World Health Organization

THE HEALTH WORKFORCE IN INDIA

Human Resources for Health Observer Series No. 16

Sudhir Anand and Victoria Fan

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Foreword

In September 2015, the world came together to launch an ambitious Agenda for Sustainable Development. People, planet, peace, prosperity, and partnership are prioritized, with a commitment to leave no one behind. Evidence-based health workforce plans and policies carry with them the potential to deliver benefits across the Sustainable Development Goals: improving health, creating employment, and generating inclusive economic growth, particularly for women and youth.

Complementing the more traditional supply-side perspective of an available, accessible, acceptable and quality health workforce is the more recent recognition of a demand-side perspective that relies on health labour markets to understand the formation, employment, deployment, remuneration and distribution of the health workforce. WHO's *Global Strategy for Human Resources for Health: Workforce 2030*, is explicit in including a global health labour market perspective. Building on collaboration with the World Bank, the Global Strategy provides new evidence on an increasing mismatch between the supply, demand, and need for health workers. While the market in middle and high income countries is likely to create 40 million new health workforce jobs over the next fifteen years, it is likely to fall well short of generating the 18 million health workers required to achieve and sustain Universal Health Coverage in low- and low-middle income countries.

Addressing this mismatch requires much better evidence-informed workforce policies based on reliable and robust national and sub-national data. In this regard, this study led by Sudhir Anand and Victoria Fan describing the nature of health workforce inequalities provides invaluable insights into myriad health and health workforces challenges faced by India. The study's rigor and quality set an important standard for evidence that will inform similar analyses beyond India. As such, it serves as a rich resource for researchers and policy makers as they work to generate and use evidence to inform health workforce strategies to accelerate progress towards Universal Health Coverage.

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Preface

I am delighted that WHO has decided to publish this very interesting study by Prof. Sudhir Anand on the distribution of the health workforce in India. The study originated out of a conversation which Sudhir, who is an old friend, had with me in 2009 when I was the Deputy Chairman of the Indian Planning Commission. He pointed out to me that we had no reliable data on the availability of health personnel of different types whereas China obtains such information from its Ministry of Health annual reporting system of health workers in both the public and private sectors. Our existing database on health workers was woefully inadequate. We had information on those employed in public sector health facilities but no information on the large numbers in private practice. We had data from professional registries, but these were scattered and also inaccurate as they did not reflect retirement, death or migration.

Sudhir suggested that the 2001 Census should be the basis of an authoritative documentation of the distribution of the health sector work-force. The Census contained information on the occupation of individuals which included several health-related categories such as allopathic doctor, ayurvedic doctor, homeopathic doctor, nurse, pharmacist, etc. It also contained information on the level of education of each individual and of course their geographical location by district and urban-rural stratum. Using this database would provide very valuable information on the educational levels of those in the health workforce. I was convinced that this was a study worth doing.

At that time, the Planning Commission was heavily engaged in trying to evolve a national strategy for universal heath care with special emphasis on the need to provide access to poorer people in rural areas and also in geographically remote areas. As often happens with government programmes, much of the focus was on how to provide the additional financial resources needed, since it was well known that India was not spending enough public money on health. Available data showed that the total expenditure on health (public and private expenditure combined) was about 4% of GDP which was comparable to that in other countries at a similar level of development. However, in India the share of public sector expenditure was only 25 percent of the total whereas in other countries it was 50 percent. Mobilising additional financial resources was a challenging task, especially because it involved a combined effort by the central government and the state governments. However, health experts had warned that in addition to finances, availability of trained personnel was a major constraint. Our efforts at strengthening the health care delivery system would be ineffective if we were not able to deploy sufficient numbers of trained professionals in the public clinics and other health facilities proposed to be set up. In the absence of a supply response on the human resource side, creating more health facilities would only drive up the wages of scarce health personnel.

The proposed study would provide an extremely valuable benchmark even if only for 2001. The work on the 2011 Census was about to start and it was argued that we should use that as our principal data source. However, knowing that the 2011 data would take time to become available, especially for extensive new tabulations, I decided that we should undertake the study on the 2001 data and use it as a benchmark against which we could measure improvement by 2011. I promptly got in touch with the Registrar General of India, Dr C. Chandramouli, who was in overall charge of the Census. He agreed that this was a worthwhile activity and promised his full support, deputing Shri R. C. Sethi, Additional Registrar General, to work closely with us. I must place on record my thanks to Shri Sethi for the unstinting support he gave to this study. A total of 593 district files on health workers were extracted from the Census data and they are the basis of the analysis in this volume.

The study was discussed internally in the Planning Commission and with other concerned officials. In a report to Prime Minister Dr Manmohan Singh, I pointed out that the study had produced some very interesting findings. Among the ones I singled out for the Prime Minister were the following:

(i) At the national level the density of doctors of all types (allopathic, ayurvedic, unani and homeopathic) in 2001 was 80 doctors per 100,000 of the population and the density of nurses was 61 per 100,000. The comparable figures for China were 148 for doctors and 103 for nurses. In both countries the densities were higher in urban areas than rural areas, but in India the density in urban areas was 4 times

the rural, whereas in China it was twice the rural density. What this showed was that in the matter of health personnel we were less well endowed than China, which is not entirely surprising considering that China had a much higher per capita GDP, but such resources as we had were more unequally distributed between urban and rural areas.

(ii) Many individuals claiming to be doctors in their occupation did not have the requisite professional qualifications. Almost one third of those calling themselves doctors were educated only upto secondary school. The lack of medical qualifications was particularly high in rural areas. Whereas 58% of the doctors in urban areas had a medical degree, only 19% of those in rural areas had such a qualification.

(iii) The lack of trained health professionals was obviously a major constraint on our ability to achieve health delivery in a short period. To reach the Chinese level of density of doctors we would need an additional 700,000 doctors but the capacity of our medical universities at the time was limited to producing only 30,000 doctors per year. It has increased since then, but hardly to the level which would allow early closing of the gap. I also pointed out that all doctors do not need to have an MBBS degree. In China, many doctors hold only three-year medical diplomas and much of our need could also be met through paramedicals. However, there was strong opposition from the medical profession to allow "unqualified persons" to practice as doctors in any public facility. There has been some change since then, with some states recognizing three-year licentiate diplomas and thus allowing these persons to serve in public clinics and hospitals.

(iv) There was enormous variation in density across states. The density of doctors in Chandigarh (a city which is a Union Territory) was ten times that in the worst state, Meghalaya. The doctor density in Punjab, one of the upper income states, was 2.6 times higher than in Bihar, which is one of the poorest states.

(v) One of the interesting findings in the study was that the percentage of female doctors who had medical degrees was much higher than male doctors. I took the liberty of drawing the Prime Minister's attention to an interesting inference from this fact: viz. if one was somewhere in India with no personal knowledge of individuals but in need of a doctor, one would do better in a probabilistic sense by going to a woman doctor!

There are many other features of the study that are of immense value not only for policy makers but also for scholars. I am truly grateful to Sudhir Anand for the enormous amount of time he devoted to this study in a purely honorary capacity as a labour of love. He was assisted by Dr N. K. Sethi of the Planning Commission who was at the time Adviser Health and Dr Arunish Chawla from my office. I am also grateful to Victoria Fan, Sudhir's coauthor and former student who was also responsible for the statistical work in preparing tables, figures and maps.

I had always hoped that Sudhir will take on the task of supervising a repeat of this study with the Census 2011 data, which are now available. This would be invaluable as it would indicate what progress there has been in the availability of health professionals in India, the extent to which geographic differences and urban-rural differences have narrowed, and most of all, whether there has been an improvement in the educational qualifications of the health workforce. I take this opportunity to persuade him to undertake this task and wish him all success in this endeavour.

Montek S. Ahluwalia
Former Deputy Chairman of the Indian Planning Commission

Acknowledgements

We owe a special debt of gratitude to Montek Ahluwalia who has supported this study in numerous ways. He enlisted the cooperation of the Registrar General of India to re-run the massive unit-record data of Census 2001, and extract 593 districtwise cross-tabulations that form the basis of our study. Officials from the Office of the Registrar General of India who helped in this intensive and lengthy process included R. C. Sethi, Dipak Roy Choudhury, Anil Singh, A. P. Singh, Anil Arora and J. S. Lamba, and from the Planning Commission N. K. Sethi and Amandeep Singh. Arunish Chawla provided logistical assistance and organized several seminars on the study at the Planning Commission. For their comments on or other forms of support of this study, in addition to Montek Ahluwalia we would like to thank Lincoln Chen, Amartya Sen, Abhijit Sen, Syeda Hameed, Srinath Reddy, Nargis Sultana, Gerard La Forgia, Roberto Zagha, Tim Evans and Jim Campbell. We are also grateful to Angelica Sousa, who acted as the principal contact between us and WHO in overseeing the publication of this study.

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Summary of findings

National profile

Composition

- Of a total population of 1 028 610 328 in 2001, there were 2 069 540 health workers of which 819 475 (or 39.6%) were doctors, 630 406 (or 30.5%) were nurses and midwives, and 24 403 (or 1.2%) were dentists. Of all doctors, 77.2% were allopathic and 22.8% were ayurvedic, homeopathic or unani. Other categories of health workers were pharmacists, ancillary health professionals, and traditional and faith healers, who comprised 28.8% of the total health workforce. There are nine separate health worker categories in this study.

Density

- The national density of doctors was 79.7 per lakh population, of nurses and midwives 61.3 per lakh, and of dentists just 2.4 per lakh.[1]

Urban–rural disparities

- There were 1 225 381 health workers in urban areas and 844 159 in rural areas, an urban–rural ratio of 1.45. Of all health workers, 59.2% were in urban areas, where 27.8% of the population resides, and 40.8% were in rural areas, where 72.2% of the population resides. The ratio of urban density to rural density for doctors was 3.8, for nurses and midwives 4.0, and for dentists 9.9.

Male–female ratios

- Of all health workers 38.0% were female. The male–female ratio of all heath workers was 1.6, of doctors 5.1, and of nurses and midwives 0.2.

Education and medical qualification

- Among allopathic doctors, as many as 31.4% were educated *only* up to secondary school level – and as many as 57.3% did *not* have a medical qualification. Among nurses and midwives, 67.1% had education only up to secondary school level.

- The education level and medical qualification of urban doctors were much *higher* than those of rural doctors. Among allopathic doctors, 83.4% of urban doctors had higher than secondary schooling compared to 45.9% of rural doctors. Of urban allopathic doctors 58.4% had a medical qualification, whereas only 18.8% of rural allopathic doctors had one.

- In every health worker category except "ancillary health professionals", a higher proportion of female than male health workers were educated to more than secondary school level. In *every* health worker category, a higher proportion of females had a medical qualification than males. Among allopathic doctors, 67.2% of females had a medical qualification compared to 37.7% of males. Among nurses and midwives (hereafter referred to as "nurses"), 11.3% of females had a medical qualification compared to 2.9% of males.

Interstate comparisons

Concentration of health workers

For certain categories of health workers, there were very high concentrations in particular states. West Bengal had 30.6% of all homeopathic doctors in the country but only 7.8% of the population. Uttar Pradesh had 37.5% of all unani doctors in the country with 16.2% of the population. Maharashtra had 23.0% of the country's ayurvedic doctors with 9.4% of the population. Kerala had 38.4% of the country's medically qualified nurses but only 3.1% of the population.

1 In the Indian numerical system, 1 lakh = 100 000.

Composition of health workers

- Although nationally 22.8% of all doctors were ayurvedic, homeopathic or unani (hereafter referred to as "AYUSH"), in some states the fraction of AYUSH doctors was much higher: 41.7% in Tripura, 40.5% in Orissa and 38.1% in Kerala.

- There is some suggestion of substitution between nurses and doctors within states. There is a negative Pearson correlation coefficient across states of –0.60 between the percentage of nurses in the health workforce of a state and the percentage of doctors.

Health worker density and income

- The density of all health workers in a state was positively but imperfectly correlated with the per capita income of the state (correlation coefficient of 0.76). Better-off states seem to afford more doctors plus nurses per capita (correlation coefficient 0.92), and more dentists per capita (correlation coefficient 0.93).

Interstate differentials in health worker density

- There was a 6-fold interstate differential between the highest and lowest density of all health workers; for health workers with more than secondary schooling this differential was 10-fold, and for health workers with a medical qualification it was 20-fold. Similar interstate differentials were observed for individual health worker categories.

Health worker distribution by gender

- The percentage of all health workers in the country who were female was 38.0%, but there was great variation across states. The states with the highest share of female health workers were Kerala (64.5%) and Meghalaya (64.2%), and the states with the lowest were Uttar Pradesh (19.9%) and Bihar (22.3%).

Interdistrict differentials in India

Interdistrict inequality in health worker densities

- Interdistrict inequality in health worker densities across the country's 593 districts is indicated in this study by the Gini coefficient. For all health workers, the national interdistrict Gini was 0.29, but it was higher for each of the nine individual categories of health worker.

- The interdistrict Gini for a health worker category increases as we restrict the category to those with more than secondary schooling and further restrict it to those with a medical qualification. For example, for allopathic doctors the interdistrict Gini is 0.31; it is 0.37 for those with more than secondary schooling, and 0.49 for those with a medical qualification. For nurses the interdistrict Gini increases from 0.40 to 0.43 to 0.75. For dentists the Gini increases from 0.56 to 0.61 to 0.70.

Lowest 30 and highest 30 districts ranked by health worker density

- This study contains tables of the lowest 30 and highest 30 districts ranked by health worker density. Similar tables are provided for districts ranked by density of health workers with more than secondary schooling and those with a medical qualification.

- Among the lowest 30 districts ranked by density of allopathic doctors, half are in north-eastern states and the remainder are in central states. The lowest 30 districts ranked by density of allopathic doctors with a medical qualification are found mainly in the states of Uttar Pradesh, Bihar and Madhya Pradesh.

- Among the highest 30 districts ranked by density of allopathic doctors, 18 are in state capitals or in the national capital (seven are in Delhi). There are 20 districts in common among the highest 30 ranked by density of all allopathic doctors and allopathic doctors with a medical qualification.

