almost a decade there has been minimal improvement in the distribution pattern of doctors, despite rapid increases in production. The current estimates do however suggest an improvement in the distribution of nurses and midwives.

Economically disadvantaged states had both lower densities of workers and less-educated workforces. These inequalities in the availability of health workers possibly explain the inequities in health outcomes across the states, as demonstrated in the regression results. Since less-developed states are likely to have lower levels of investments in health and health systems, training, recruitment and retention of skilled health workers will remain a persistent challenge.

These findings suggest the need to trial alternative service delivery mechanisms. Some states have already

experimented with the provision of doctors with lower levels of training.^[6] While the effectiveness of this cadre of health workers and the quality of care provided remains to be formally evaluated, the central government has expressed plans to expand the model. It has been proposed that a new cadre of rural health workers will be trained through a course that is an abridged version of the traditional medical degree, with a focus on core competencies such as disease prevention, health promotion and rehabilitation. This Bachelor of Rural Medical Science has been advocated as innovative move to address the country's rural health-care challenges.^[27]

The observed shortages in health workers also suggests the need to strengthen further the available alternative workforce such the Accredited Social Health Activists (front-line health workers introduced under the National Rural Health Mission) and the Ayurvedic, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) doctors. Both of these providers can play a vital role in enhancing access to basic health-care services, especially at the community level.^[28]

In conclusion, while production of health workers has greatly expanded in recent years, this has been at the cost of increased privatization of medical education in India. The rapid growth in the production of health workers such as doctors, dentists, nurses and midwives has not helped fill vacant positions in the public-health system. Further, the problems of imbalances in the distribution of these health personnel persist, with certain states remaining at a disadvantage. These findings suggest that mere increase in production capacity is unlikely to resolve the issues related to health-worker availability or distribution. There is an urgent need to adopt sustained and innovative actions to address India's current health-workforce crisis.

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