Nurses

- The lowest 30 districts ranked by density of nurses are all located in the states of Bihar, Uttar Pradesh and Jharkhand. Among the highest 30 districts, seven districts are in Kerala and 13 are in state capitals or in the national capital.

- As many as 73 districts had *no* nurses with a medical qualification. Among the highest 30 districts ranked by density of nurses with a medical qualification, the top six districts are in Kerala.

Dentists

- Out of the 593 districts in the country, 58 districts had no dentists *at all*; 88 districts had no dentists with more than secondary schooling; and 175 districts had no dentists with a medical qualification.

1. Introduction

This study on the health workforce is based on data at district level from the Indian census of 2001. The census of India 2001 canvassed information on the occupation of main and marginal workers, which is coded using the National Classification of Occupations (NCO) 2004 at four-digit level. There are 19 distinct occupations of health workers at the four-digit level in NCO, which have been aggregated into nine separate categories for the purposes of this study (Table 1). In addition, we have further aggregated some of these categories to form relevant groups, namely all health workers, all doctors and nurses, all doctors and AYUSH doctors.

The data for this study were specially extracted for each district in the country from the 2001 census by the Office of the Registrar General of India. These data on main plus marginal health workers consist of district tables that cross-classify the nine health worker categories by four education levels and by medical qualification; the data are also disaggregated by urban–rural stratum and gender of worker. This information is contained in four pages of tables for each of the country's 593 districts.

Table 1. Health worker categories with corresponding NCO codes

	HEALTH WORKER CATEGORY	FOUR-DIGIT NCO CODE(S)
1.	Allopathic doctors	2221
2.	Ayurvedic doctors	2222
3.	Homeopathic doctors	2223
4.	Unani doctors	2224
5.	Dental practitioners	2225, 3225
6.	Nurses and midwives	2230, 3231, 3232
7.	Pharmacists	3228
8.	Ancillary health professionals	2229, 3221–3224, 3226, 3229
9.	Traditional practitioners and faith healers	3241, 3242
10.	**All health workers**	**2221–2224, 2230, 3231, 3232, 2225,3225, 3228, 2229, 3221–3224, 3226, 3229, 3241, 3242 (refers to the sum of 1–9 above)**
11.	All doctors and nurses (all doctors plus nurses and midwives)	2221–2224, 2230, 3231, 3232
12.	All doctors (allopathic plus AYUSH doctors)	2221–2224
13.	Ayurvedic, homeopathic and unani (AYUSH) doctors	2222–2224

Note: The description of occupational categories corresponding to each NCO code is contained in: National Classification of Occupations 2004: code structure. New Delhi: Directorate General of Employment and Training, Ministry of Labour, Government of India; 2004 (http://dget.nic.in/upload/uploadfiles/files/publication/Code%20Structure.pdf). Annex 1 contains a description of the 19 distinct occupations at the four-digit level in NCO that are used to define a health worker.

2. National profile

The census canvassed data on "main" and "marginal" workers. Main workers are defined as those who worked for six months or more in the previous year, and marginal workers as those who worked for less than six months. Of all health workers, 96.3% were main workers and 3.7% were marginal workers (Table 2.1).

In this study health worker categories include both main and marginal workers, except where otherwise stated. There were 2 069 540 main plus marginal health workers in India in 2001 (Table 2.1 and Figure 2.1.1), and the total population was 1 028 610 328. Of all health workers, 819 475 were doctors (adding together allopathic, ayurvedic, homeopathic and unani), 630 406 nurses and midwives, 24 403 dental practitioners, 231 438 pharmacists, 12 640 traditional and faith healers, and 351 178 other health workers in an aggregate category that we label "ancillary health professionals" – which includes laboratory technicians, opticians, dieticians and others (the category comprises seven different NCO 2004 codes – see Table 1). As seen in Table 2.1, all doctors comprise 39.6% of all health workers, nurses and midwives 30.5%, ancillary health professionals 17.0%, pharmacists 11.2%, dental practitioners 1.2%, and traditional and faith healers 0.6%. In 2001 India had more doctors than nurses and midwives (hereafter abbreviated to "nurses"), with a doctor–nurse ratio of 1.3.

In this study the category of doctors comprises allopathic doctors as well as ayurvedic, homeopathic and unani (hereafter referred to as "AYUSH")[2] doctors. There were 632 434 allopathic doctors, 110 283 ayurvedic doctors, 66 416 homeopathic doctors and 10 342 unani doctors. More than three quarters (77.2%) of all doctors were allopathic practitioners, 13.5% were ayurvedic, 8.1% homeopathic and 1.3% unani.

The number of health workers is adjusted for the population in a geographical area through a measure called the density of health workers. The *density* of health workers in an area is the absolute number of health workers divided by the population size of the area expressed in lakhs in this study. The numerical expression "lakh" used in India is equal to 100 000. Thus, density is simply the number of health workers per 100 000 persons in a given geographical area (e.g. district, state, stratum). The national health workforce density is the total number of workers in a health worker category divided by the total national population in lakhs. In 2001, the national health worker densities per lakh population were as follows: all health workers 201.2, doctors 79.7, nurses 61.3, ancillary health professionals 34.1, pharmacists 22.5, dental practitioners 2.4, and traditional and faith healers 1.2 (see Table 2.1).

2.1 Interdistrict inequalities

In 2001 there were 593 districts in India, and much variation is observed in the district density of health workers (calculated as the number of health workers in the district divided by the district population in lakhs). For each health worker category, we attempt to capture the variation by measuring inequality in the density of workers in that category across the 593 districts. As the districts are of different population sizes, the density in a district is weighted by the population size of the district in calculating interdistrict inequality in health worker availability per person. This amounts to constructing a health workforce distribution that assigns to each person in a district the health worker density of the district. To illustrate the variation in density between districts, we have constructed district-level maps of the country for three health worker categories: all health workers, allopathic doctors, and nurses and midwives (maps not shown here, but available upon request from the authors).

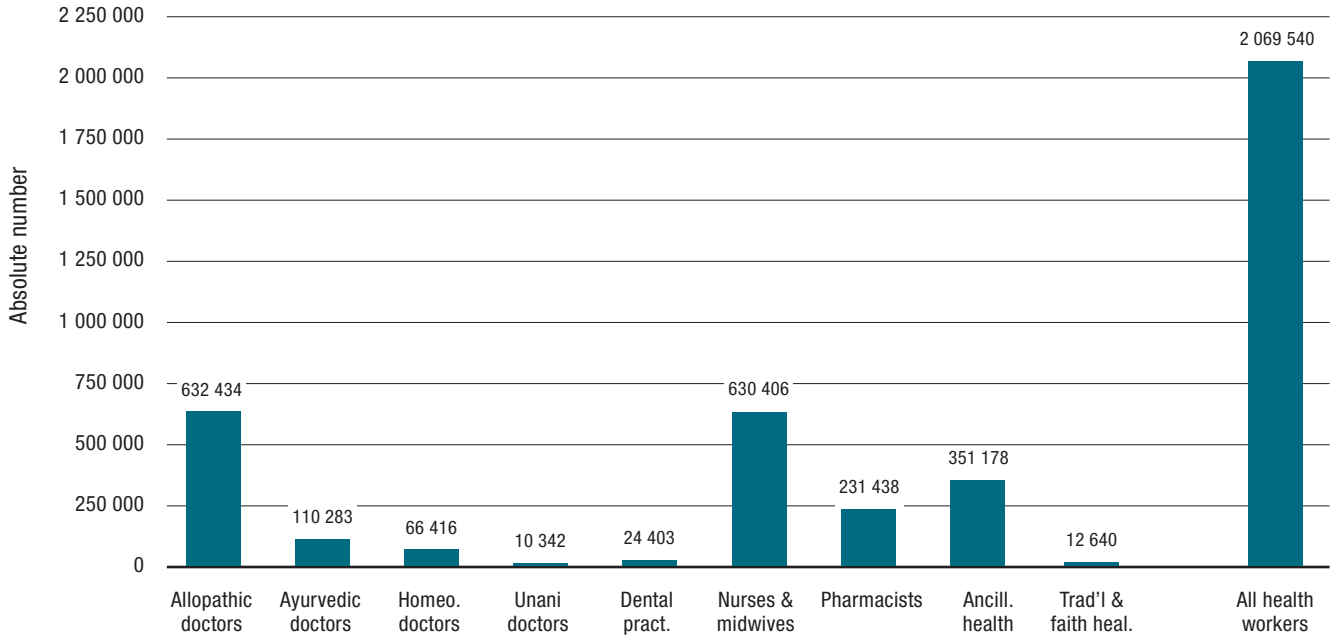
2 Our category labelled "AYUSH" is not fully comprehensive: the Ministry of Health and Family Welfare, Government of India, uses the term AYUSH to refer to ayurveda, yoga and naturopathy, unani, siddha and homeopathy. Unfortunately, census 2001 and NCO 2004 did not allow yoga practitioners to be identified. Moreover, NCO 2004 identifies naturopaths and siddha physicians through a six-digit code (2229.20 and 2229.40, respectively), but census 2001 uses only four-digit codes to classify workers. We had to decide where to place the four-digit family of workers in code 2229 – which apart from naturopaths and siddha physicians includes health officers, hospital administrators, osteopathic physicians, and other physicians and surgeons. It was decided to classify all different types of workers under code 2229 as "ancillary health professionals". The total number of workers in the entire four-digit code 2229 was approximately 45 000.

Table 2.1. Health workforce in India, 2001

HEALTH WORKER CATEGORY	NUMBER	% OF ALL HEALTH WORKERS	DENSITY PER LAKH POPULATION	INTERDISTRICT GINI	% RURAL	% FEMALE	% WITH MORE THAN SECONDARY SCHOOLING	% WITH A MEDICAL QUALIFICATION	% MAIN WORKERS
Allopathic doctors	632 434	30.6	61.5	0.3093	39.6	16.8	68.6	42.7	97.7
Ayurvedic doctors	110 283	5.3	10.7	0.4214	42.4	14.7	74.8	60.1	97.3
Homeo. doctors	66 416	3.2	6.5	0.5410	45.8	16.0	66.9	41.8	97.2
Unani doctors	10 342	0.5	1.0	0.6588	32.4	8.3	60.9	45.8	96.9
Dental pract.	24 403	1.2	2.4	0.5604	20.8	23.6	62.1	42.3	97.2
Nurses & midwives	630 406	30.5	61.3	0.4014	39.6	83.4	32.9	9.9	94.8
Pharmacists	231 438	11.2	22.5	0.2892	45.1	9.9	31.8	8.3	95.7
Ancill. health	351 178	17.0	34.1	0.3646	41.6	27.3	39.2	5.8	96.4
Trad'l & faith heal.	12 640	0.6	1.2	0.7620	63.6	10.3	37.2	7.2	90.9
All health workers	**2 069 540**	**100.0**	**201.2**	**0.2858**	**40.8**	**38.0**	**48.6**	**23.3**	**96.3**
All doctors & nurses	1 449 881	70.1	141.0	0.3016	40.1	45.5	53.4	29.7	96.4
All doctors	819 475	39.6	79.7	0.2926	40.4	16.4	69.2	45.0	97.3
AYUSH doctors	187 041	9.0	18.2	0.3523	43.0	14.8	71.2	52.8	97.6

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers.
All doctors refers to allopathic plus AYUSH doctors; AYUSH doctors include ayurvedic, homeopathic, and unani doctors.
The national density is defined as the number of health workers divided by the national population. The national population was 10 286 lakhs.
The number of health workers with more than secondary schooling is the sum of those with a technical or non-technical diploma, a graduate degree, or a post-graduate degree.
Main workers are those who worked for six months or more during the previous year.

Figure 2.1.1. Health workers by category: absolute number



In this study inequality in the health workforce distribution across districts is measured by the Gini coefficient – the most commonly used index of inequality – which varies between 0 when there is no inequality and 1 when there is perfect inequality. For all health workers, the national interdistrict Gini was calculated as 0.2858 (see Table 2.1 and Figure 2.1.2). The national interdistrict Gini for allopathic doctors was 0.3093, for nurses 0.4014, for dental practitioners 0.5604, and for AYUSH doctors 0.3523. The Gini for all health workers is lower than for each of the nine individual categories. This can be explained in terms of compensating variations in the densities of different health worker categories across districts. Districts with a higher-than-average doctor density tend to have a lower-than-average non-doctor (e.g. nurse) density, and vice versa.

2.2 Urban–rural distribution

There were 1 225 381 health workers in urban areas and 844 159 in rural areas (see Table 2.2) – an urban–rural ratio of 1.45. By contrast, the urban–rural population ratio was 0.39. Of all health workers, 59.2% were in urban areas, where 27.8% of the population resides, and 40.8% were in rural areas, where 72.2% of the population resides.

Table 2.1 shows the percentage of each health worker category that resides in rural areas. Particularly striking is the urban–rural distribution of the very small number of dentists in the country. The total number of dental practitioners in rural India was just 5088 (Table 2.2), which accounts for 20.8% of all dentists in the country (Table 2.1). Expressed in terms of urban–rural ratio, the ratio for dental practitioners was 3.80 – higher than for any other category of health worker.

For doctors, nurses and pharmacists, the percentage in rural areas was close to the average for all health workers of about 40% (Table 2.1). The urban–rural ratio for doctors was 1.48, and for nurses 1.52. Traditional and faith healers had an urban–rural ratio of 0.57 (with an absolute number in rural areas of 8034, which is more than the number of dentists in rural areas – see Table 2.2). As shown in Table 2.2 and Figure 2.2.1, the absolute number of health workers in urban areas was greater than that in rural areas for every category of health worker except for traditional and faith healers. (Note that the urban–rural ratios here refer to the ratio of the absolute number of health workers in the two strata, and not to the ratio of urban density to rural density.)

Table 2.2 shows the composition of the health workforce by health worker category, separately for urban and rural areas. Comparing the composition in the two strata, the percentage of each health worker category in all health workers in the stratum is quite similar. For example, all doctors accounted for 39.9% of urban health workers and for 39.2% of rural health workers; and nurses accounted for 31.1% of urban health workers and for 29.6% of rural health workers.

The *urban density* of health workers is defined as the number of urban health workers divided by the urban population in lakhs; the *rural density* is defined as the number of rural health workers divided by the rural population in lakhs. The urban health worker density was 428.3 per lakh and the rural health worker density was 113.7; the ratio of urban density to rural density for all health workers was 3.8 (see Table 2.2). Thus, there were almost 4 times as many health workers per person in urban areas compared to rural areas.

The ratio of urban density to rural density was greater than 1 for every health worker category (Table 2.2 and Figure 2.2.2). The ratio of urban density to rural density was 9.9 for dental practitioners, followed by 4.0 for allopathic doctors, 4.0 for nurses and midwives, 3.6 for ancillary health professionals, 3.4 for AYUSH doctors, 3.2 for pharmacists, and 1.5 for traditional and faith healers. With a relative urban–rural density of 9.9 for dental practitioners, i.e. 10 times as many dental practitioners per person in urban compared to rural areas, the urban–rural maldistribution of dentists was acute. This was compounded by the extremely low absolute density of dentists in the country (2.4 per 100 000 population).

Figure 2.1.2. Health workers by category: interdistrict Gini

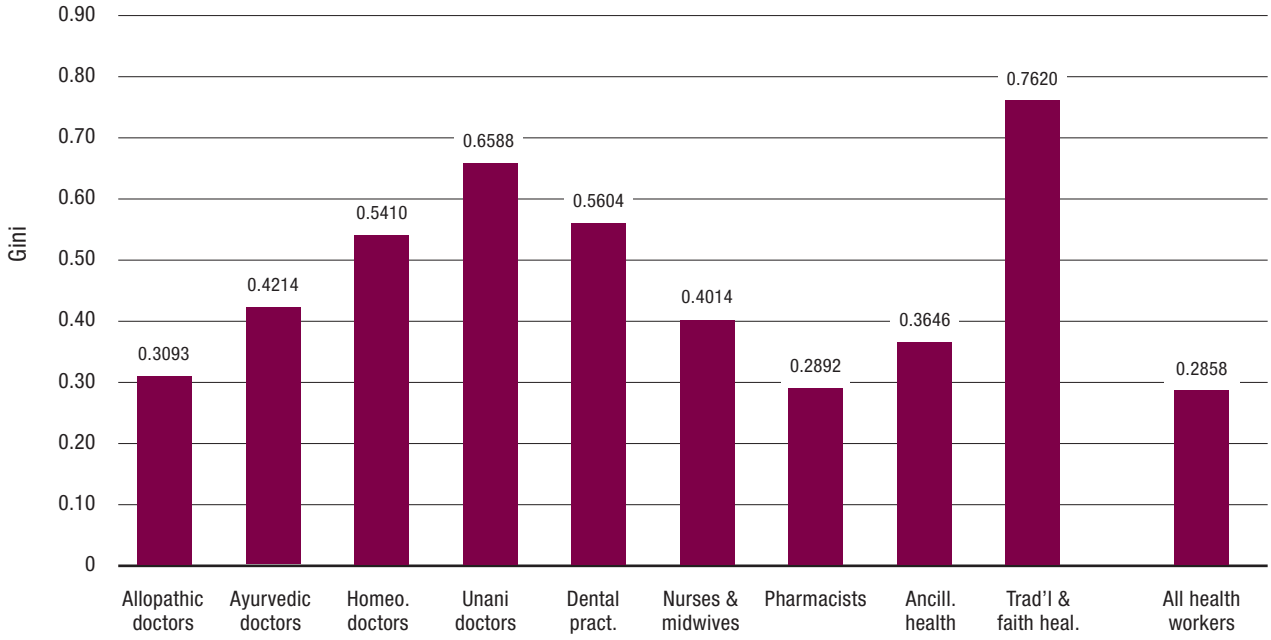


Table 2.2. Health workers by urban–rural stratum and gender

HEALTH WORKER CATEGORY	URBAN			RURAL			RATIO OF URBAN DENSITY TO RURAL DENSITY	MALE		FEMALE		MALE–FEMALE RATIO
	Number	% of all urban health workers	Density per lakh urban pop'n	Number	% of all rural health workers	Density per lakh rural pop'n		Number	% of all male health workers	Number	% of all female health workers	
Allopathic doctors	381 980	31.2	133.5	250 454	29.7	33.7	4.0	525 945	41.0	106 489	13.6	4.9
Ayurvedic doctors	63 564	5.2	22.2	46 719	5.5	6.3	3.5	94 040	7.3	16 243	2.1	5.8
Homeo. doctors	35 984	2.9	12.6	30 432	3.6	4.1	3.1	55 784	4.3	10 632	1.4	5.3
Unani doctors	6 993	0.6	2.4	3 349	0.4	0.5	5.4	9 479	0.7	863	0.1	11.0
Dental pract.	19 315	1.6	6.8	5 088	0.6	0.7	9.9	18 648	1.5	5 755	0.7	3.2
Nurses & midwives	380 611	31.1	133.0	249 795	29.6	33.6	4.0	104 609	8.1	525 797	66.9	0.2
Pharmacists	127 172	10.4	44.5	104 266	12.4	14.0	3.2	208 559	16.2	22 879	2.9	9.1
Ancill. health	205 156	16.7	71.7	146 022	17.3	19.7	3.6	255 415	19.9	95 763	12.2	2.7
Trad'l & faith heal.	4 606	0.4	1.6	8 034	1.0	1.1	1.5	11 341	0.9	1 299	0.2	8.7
All health workers	1 225 381	100.0	428.3	844 159	100.0	113.7	3.8	1 283 820	100.0	785 720	100.0	1.6
All doctors & nurses	869 132	70.9	303.8	580 749	68.8	78.2	3.9	789 857	61.5	660 024	84.0	1.2
All doctors	488 521	39.9	170.7	330 954	39.2	44.6	3.8	685 248	53.4	134 227	17.1	5.1
AYUSH doctors	106 541	8.7	37.2	80 500	9.5	10.8	3.4	159 303	12.4	27 738	3.5	5.7

Notes: All doctors comprise allopathic plus AYUSH doctors. AYUSH doctors include ayurvedic, homeopathic, and unani doctors. The urban population was 2,861 lakhs and the rural population was 7,425 lakhs. Urban (or rural) density is defined as the number of urban (or rural) health workers divided by the urban (or rural) population.

Figure 2.2.1. Health workers by category: absolute number by urban–rural stratum

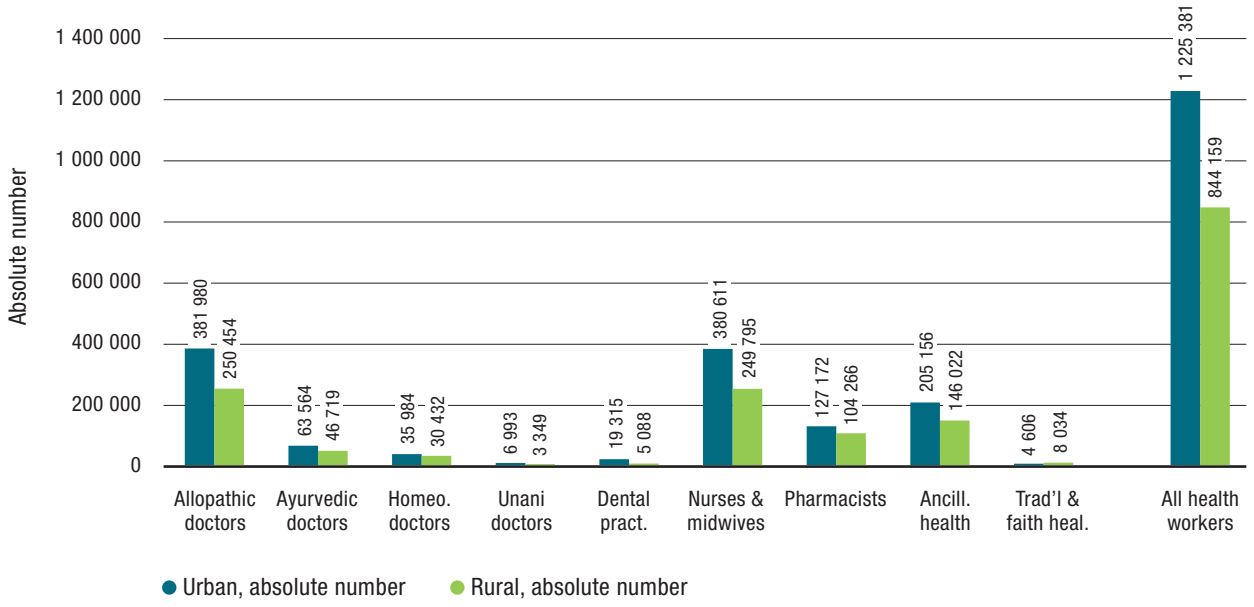
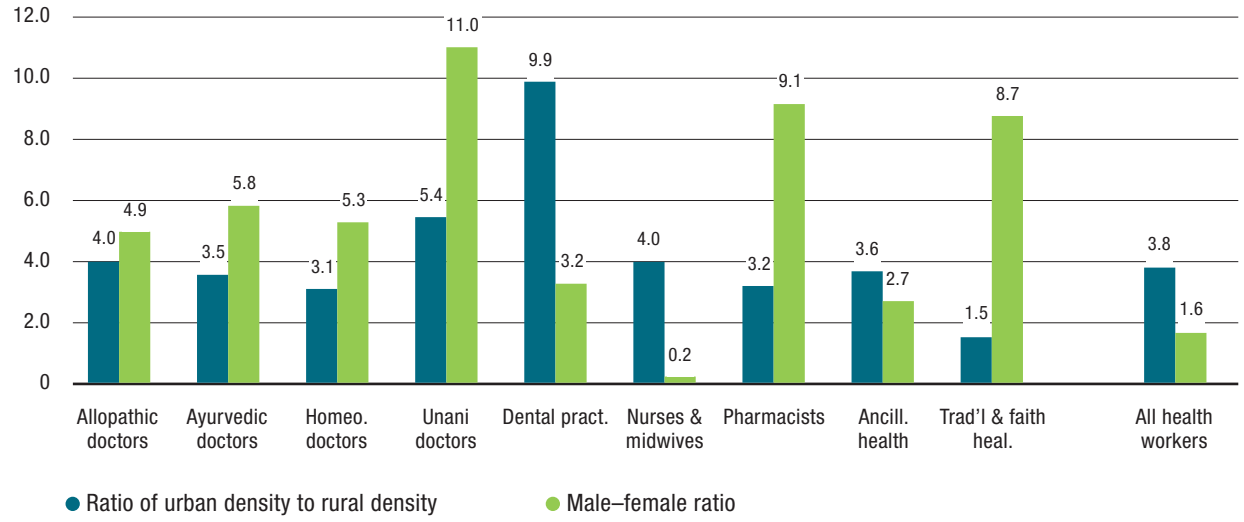


Figure 2.2.2. Health workers by category: ratio of urban density to rural density, and male–female ratio



2.3 Male–female distribution

As seen in Table 2.2, there were 1 283 820 male health workers and 785 720 female health workers, or a male–female ratio of 1.6 (compared to a male–female population ratio of 1.07). Of all health workers 38.0% were female, but of allopathic doctors only 16.8% were female (Table 2.1). There were more female than male nurses and midwives, with females accounting for 83.4% of the nurses category (who in turn account for 30.5% of all health workers) – see Table 2.1. See Table 2.2 and Figure 2.2.3 for the absolute number of males and females in each health worker category.

Table 2.2 shows the composition of male and female health workers separately. Whereas 53.4% of all male health workers were doctors, 17.1% of all female health workers were doctors. By contrast, 8.1% of male health workers were nurses and 66.9% of female health workers were nurses. Table 2.2 also shows the male–female ratio for each health worker category. Unani doctors had the highest male–female ratio of 11.0 (but there were only 863 female unani doctors), whereas nurses had the lowest male–female ratio of 0.2.

In this study, we define the male (female) health worker density as the number of male (female) health workers per lakh persons (both male and female) in a given population. The national male health worker density was 124.8 and the national female health worker density was 76.4, which sums to the national health worker density of 201.2.

2.4 Education level and medical qualification

This study classifies health workers according to both education level and medical qualification. In this study we distinguish the following levels of education for a health worker: (i) those with only secondary schooling or less; (ii) those with a technical or non-technical diploma; (iii) those with a graduate degree; and (iv) those with a postgraduate degree. The study identifies a person as having a medical qualification if the highest level of education achieved by the person consisted of a medical diploma or certificate or a degree in a selected list.[3] A medical qualification could be obtained only by those who had a technical or non-technical diploma, a graduate degree or a postgraduate degree – but not by those with only secondary schooling or less.

It follows that those with a medical qualification must have *more* than secondary schooling. In other words, those with a medical qualification are a subset of those with more than secondary schooling. It is also the case that those with more than secondary schooling are a subset of all health workers.

As seen in Table 2.1, of all health workers just 48.6% had more than secondary schooling and only 23.3% had a medical qualification.

The education level and medical qualification of health workers are shown for each health worker category in Table 2.3. For the aggregate category of all health workers, 51.4% had only secondary schooling or less, 5.8% had a technical or non-technical diploma, 34.7% a graduate degree, and 8.1% a postgraduate degree (Figure 2.3). Less than a quarter (23.3%) of all health workers had a medical qualification.

Among allopathic doctors, as many as 31.4% were educated only up to secondary school level (Table 2.3) – in other words, 68.6% of allopathic doctors had more than secondary schooling. Only 42.7% of allopathic doctors had a medical qualification (Table 2.3) – in other words, 57.3% did *not* have a medical qualification. (Maps are available at the district level, upon request from the authors, which illustrate the percentage of allopathic doctors with more than secondary schooling and the percentage of allopathic doctors with a medical qualification.)

3 This list is in Annex 2 and was selected by N.K. Sethi of the Planning Commission in consultation with the Office of the Registrar General of India.

Figure 2.2.3. Health workers by category: absolute number by gender

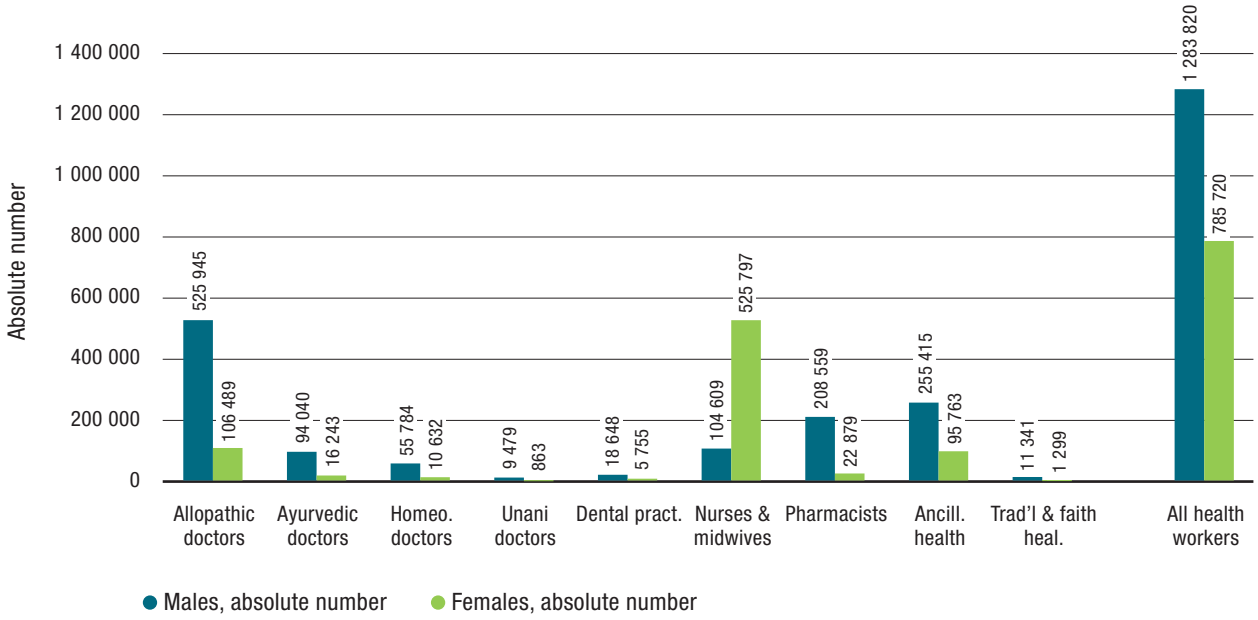
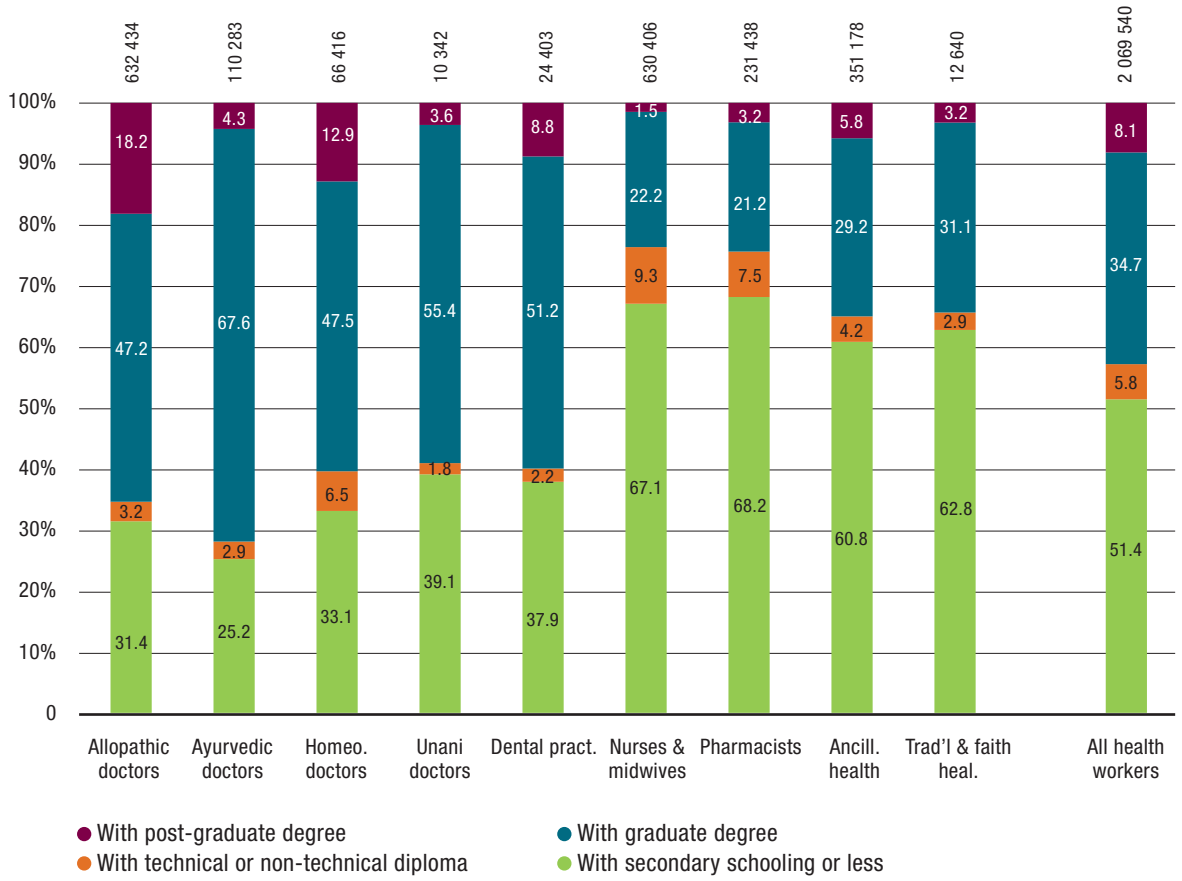


Table 2.3. Health workers by education level and by medical qualification

HEALTH WORKER CATEGORY	WITH SECONDARY SCHOOLING OR LESS		WITH TECHNICAL OR NON-TECHNICAL DIPLOMA		WITH GRADUATE DEGREE		WITH POST-GRADUATE DEGREE		TOTAL		WITH A MEDICAL QUALIFICATION	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Allopathic doctors	198 719	31.4	20 264	3.2	298 521	47.2	114 930	18.2	632 434	100.0	269 956	42.7
Ayurvedic doctors	27 792	25.2	3 183	2.9	74 603	67.6	4 705	4.3	110 283	100.0	66 266	60.1
Homeo. doctors	21 987	33.1	4 319	6.5	31 561	47.5	8 549	12.9	66 416	100.0	27 759	41.8
Unani doctors	4 045	39.1	190	1.8	5 733	55.4	374	3.6	10 342	100.0	4 738	45.8
Dental pract.	9 239	37.9	531	2.2	12 490	51.2	2 143	8.8	24 403	100.0	10 325	42.3
Nurses & midwives	422 745	67.1	58 548	9.3	139 819	22.2	9 294	1.5	630 406	100.0	62 592	9.9
Pharmacists	157 751	68.2	17 252	7.5	49 069	21.2	7 366	3.2	231 438	100.0	19 124	8.3
Ancill. health	213 665	60.8	14 658	4.2	102 513	29.2	20 342	5.8	351 178	100.0	20 226	5.8
Trad'l & faith heal.	7 933	62.8	362	2.9	3 937	31.1	408	3.2	12 640	100.0	910	7.2
All health workers	1 063 876	51.4	119 307	5.8	718 246	34.7	168 111	8.1	2 069 540	100.0	481 896	23.3
All doctors & nurses	675 288	46.6	86 504	6.0	550 237	38.0	137 852	9.5	1 449 881	100.0	431 311	29.7
All doctors	252 543	30.8	27 956	3.4	410 418	50.1	128 558	15.7	819 475	100.0	368 719	45.0
AYUSH doctors	53 824	28.8	7 692	4.1	111 897	59.8	13 628	7.3	187 041	100.0	98 763	52.8

Notes: % here refers to the percentage of the health worker category with a given education level or medical qualification. See Annex 2 for the list of medical qualifications.

Figure 2.3. Health workers by category: disaggregated by level of education



Among AYUSH doctors, the proportions with only secondary schooling or less were as follows: ayurvedic doctors 25.2%, homeopathic doctors 33.1%, and unani doctors 39.1% (Table 2.3). For the aggregate category of all doctors, 30.8% had education only up to secondary school level. By contrast, 67.1% of nurses had education only up to secondary school level.

The percentage of all doctors with a medical qualification was 45.0%; of allopathic doctors 42.7%; and of AYUSH doctors 52.8%. Within the category of AYUSH doctors, the percentages with a medical qualification were as follows: ayurvedic 60.1%; homeopathic 41.8%; and unani 45.8%.

The composition of health workers by category is different when one considers a more restricted subset of health workers defined by secondary schooling or medical qualification. For example, allopathic doctors comprised 30.6% of all health workers, 43.1% of all health workers with more than secondary schooling and 56.0% of all health workers with a medical qualification (see Tables 2.1 and 2.4). By contrast, nurses comprised 30.5% of all health workers, 20.6% of all health workers with more than secondary schooling, and 13.0% of all health workers with a medical qualification (Tables 2.1 and 2.4).

Education level and medical qualification by stratum

The education level and medical qualification of urban health workers were higher than those of rural health workers for every category except nurses (see Table 2.5). Among all health workers, 55.4% of urban workers had more than secondary schooling compared to 38.7% of rural workers; and 29.2% of urban workers had a medical qualification compared to 14.6% of rural workers.

Among allopathic doctors, 83.4% of urban doctors had more than secondary schooling compared to 45.9% of rural doctors; and 58.4% of urban doctors had a medical qualification compared to 18.8% of rural doctors.

There were also large urban–rural differences in education level and medical qualification among dental practitioners: 66.4% of urban dentists had more than secondary schooling compared to 45.8% of rural dentists; and 46.2% of urban dentists had a medical qualification compared to 27.4% of rural dentists.

Unlike the case for other health workers, the level of schooling and medical qualification for nurses were slightly higher in rural areas than in urban areas: 33.3% of rural nurses had more than secondary schooling compared to 32.7% of urban nurses, and 10.8% of rural nurses had a medical qualification compared to 9.3% of urban nurses.

As stated earlier and seen in Table 2.2, the composition of health workers in urban and rural areas without accounting for level of schooling or medical qualification is quite similar. However, when we restrict health workers to those with more than secondary schooling, the composition in urban and rural areas turns out to be quite different (see Table 2.4). For example, of health workers with more than secondary schooling the percentage of allopathic doctors was 46.9% in urban areas and 35.2% in rural areas – compared to 31.2% and 29.7%, respectively, of all health workers. Thus, compared to the percentage of doctors among all health workers, the percentage of doctors among health workers with more than secondary schooling was higher in both urban and rural areas, but disproportionately so in urban areas. Of health workers with more than secondary schooling, the percentage of nurses was 18.3% in urban areas and 25.5% in rural areas – compared to 31.1% and 29.6%, respectively, of all health workers. Thus, restricting health workers by education level, the percentage of nurses was lower in both urban and rural areas, and disproportionately so in urban areas.

Education level and medical qualification by gender

As seen in Table 2.5, a higher proportion of female than male health workers were educated to more than secondary school level in every health worker category except ancillary health professionals. But in *every* health worker category a higher proportion of females had a medical qualification than males. For example, in the category of allopathic doctors, 86.3% of females compared to 65.0% of males had more than secondary schooling, and 67.2% of females compared to 37.7% of males had a medical qualification. Among nurses, 34.4% of females had more than secondary schooling compared to 25.5% of males, and 11.3% of females had a medical qualification compared to 2.9% of males.

Table 2.4. Composition of health workers with more than secondary schooling and with a medical qualification by category: disaggregated by stratum and gender

HEALTH WORKER CATEGORY	COMPOSITION (%) OF HEALTH WORKERS WITH MORE THAN SECONDARY SCHOOLING					COMPOSITION (%) OF HEALTH WORKERS WITH A MEDICAL QUALIFICATION				
	Total	Urban	Rural	Male	Female	Total	Urban	Rural	Male	Female
Allopathic doctors	43.1	46.9	35.2	52.0	26.4	56.0	62.2	38.1	62.8	43.1
Ayurvedic doctors	8.2	7.7	9.3	10.3	4.2	13.8	11.8	19.3	16.8	7.9
Homeo. doctors	4.4	4.0	5.2	5.4	2.6	5.8	5.0	8.0	6.5	4.4
Unani doctors	0.6	0.7	0.4	0.8	0.2	1.0	1.1	0.8	1.3	0.4
Dental pract.	1.5	1.9	0.7	1.6	1.3	2.1	2.5	1.1	2.1	2.2
Nurses & midwives	20.6	18.3	25.5	4.0	52.1	13.0	9.9	21.9	1.0	35.8
Pharmacists	7.3	6.5	9.1	9.7	2.8	4.0	3.1	6.4	4.7	2.6
Ancill. health	13.7	13.5	13.9	15.6	10.1	4.2	4.2	4.1	4.6	3.5
Trad'l & faith heal.	0.5	0.3	0.7	0.6	0.2	0.2	0.2	0.3	0.2	0.1
All health workers	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All doctors & nurses	77.0	77.7	75.6	72.5	85.5	89.5	90.0	88.1	88.4	91.5
All doctors	56.4	59.4	50.1	68.5	33.5	76.5	80.1	66.2	87.5	55.7
AYUSH doctors	13.2	12.5	14.9	16.5	7.1	20.5	17.9	28.1	24.6	12.7

Notes: The number of health workers with more than secondary schooling is the sum of those with a technical or non-technical diploma, a graduate degree, or a postgraduate degree. See Annex 2 for the list of medical qualifications.

Table 2.5. Percentage of health workers with more than secondary schooling and percentage with a medical qualification, by stratum and gender

HEALTH WORKER CATEGORY	% WITH MORE THAN SECONDARY SCHOOLING									% WITH A MEDICAL QUALIFICATION								
	NATIONAL			URBAN			RURAL			NATIONAL			URBAN			RURAL		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Allopathic doctors	68.6	65.0	86.3	83.4	81.5	89.7	45.9	44.3	68.1	42.7	37.7	67.2	58.4	54.6	70.5	18.8	16.6	49.6
Ayurvedic doctors	74.8	72.1	90.3	82.0	79.4	92.8	65.0	63.3	82.5	60.1	56.5	80.7	66.7	62.8	82.8	51.1	49.0	74.3
Homeo. doctors	66.9	63.3	85.9	76.4	72.8	88.8	55.7	53.7	77.1	41.8	36.8	68.1	49.5	43.7	69.8	32.7	29.8	63.0
Unani doctors	60.9	58.6	86.2	70.1	67.5	91.5	41.7	41.5	48.1	45.8	42.7	80.0	54.4	50.7	84.4	28.0	27.3	48.1
Dental pract.	62.1	56.9	79.1	66.4	61.6	80.1	45.8	41.5	72.4	42.3	35.6	64.1	46.2	39.6	65.1	27.4	22.5	57.1
Nurses & midwives	32.9	25.5	34.4	32.7	25.3	34.3	33.3	25.9	34.7	9.9	2.9	11.3	9.3	3.1	10.7	10.8	2.6	12.3
Pharmacists	31.8	30.6	43.3	34.7	33.6	42.3	28.4	27.0	45.2	8.3	7.1	19.1	8.8	7.8	16.8	7.6	6.3	23.5
Ancill. health	39.2	40.1	36.6	44.8	45.4	43.3	31.2	32.7	27.1	5.8	5.6	6.1	7.4	7.2	8.1	3.4	3.5	3.3
Trad'l & faith heal.	37.2	34.4	61.7	50.7	47.5	69.8	29.5	27.5	53.4	7.2	6.8	10.3	12.6	12.4	14.0	4.1	3.9	6.6
All health workers	**48.6**	**51.2**	**44.3**	**55.4**	**60.3**	**48.3**	**38.7**	**39.5**	**37.1**	**23.3**	**24.6**	**21.2**	**29.2**	**32.5**	**24.6**	**14.6**	**14.4**	**15.0**
All doctors & nurses	53.4	60.4	45.1	60.7	72.1	48.8	42.5	45.4	38.4	29.7	35.3	23.1	37.1	47.1	26.6	18.8	20.2	16.6
All doctors	69.2	65.7	86.7	82.5	80.3	90.0	49.5	47.8	71.4	45.0	40.3	69.0	58.7	54.9	71.9	24.7	22.4	55.2
AYUSH doctors	71.2	68.2	88.5	79.3	76.4	91.3	60.5	58.7	79.9	52.8	48.8	75.9	60.1	55.7	77.9	43.2	40.8	69.5

Note: The number of health workers with more than secondary schooling is the sum of those with a technical or non-technical diploma, a graduate degree, and a postgraduate degree.

Among *all* health workers, however, 44.3% of females had more than secondary schooling compared to 51.2% of males, and 21.2% of females had a medical qualification compared to 24.6% of males. Despite females being more educated and medically qualified than males in almost every health worker category, females turn out to be less qualified than males in aggregate. The lower education level and medical qualification of females compared to males in aggregate is explained by the different composition of females and males in the different health worker categories. In aggregating health worker categories for males and females, respectively, the weight of doctors (a category with a generally high medical qualification) among males is large and the weight of nurses (a category with a generally low medical qualification) is small; among females, in contrast, the weight of doctors is small and the weight of nurses is large.

Education level and medical qualification by gender and stratum

The pattern of females being more educated and medically qualified than males in each health worker category (except ancillary health professionals) persists when the workforce is disaggregated by urban–rural stratum (see Table 2.5 and Figures 2.5.1 and 2.5.2). For example, in urban areas 89.7% of female allopathic doctors had more than secondary schooling compared to 81.5% of male allopathic doctors (Figure 2.5.1). In rural areas, 68.1% of female allopathic doctors had more than secondary schooling compared to 44.3% of male allopathic doctors (Figure 2.5.1). In terms of medical qualification (Figure 2.5.2), the female–male difference was even sharper than that for more than secondary schooling. For example, in urban areas 70.5% of female allopathic doctors had a medical qualification compared to 54.6% of male allopathic doctors. In rural areas, 49.6% of female allopathic doctors had a medical qualification compared to 16.6% of male allopathic doctors. The female–male differences in secondary schooling as well as in medical qualification were generally smaller in urban areas than in rural areas.

The other pattern of urban health workers being more educated and medically qualified than rural health workers persists when the workforce is disaggregated by gender, except for the categories of nurses (for both males and females) and of pharmacists for females (see Table 2.5 and Figures 2.5.1 and 2.5.2). The urban–rural differences in schooling were larger for males than for females in most health worker categories.

2.5 Main and marginal health workers

As noted in Table 2.1, of all health workers 96.3% were "main" workers and 3.7% were "marginal" workers. Table 2.6 shows that the characteristics of main and marginal workers are different in terms of urban–rural location, gender, secondary schooling, and medical qualification. Compared to main workers, a larger percentage of marginal workers were located in rural areas and were female: 58.4% of marginal workers were in rural areas compared to 40.1% of main workers; 53.2% of marginal workers were female compared to 37.4% of main workers. Compared to main workers, a smaller percentage of marginal workers had more than secondary schooling and a medical qualification: 43.9% of marginal workers compared to 48.8% of main workers had more than secondary schooling; 10.8% of marginal workers compared to 23.8% of main workers had a medical qualification.

For every health worker category except traditional and faith healers, the percentage of marginal workers in rural areas was higher than that of main workers in rural areas. For every health worker category, the percentage of marginal workers who were female was larger than that of main workers who were female. For each health worker category except nurses and traditional and faith healers, the percentage of marginal workers with more than secondary schooling was lower than that of main workers with more than secondary schooling. Among nurses, however, 52.5% of marginal workers had more than secondary schooling compared to 31.9% of main workers. For every health worker category, the percentage of marginal workers with a medical qualification was lower than that of main workers with a medical qualification. These differences in secondary schooling and medical qualification between main workers and marginal workers also obtained separately within urban areas and within rural areas (tables not shown in this study).

Figure 2.5.1. Percentage of health workers with more than secondary schooling, by stratum and gender

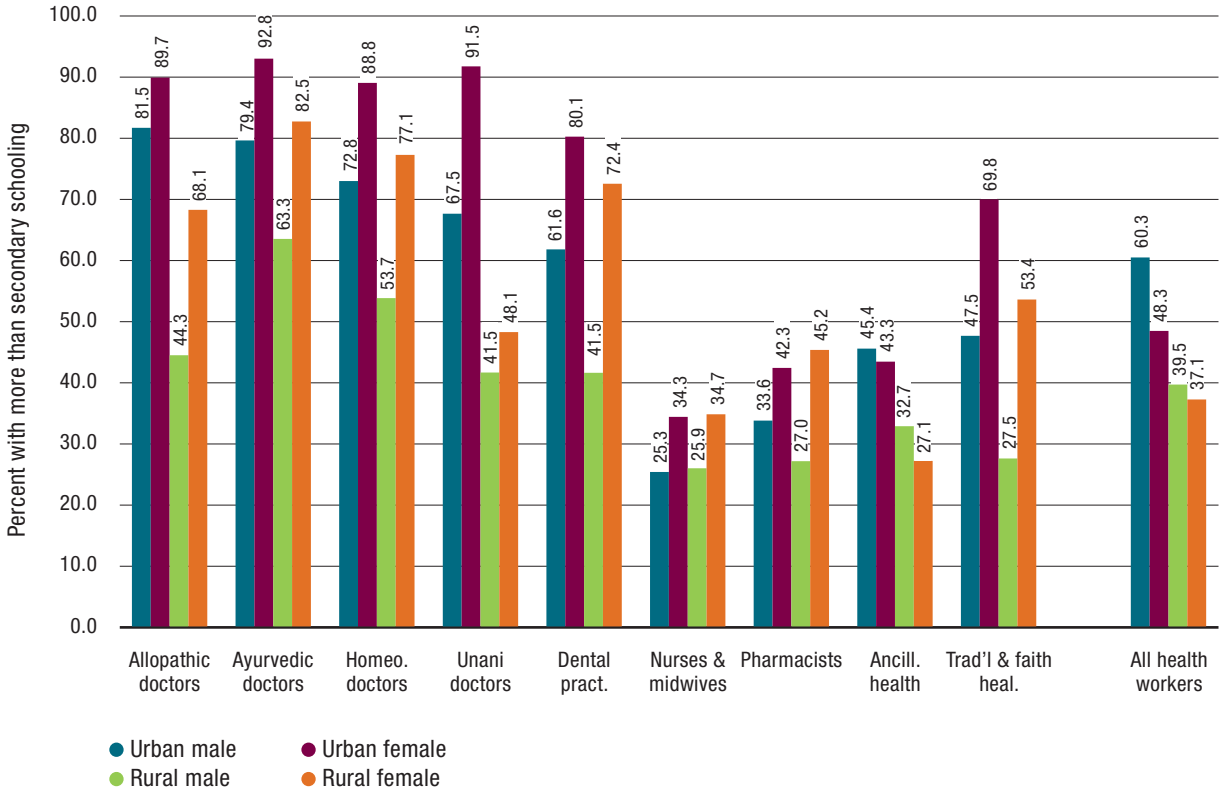


Figure 2.5.2. Percentage of health workers with a medical qualification, by stratum and gender

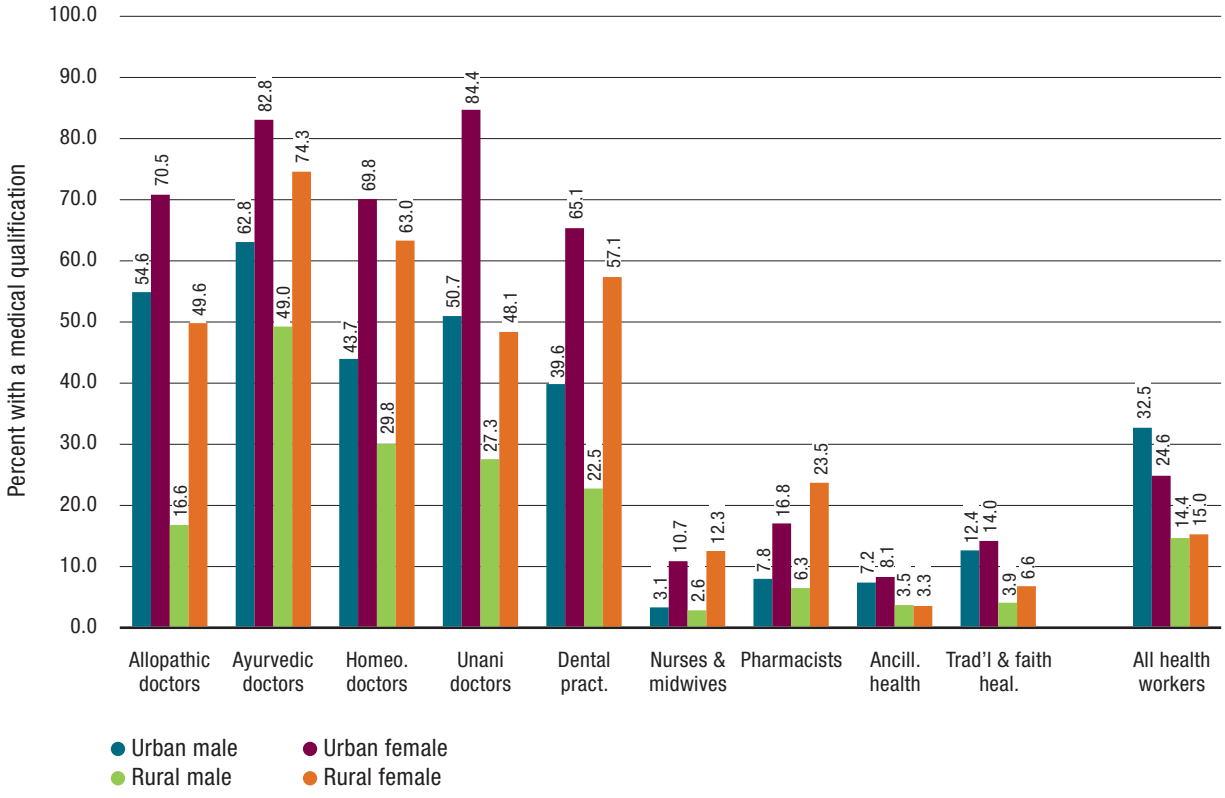


Table 2.6. Main and marginal health workers: summary statistics

HEALTH WORKER CATEGORY	% RURAL		% FEMALE		SECONDARY SCHOOLING		MEDICAL QUALIFICATION	
	Main workers, % rural	Marginal workers, % rural	Main workers, % female	Marginal workers, % female	Main workers, % with more than secondary schooling	Marginal workers, % with more than secondary schooling	Main workers, % with a medical qualification	Marginal workers, % with a medical qualification
Allopathic doctors	39.0	64.8	16.8	17.3	69.1	47.6	43.2	22.1
Ayurvedic doctors	42.0	56.8	14.6	19.8	75.6	47.3	60.8	33.9
Homeo. doctors	45.4	60.0	15.7	25.9	67.2	57.0	42.2	28.3
Unani doctors	31.7	52.8	8.1	15.2	61.6	38.5	46.5	25.2
Dental pract.	20.5	34.7	23.4	30.0	62.8	40.7	42.8	24.4
Nurses & midwives	38.6	57.8	83.0	91.3	31.9	52.5	10.1	7.6
Pharmacists	44.6	54.8	9.6	17.0	32.2	23.2	8.4	4.8
Ancill. health	41.0	56.8	26.8	40.4	39.5	30.4	5.9	2.4
Trad'l & faith heal.	64.1	58.2	8.2	31.0	36.3	46.5	7.8	1.6
All health workers	**40.1**	**58.4**	**37.4**	**53.2**	**48.8**	**43.9**	**23.8**	**10.8**
All doctors & nurses	39.3	59.8	44.8	63.8	53.5	50.9	30.3	14.0
All doctors	39.8	63.0	16.3	18.4	69.7	48.3	45.5	24.5
AYUSH doctors	42.6	57.7	14.6	21.7	71.8	50.2	53.4	31.3

Note: Main workers are those who worked for six months or more during the previous year and marginal workers are those who worked for less than six months.

3. Interstate comparisons

In this section, the national profile is disaggregated to the level of states and union territories (hereafter referred to as "states"). We examine interstate differences in India's health workforce across its 35 states. We begin with the statewise concentration of health workers, i.e. each state's share of the national health workforce. We then discuss the composition of health workers within states and differences in the composition across states. The definitions of state concentration and composition of health workers are independent of the population size of a state. We then account for population size and examine the density of health workers in each state, defined as the total number of health workers per lakh population. Finally, we discuss interstate differentials in the distribution of health workers by gender, by education level and medical qualification, and by urban–rural stratum.

3.1 Concentration of health workers

We define the concentration of health workers in a state as follows: the number of health workers in the state divided by the total number of health workers in the country, expressed as a percentage. For each health worker category, the concentration across the country's 35 states adds up to 100% by definition. There is much interest in identifying states that have high concentrations of particular categories of health workers, independently of their population size. For example, it is of interest to note that 30.59% of all homeopathic doctors in India were concentrated in West Bengal, and 37.47% of all unani doctors were found in Uttar Pradesh (see Table 3.1.1).

In Figure 3.1.1 we illustrate the concentration of allopathic doctors and nurses by state, along with the state's population share in the national total, i.e. the concentration of population in the state. Significant variations in the concentration of allopathic doctors and of nurses are observed. In Uttar Pradesh, the concentration of nurses (6.35%) was less than half the share of the state in the national population, i.e. the state's population concentration (16.16%). In Maharashtra, the concentration both of allopathic doctors (12.01%) and of nurses (15.81%) was substantially higher than the state's population concentration (9.42%). Orissa had a significantly high concentration of nurses (6.17%) relative to its population share (3.58%), but a low concentration of allopathic doctors (1.54%). Kerala had a significantly higher concentration of nurses (9.36%) than its population share (3.10%), and a concentration of allopathic doctors (3.09%) that was similar to its population share. (Maps are available, upon request from the authors, which illustrate the geographical differences in concentration of allopathic doctors and of nurses at the level of district within a state.)

It is useful to relate the *concentration* of health workers in a state to the *density* of health workers in the state. A little notation helps us to formalize the relationship. Let h_i = number of health workers in state i, p_i = population of state i, H = total number of health workers in the country, and P = total population of the country. Then, by definition, concentration of health workers in state i = h_i/H , density of health workers in state i = h_i/p_i, population share of state i = p_i/P, and national density of health workers = H/P. We can write h_i/H as

$h_i/H = (h_i/p_i)\,(p_i/P)\,(P/H)$
or
$h_i/H = (p_i/P)\,(h_i/p_i) / (H/P)$.

This equation states that the concentration of health workers in state i (h_i/H) is equal to the population share of state i (p_i/P) multiplied by the density of health workers in state i (h_i/p_i) divided by the national density of health workers (H/P).

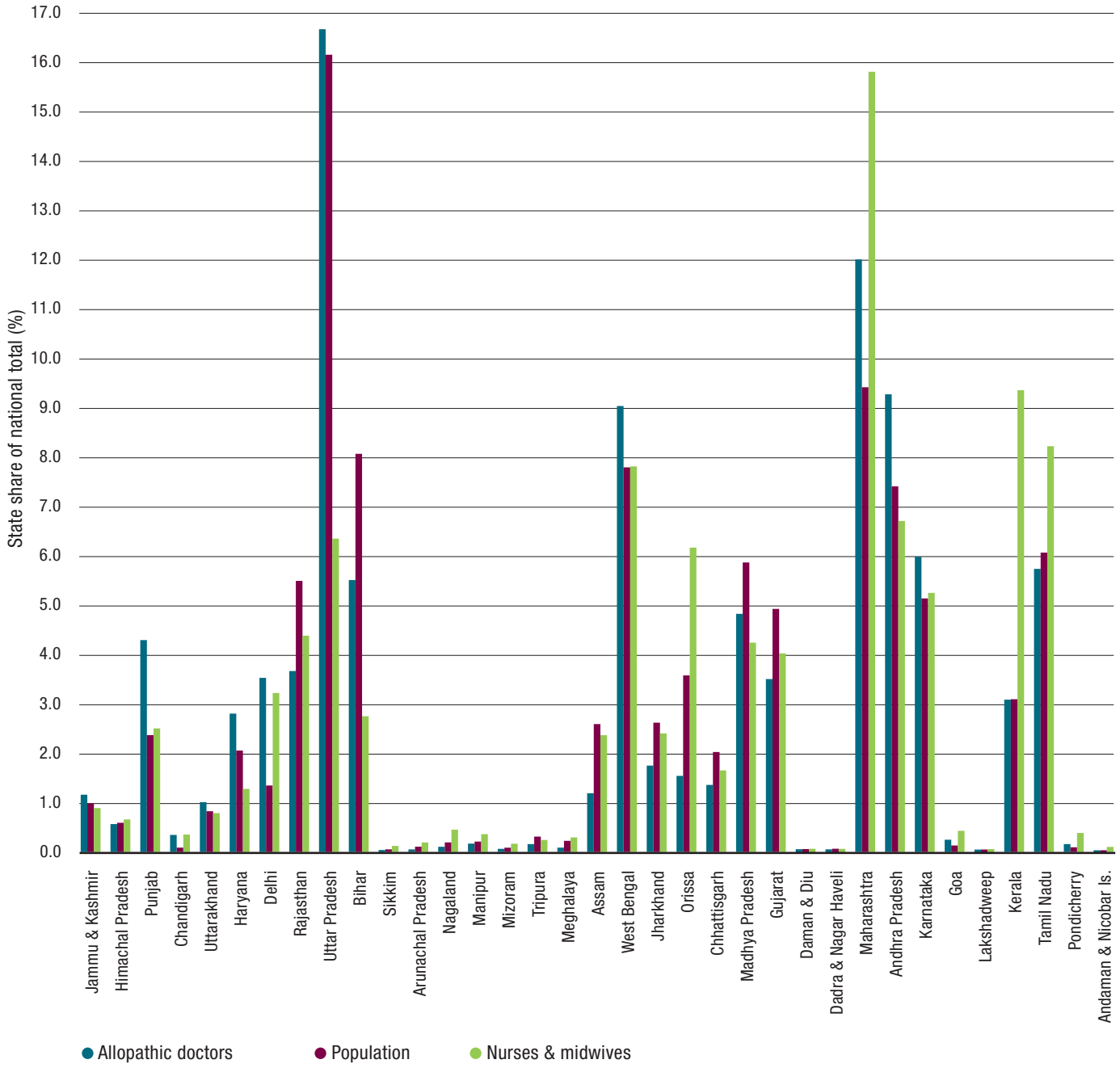
We can rewrite this equation as
$(h_i/H) / (p_i/P) = (h_i/p_i) / (H/P)$.

Table 3.1.1. Concentration by state of health workers (% in state as fraction of national total)

NO.	STATE OR UT	POP'N (LAKHS)	POP'N SHARE (%)	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	101.4	0.99	1.16	0.34	0.05	2.57	1.54	0.89	2.19	0.94	0.05	1.08	0.94	0.98	0.36
2.	Himachal Pradesh	60.8	0.59	0.56	1.49	0.14	0.08	1.30	0.66	1.38	0.79	0.05	0.76	0.65	0.65	0.93
3.	Punjab	243.6	2.37	4.29	4.12	1.09	3.64	4.52	2.50	3.50	2.31	1.46	3.19	3.35	4.00	3.02
4.	Chandigarh	9.0	0.09	0.34	0.23	0.11	0.08	0.77	0.35	0.16	0.24	0.24	0.30	0.33	0.31	0.18
5.	Uttarakhand	84.9	0.83	1.01	1.42	0.39	1.00	1.05	0.79	1.36	0.48	0.05	0.89	0.92	1.01	1.03
6.	Haryana	211.4	2.06	2.80	3.92	0.83	0.83	4.08	1.28	2.71	1.48	0.63	2.09	2.12	2.77	2.65
7.	Delhi	138.5	1.35	3.53	2.86	1.50	6.80	7.37	3.22	2.92	3.01	0.49	3.22	3.27	3.32	2.60
8.	Rajasthan	565.1	5.49	3.67	6.27	1.12	2.91	4.75	4.38	6.24	1.74	5.84	3.92	4.05	3.80	4.26
9.	Uttar Pradesh	1662.0	16.16	16.67	12.55	6.41	37.47	9.34	6.35	13.52	6.19	7.83	10.81	11.55	15.55	11.75
10.	Bihar	830.0	8.07	5.51	2.24	8.84	4.82	1.90	2.75	7.31	3.70	0.06	4.42	4.21	5.33	4.73
11.	Sikkim	5.4	0.05	0.04	0.00	0.01	0.00	0.07	0.12	0.02	0.41	0.05	0.12	0.07	0.03	0.00
12.	Arunachal Pradesh	11.0	0.11	0.05	0.01	0.03	0.00	0.09	0.19	0.12	0.31	0.01	0.14	0.11	0.04	0.02
13.	Nagaland	19.9	0.19	0.10	0.02	0.03	0.02	0.10	0.45	0.40	0.26	0.00	0.26	0.25	0.09	0.02
14.	Manipur	21.7	0.21	0.17	0.02	0.10	0.10	0.17	0.36	0.32	0.39	0.19	0.27	0.24	0.14	0.06
15.	Mizoram	8.9	0.09	0.06	0.00	0.01	0.01	0.23	0.17	0.05	1.02	0.11	0.25	0.10	0.05	0.01
16.	Tripura	32.0	0.31	0.16	0.14	0.86	0.00	0.20	0.24	0.33	0.48	0.33	0.28	0.22	0.21	0.38
17.	Meghalaya	23.2	0.23	0.09	0.04	0.06	0.00	0.16	0.29	0.14	0.19	0.17	0.17	0.17	0.08	0.05
18.	Assam	266.6	2.59	1.19	0.87	3.30	0.55	0.72	2.37	2.69	1.91	6.64	1.91	1.77	1.31	1.71
19.	West Bengal	801.8	7.79	9.04	2.98	30.59	5.17	5.45	7.81	5.16	14.42	7.07	9.44	9.00	9.92	12.90
20.	Jharkhand	269.5	2.62	1.75	0.74	2.25	0.72	1.28	2.40	2.20	2.11	0.13	2.00	1.97	1.64	1.28
21.	Orissa	368.0	3.58	1.54	2.53	5.00	5.07	1.20	6.17	1.89	3.77	1.02	3.54	3.81	2.00	3.55
22.	Chhattisgarh	208.3	2.03	1.36	1.93	0.66	0.39	0.84	1.65	1.12	2.67	5.00	1.66	1.49	1.37	1.40
23.	Madhya Pradesh	603.5	5.87	4.83	6.57	1.99	2.01	2.69	4.24	5.87	5.11	1.04	4.75	4.55	4.79	4.69
24.	Gujarat	506.7	4.93	3.50	6.82	3.56	0.97	4.49	4.02	6.71	3.59	13.86	4.27	3.97	3.92	5.34
25.	Daman & Diu	1.6	0.02	0.01	0.01	0.01	0.01	0.05	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01
26.	Dadra & Nagar Haveli	2.2	0.02	0.01	0.02	0.00	0.00	0.01	0.02	0.02	0.01	0.00	0.01	0.01	0.01	0.01
27.	Maharashtra	968.8	9.42	12.01	22.97	13.15	11.74	14.22	15.81	10.81	12.13	7.21	13.67	14.55	13.57	18.86
28.	Andhra Pradesh	762.1	7.41	9.28	3.95	2.88	6.33	4.03	6.71	7.92	9.05	24.84	7.83	7.44	8.00	3.70
29.	Karnataka	528.5	5.14	5.98	4.56	1.44	2.56	8.24	5.25	2.90	6.53	1.16	5.27	5.32	5.38	3.34
30.	Goa	13.5	0.13	0.25	0.09	0.14	0.03	0.83	0.43	0.24	0.23	0.02	0.29	0.31	0.22	0.10
31.	Lakshadweep	0.6	0.01	0.00	0.00	0.00	0.00	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.00	0.00
32.	Kerala	318.4	3.10	3.09	6.19	7.44	2.26	9.22	9.36	5.03	5.56	12.02	6.06	6.24	3.85	6.42
33.	Tamil Nadu	624.1	6.07	5.74	4.01	5.88	1.87	8.63	8.22	4.53	8.38	2.44	6.72	6.67	5.47	4.56
34.	Pondicherry	9.7	0.09	0.16	0.07	0.09	0.02	0.37	0.38	0.17	0.32	0.00	0.25	0.25	0.14	0.08
35.	Andaman & Nicobar Is.	3.6	0.03	0.03	0.01	0.03	0.00	0.05	0.10	0.06	0.22	0.00	0.09	0.06	0.03	0.01
	All India	10 286	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers. All doctors refers to allopathic plus AYUSH doctors. AYUSH doctors include ayurvedic, homeopathic, and unani doctors. UT refers to union territory.

Figure 3.1.1. Allopathic doctors, population, and nurses and midwives: concentration by state



Thus any state i with a concentration of health workers smaller than its population share will have a density of health workers correspondingly smaller than the national density, and vice versa. For example, Uttar Pradesh had a concentration of 10.81% of all health workers but a population share of 16.16% (see Table 3.1.1); its density of health workers was 134.6 per lakh population compared to the national density of 201.2 (see Table 3.3.1 in section 3.3) – the ratio 10.81/16.16 is equal to the ratio 134.6/201.2.

In describing the concentration of different health worker categories, we begin with all health workers. The states with the highest concentration of all health workers in descending order were Maharashtra (13.67%), Uttar Pradesh (10.81%), West Bengal (9.44%), Andhra Pradesh (7.83%) and Tamil Nadu (6.72%) (Table 3.1.1). The states with the lowest concentration of all health workers in ascending order were Lakshadweep (0.01%), Dadra and Nagar Haveli (0.01%), Daman and Diu (0.02%), Andaman and Nicobar Islands (0.09%) and Sikkim (0.12%).

We expect state concentrations of health workers to be correlated with state population shares; but the greater the variation in health worker density across states, the lower will be this correlation. The density of health workers does vary across states (see Table 3.3.1 in section 3.3), there being a 6-fold differential between the state with the lowest density (Bihar with a density of 110.2 per lakh) and the state with the highest density (Chandigarh with a density of 683.7 per lakh). Bihar with 8.07% of the national population had only 4.42% of the country's health workers, whereas Chandigarh with 0.09% of the national population had 0.30% of the country's health workers. Across states the Pearson correlation coefficient between concentration of all health workers and population concentration was estimated to be 0.9060.

Across states the correlation between concentration of health workers and population concentration can vary markedly for the different categories. The Pearson correlation coefficient between population concentration and concentration of allopathic doctors was highest at 0.9580, and that between population concentration and concentration of homeopathic doctors was among the lowest at 0.5874. The latter correlation is consistent with the large interstate variation in density of homeopathic doctors (see Table 3.3.1 in section 3.3). For example, the density of homeopathic doctors in West Bengal was 25.3 per lakh population and in Tripura 17.8 per lakh population, compared to densities of 0.3 in Jammu and Kashmir and 0.9 in Nagaland – with a national density of 6.5 (Table 3.3.1 in section 3.3).

We turn next to examining the concentration of health workers by level of education and medical qualification – see Table 3.1.2. We compare state concentrations of (A) all health workers with any level of education, (B) those with more than secondary schooling, and (C) those with a medical qualification. These are successively more restrictive categories, with (C) being a subset of (B), which in turn is a subset of (A). Table 3.1.2 shows the state concentration of selected health worker categories by level of education and medical qualification. We focus on a single health worker category, viz., allopathic doctors – see Figure 3.1.2 (and Table 3.1.2). The differences in state concentration of allopathic doctors by (A), (B) and (C) stand out sharply for Uttar Pradesh and Maharashtra. In Uttar Pradesh, the concentration of allopathic doctors was 16.67% (A), which fell to 13.77% for those with more than secondary schooling (B), which in turn dropped very sharply to 7.19% for those with a medical qualification (C). On the other hand, in Maharashtra, the concentration of allopathic doctors was 12.01% (A), which increased to 14.41% for those with more than secondary schooling (B), which in turn increased further to 16.09% for those with a medical qualification (C).

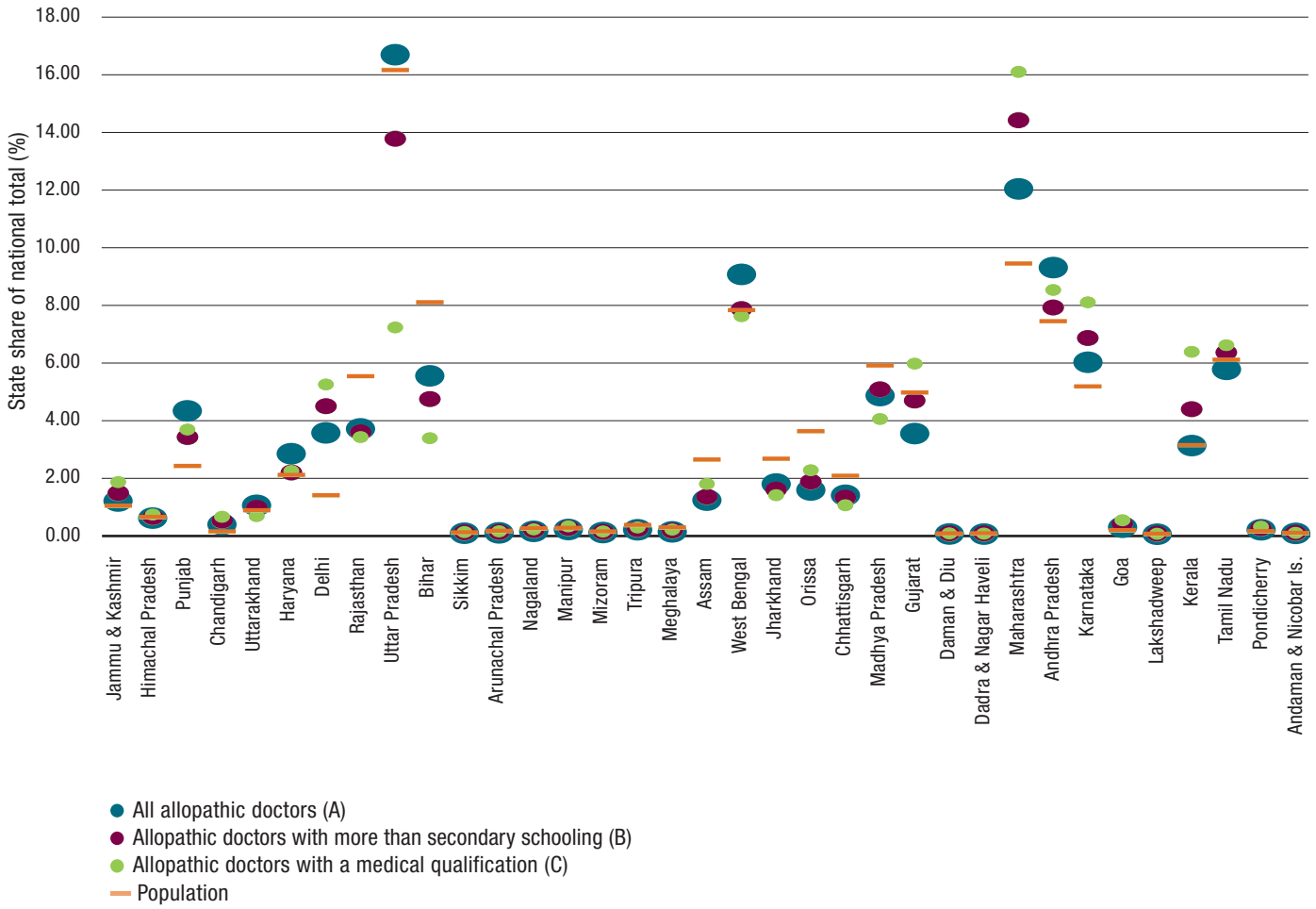
The state concentrations of nurses by education level and medical qualification are also shown in Table 3.1.2. An interesting feature of the comparison by level of education and medical qualification is the case of Kerala. In Kerala, the concentration of nurses was 9.36% (A), which increased to 14.54% for nurses with more than secondary schooling (B), which in turn increased sharply to 38.43% for nurses with a medical qualification (C). Almost two fifths of the country's medically qualified nurses were thus found in the state of Kerala.

Table 3.1.2. Selected categories of health workers by education levels (A), (B), and (C): concentration by state

NO.	STATE OR UT	POP'N (LAKHS)	POP'N SHARE (%)	ALL HEALTH WORKERS			ALLOPATHIC DOCTORS			NURSES & MIDWIVES			PHARMACISTS			AYUSH DOCTORS			DENTAL PRACTITIONERS			ANCILL. HEALTH PROF.		
				(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
1.	Jammu & Kashmir	101.44	0.99	1.08	1.02	1.19	1.16	1.42	1.81	0.89	0.59	0.20	2.19	1.53	0.67	0.36	0.38	0.43	1.54	1.59	1.27	0.94	0.68	0.28
2.	Himachal Pradesh	60.78	0.59	0.76	0.73	0.80	0.56	0.59	0.68	0.66	0.57	0.44	1.38	1.49	2.06	0.93	1.06	1.14	1.30	1.21	1.14	0.79	0.70	0.54
3.	Punjab	243.59	2.37	3.19	3.26	3.87	4.29	3.38	3.64	2.50	3.68	5.18	3.50	4.66	8.39	3.02	2.74	3.10	4.52	4.21	4.90	2.31	2.00	2.12
4.	Chandigarh	9.01	0.09	0.30	0.43	0.58	0.34	0.46	0.60	0.35	0.56	0.93	0.16	0.33	0.45	0.18	0.22	0.27	0.77	0.89	1.11	0.24	0.35	0.52
5.	Uttarakhand	84.89	0.83	0.89	0.88	0.70	1.01	0.91	0.63	0.79	0.69	0.21	1.36	1.61	1.44	1.03	1.08	1.16	1.05	0.88	0.43	0.48	0.52	0.44
6.	Haryana	211.45	2.06	2.09	2.07	2.41	2.80	2.14	2.20	1.28	1.79	2.10	2.71	2.37	3.72	2.65	2.66	3.00	4.08	4.02	4.17	1.48	1.33	1.24
7.	Delhi	138.51	1.35	3.22	3.87	4.55	3.53	4.45	5.21	3.22	3.75	5.10	2.92	3.45	3.11	2.60	3.00	3.19	7.37	6.14	4.70	3.01	3.17	2.28
8.	Rajasthan	565.07	5.49	3.92	3.67	2.77	3.67	3.54	3.38	4.38	3.92	1.53	6.24	6.98	2.52	4.26	3.84	2.31	4.75	2.72	1.44	1.74	1.69	1.80
9.	Uttar Pradesh	1661.98	16.16	10.81	11.03	7.20	16.67	13.77	7.19	6.35	7.47	1.40	13.52	12.51	4.40	11.75	12.23	12.43	9.34	6.12	2.72	6.19	6.39	4.70
10.	Bihar	829.99	8.07	4.42	4.43	2.65	5.51	4.70	3.34	2.75	3.72	0.32	7.31	7.00	1.26	4.73	4.04	2.42	1.90	1.82	1.08	3.70	4.12	4.06
11.	Sikkim	5.41	0.05	0.12	0.06	0.06	0.04	0.05	0.07	0.12	0.04	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.07	0.07	0.11	0.41	0.21	0.20
12.	Arunachal Pradesh	10.98	0.11	0.14	0.09	0.09	0.05	0.06	0.10	0.19	0.11	0.06	0.12	0.14	0.27	0.02	0.02	0.02	0.09	0.11	0.15	0.31	0.20	0.33
13.	Nagaland	19.90	0.19	0.26	0.14	0.14	0.10	0.13	0.17	0.45	0.22	0.17	0.40	0.21	0.28	0.02	0.02	0.03	0.10	0.13	0.15	0.26	0.12	0.10
14.	Manipur	21.67	0.21	0.27	0.27	0.23	0.17	0.21	0.27	0.36	0.37	0.24	0.32	0.49	0.41	0.06	0.04	0.03	0.17	0.18	0.19	0.39	0.40	0.49
15.	Mizoram	8.89	0.09	0.25	0.10	0.07	0.06	0.07	0.09	0.17	0.06	0.06	0.05	0.02	0.05	0.01	0.01	0.01	0.23	0.16	0.19	1.02	0.39	0.21
16.	Tripura	31.99	0.31	0.28	0.20	0.19	0.16	0.17	0.23	0.24	0.19	0.02	0.33	0.40	0.43	0.38	0.19	0.09	0.20	0.15	0.14	0.48	0.26	0.33
17.	Meghalaya	23.19	0.23	0.17	0.11	0.13	0.09	0.11	0.16	0.29	0.13	0.04	0.14	0.09	0.09	0.05	0.02	0.01	0.16	0.20	0.22	0.19	0.19	0.52
18.	Assam	266.56	2.59	1.91	1.25	1.40	1.19	1.29	1.75	2.37	1.05	0.74	2.69	2.13	2.14	1.71	0.75	0.49	0.72	0.71	0.61	1.91	1.31	2.64
19.	West Bengal	801.76	7.79	9.44	8.35	6.16	9.04	7.83	7.58	7.81	8.38	1.59	5.16	4.20	2.82	12.90	9.33	5.79	5.45	5.12	4.21	14.42	11.68	7.54
20.	Jharkhand	269.46	2.62	2.00	1.86	1.02	1.75	1.54	1.35	2.40	3.21	0.54	2.20	1.87	0.59	1.28	0.86	0.44	1.28	0.78	0.27	2.11	1.93	1.70
21.	Orissa	368.05	3.58	3.54	2.50	2.31	1.54	1.82	2.22	6.17	3.64	1.41	1.89	2.99	5.61	3.55	2.76	2.50	1.20	0.80	0.48	3.77	2.67	3.30
22.	Chhattisgarh	208.34	2.03	1.66	1.48	1.11	1.36	1.27	1.00	1.65	1.54	0.79	1.12	0.98	0.43	1.40	1.44	1.47	0.84	0.63	0.61	2.67	2.34	2.51
23.	Madhya Pradesh	603.48	5.87	4.75	4.77	3.82	4.83	5.04	4.01	4.24	3.79	1.53	5.87	5.62	2.09	4.69	5.34	5.34	2.69	2.83	2.52	5.11	4.79	3.51
24.	Gujarat	506.71	4.93	4.27	4.97	6.39	3.50	4.65	5.93	4.02	4.33	7.52	6.71	4.99	7.58	5.34	6.58	6.78	4.49	6.19	7.19	3.59	4.78	5.01
25.	Daman & Diu	1.58	0.02	0.02	0.02	0.03	0.01	0.02	0.02	0.02	0.02	0.05	0.02	0.02	0.06	0.01	0.01	0.01	0.05	0.07	0.11	0.02	0.01	0.02
26.	Dadra & Nagar Haveli	2.20	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.05	0.02	0.02	0.04	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01
27.	Maharashtra	968.79	9.42	13.67	14.33	18.60	12.01	14.41	16.09	15.81	10.38	10.59	10.81	7.58	7.73	18.86	24.84	31.46	14.22	18.18	22.21	12.13	13.15	22.65
28.	Andhra Pradesh	762.10	7.41	7.83	7.30	6.75	9.28	7.89	8.50	6.71	6.50	4.35	7.92	7.04	7.07	3.70	3.30	3.31	4.03	4.99	5.74	9.05	10.52	7.58
29.	Karnataka	528.51	5.14	5.27	5.71	6.76	5.98	6.83	8.07	5.25	4.84	4.96	2.90	2.75	3.14	3.34	3.78	4.32	8.24	7.72	7.84	6.53	6.89	9.96
30.	Goa	13.48	0.13	0.29	0.31	0.45	0.25	0.34	0.48	0.43	0.34	0.60	0.24	0.32	0.58	0.10	0.13	0.15	0.83	1.10	1.41	0.23	0.23	0.33
31.	Lakshadweep	0.61	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.03	0.01	0.01	0.04	0.00	0.00	0.01	0.04	0.05	0.04	0.02	0.02	0.04
32.	Kerala	318.41	3.10	6.06	7.57	11.27	3.09	4.35	6.34	9.36	14.54	38.43	5.03	9.21	21.48	6.42	6.03	6.65	9.22	12.38	16.06	5.56	7.36	3.63
33.	Tamil Nadu	624.06	6.07	6.72	6.84	5.83	5.74	6.32	6.57	8.22	8.93	7.54	4.53	6.59	8.20	4.56	3.18	1.57	8.63	7.29	5.89	8.38	9.12	9.03
34.	Pondicherry	9.74	0.09	0.25	0.28	0.34	0.16	0.20	0.26	0.38	0.52	1.02	0.17	0.30	0.63	0.08	0.07	0.06	0.37	0.49	0.59	0.32	0.37	0.23
35.	Andaman & Nicobar Is.	3.56	0.03	0.09	0.06	0.07	0.03	0.03	0.04	0.10	0.09	0.23	0.06	0.09	0.24	0.01	0.01	0.01	0.05	0.06	0.08	0.22	0.11	0.13
	All India	10 286	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note: (A) refers to all health workers in the category; (B) refers to health workers with more than secondary schooling; and (C) refers to health workers with a medical qualification.

Figure 3.1.2. Allopathic doctors by education levels (A), (B), and (C): concentration by state



3.2 Composition of health workers

The composition of health workers is defined as the list of the percentages of health workers in each category, i.e. 100 times the number of health workers in each category divided by the number of all health workers. By definition, these percentages sum to 100%. Composition refers to the list of percentages of different health worker categories in a given unit (e.g. nation or state), whereas concentration refers to the percentage of a given health worker category in total health workers in that category across units (e.g. states).

The national composition of selected health worker categories was as follows: doctors comprised 39.6% of all health workers, nurses and midwives comprised 30.5%, ancillary health professionals 17.0%, pharmacists 11.2%, dental practitioners 1.2%, and traditional and faith healers 0.6% (see Table 3.2).

The composition of these health worker categories was very different across states (Table 3.2). The percentage of doctors among all health workers ranged across states from 7.8% (in Mizoram) to 56.9% (in Uttar Pradesh). States with the highest percentage of doctors were in the north: Uttar Pradesh, Haryana, Punjab, Bihar and Uttarakhand. In Uttar Pradesh and Haryana, doctors accounted for more than half of all health workers. States with the lowest percentage of doctors were in the north-east: Mizoram, Sikkim, Arunachal Pradesh and Nagaland.

Nurses accounted for 30.5% of the total health workforce in the country (Table 3.2). In Orissa, Nagaland and Meghalaya, nurses accounted for more than 50% of all health workers. In Kerala, nurses accounted for 47.0% of all health workers. Low percentages of nurses in the health workforce were found in Uttar Pradesh (17.9%), Haryana (18.6%) and Bihar (19.0%). Across states the percentage of nurses in the health workforce was negatively correlated with the percentage of doctors (Pearson correlation coefficient of –0.5973) – see Figure 3.2.1.

The doctor–nurse ratio in the country as a whole was 1.3 (Table 3.2, last column). As shown in Figure 3.2.2, this ratio varied substantially across states – from 0.2 (in Nagaland) to 3.2 (in Uttar Pradesh). In total, 18 states had more doctors than nurses, and 17 had more nurses than doctors. All northern states had a doctor–nurse ratio larger than 1.0, and all states with the highest ratios were in the north (Uttar Pradesh 3.2, Haryana 2.8, Bihar 2.5, Punjab 2.1, Uttarakhand 1.7). By contrast, most eastern states had ratios less than 1.0 (e.g. Orissa had a ratio of 0.4) – the exceptions were West Bengal (1.7) and Tripura (1.1). Of the southern states, Karnataka and Andhra Pradesh had ratios greater than 1.0, but Kerala and Tamil Nadu had ratios less than 1.0. (A map is available, upon request from the authors, which disaggregates the state doctor–nurse ratios and shows them at the level of district.)

Pharmacists accounted for 11.2% of the nation's health workforce (Table 3.2). Across states, the share of pharmacists was highest in Jammu and Kashmir (22.6%) and Himachal Pradesh (20.3%). Pharmacists in the north-eastern states of Sikkim and Mizoram accounted for just 1.9% and 2.0%, respectively, of all health workers in the state. However, these two states had the highest shares of ancillary health professionals. There may be some substitution between pharmacists and ancillary health professionals within a state: across states the share of pharmacists was negatively correlated with the share of ancillary health professionals (Pearson correlation coefficient of –0.6140). In contrast, the share of pharmacists was positively correlated with the share of doctors (Pearson correlation coefficient of 0.4123).

Nationally, ancillary health professionals accounted for 17.0% of all health workers (Table 3.2). But we find large variations in this proportion across states. In Rajasthan ancillary health professionals accounted for 7.5% of the health workforce, but in Mizoram they accounted for as much as 68.6%.[4] Ancillary health professionals also comprised the majority of health workers in Sikkim (56.5%). By contrast, doctors and nurses formed the majority of the health workforce nationally (70.1%) and in every state except Mizoram, Sikkim, and Andaman and Nicobar Islands (where they formed 48.8%). The share of ancillary health professionals was negatively correlated with the share of doctors (Pearson correlation coefficient of –0.6957).

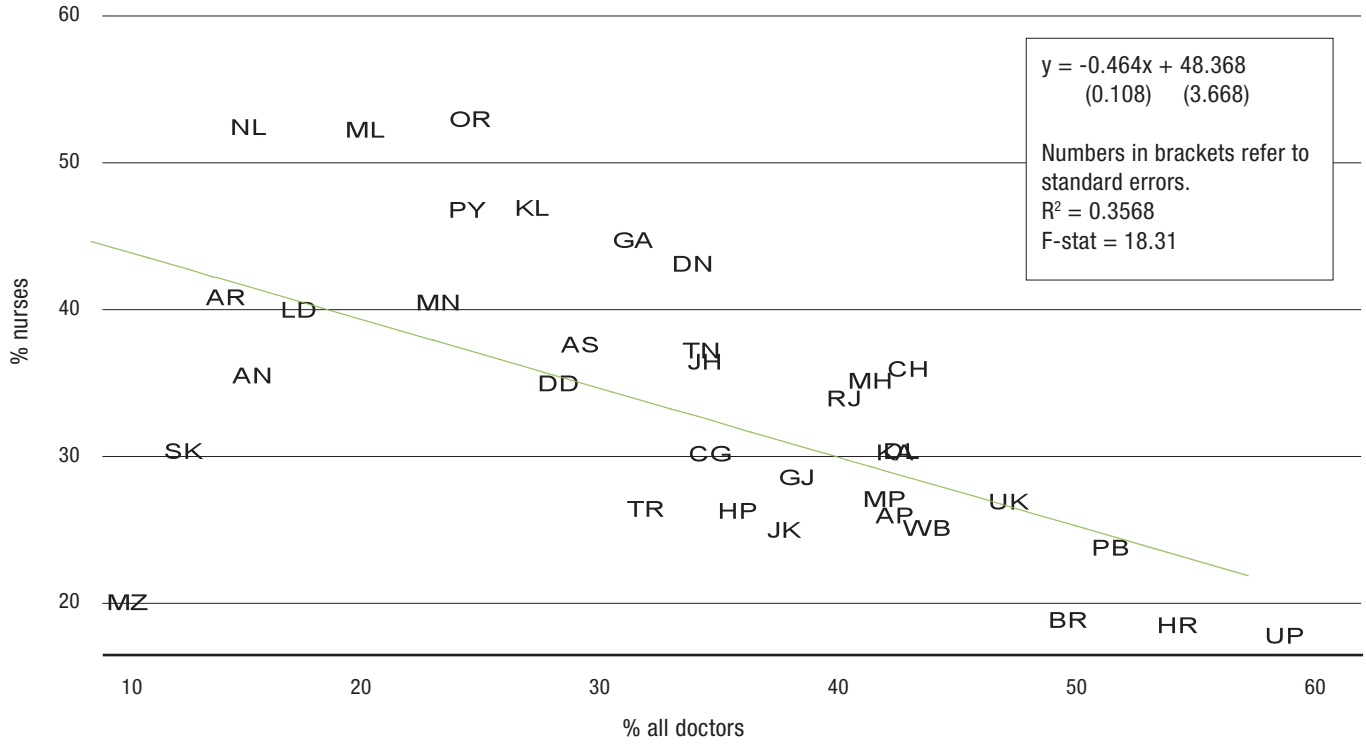
4 As indicated earlier, ancillary health professionals include various different types of health worker – defined by seven NCO codes (see Table 1), with descriptions of these codes shown in Annex 1.

Table 3.2. Composition of all health workers, and composition of all doctors, in each state

NO.	STATE OR UT	DENSITY OF ALL HEALTH WORKERS	OF ALL HEALTH WORKERS							DENSITY OF ALL DOCTORS	OF ALL DOCTORS					AYUSH AS % OF ALL DOCTORS	DOCTOR -NURSE RATIO
			% all doctors	% nurses	% pharma.	% dental	% ancill.	% trad'l heal.	Total		% allop.	% ayurv.	% homeo.	% unani	Total		
1.	Jammu & Kashmir	220.5	35.8	25.1	22.6	1.7	14.7	0.0	100.0	79.0	91.5	4.7	0.4	3.3	100.0	8.5	1.4
2.	Himachal Pradesh	259.2	33.8	26.4	20.3	2.0	17.5	0.0	100.0	87.5	67.2	30.9	1.7	0.2	100.0	32.8	1.3
3.	Punjab	271.3	49.6	23.9	12.3	1.7	12.3	0.3	100.0	134.6	82.8	13.9	2.2	1.1	100.0	17.2	2.1
4.	Chandigarh	683.7	40.9	36.1	5.9	3.1	13.6	0.5	100.0	279.9	86.5	10.3	2.9	0.3	100.0	13.5	1.1
5.	Uttarakhand	216.3	45.2	27.0	17.1	1.4	9.2	0.0	100.0	97.8	76.9	18.8	3.1	1.2	100.0	23.1	1.7
6.	Haryana	204.8	52.4	18.6	14.5	2.3	12.0	0.2	100.0	107.3	78.2	19.0	2.4	0.4	100.0	21.8	2.8
7.	Delhi	481.4	40.8	30.5	10.1	2.7	15.9	0.1	100.0	196.2	82.1	11.6	3.7	2.6	100.0	17.9	1.3
8.	Rajasthan	143.7	38.4	34.0	17.8	1.4	7.5	0.9	100.0	55.1	74.4	22.2	2.4	1.0	100.0	25.6	1.1
9.	Uttar Pradesh	134.6	56.9	17.9	14.0	1.0	9.7	0.4	100.0	76.7	82.8	10.9	3.3	3.0	100.0	17.2	3.2
10.	Bihar	110.2	47.8	19.0	18.5	0.5	14.2	0.0	100.0	52.6	79.8	5.7	13.4	1.1	100.0	20.2	2.5
11.	Sikkim	465.6	10.2	30.5	1.9	0.7	56.5	0.2	100.0	47.7	96.5	1.2	2.3	0.0	100.0	3.5	0.3
12.	Arunachal Pradesh	270.3	12.0	40.9	9.2	0.8	37.1	0.0	100.0	32.5	91.3	2.2	6.4	0.0	100.0	8.7	0.3
13.	Nagaland	272.7	13.0	52.5	17.1	0.4	16.9	0.0	100.0	35.6	93.8	3.5	2.4	0.3	100.0	6.2	0.2
14.	Manipur	258.5	21.0	40.6	13.1	0.7	24.2	0.4	100.0	54.2	91.1	2.2	5.9	0.9	100.0	8.9	0.5
15.	Mizoram	588.2	7.8	20.2	2.0	1.1	68.6	0.3	100.0	46.0	97.3	0.2	2.2	0.2	100.0	2.7	0.4
16.	Tripura	180.6	29.9	26.5	13.0	0.9	28.9	0.7	100.0	54.0	58.3	8.6	33.0	0.0	100.0	41.7	1.1
17.	Meghalaya	153.0	18.0	52.3	9.3	1.1	18.7	0.6	100.0	27.5	86.5	7.4	6.1	0.0	100.0	13.5	0.3
18.	Assam	148.5	27.1	37.7	15.7	0.4	16.9	2.1	100.0	40.3	70.1	8.9	20.4	0.5	100.0	29.9	0.7
19.	West Bengal	243.7	41.6	25.2	6.1	0.7	25.9	0.5	100.0	101.4	70.3	4.0	25.0	0.7	100.0	29.7	1.7
20.	Jharkhand	153.8	32.5	36.5	12.3	0.8	17.9	0.0	100.0	49.9	82.2	6.1	11.1	0.5	100.0	17.8	0.9
21.	Orissa	199.2	22.4	53.1	6.0	0.4	18.1	0.2	100.0	44.5	59.5	17.0	20.3	3.2	100.0	40.5	0.4
22.	Chhattisgarh	165.3	32.5	30.3	7.5	0.6	27.3	1.8	100.0	53.8	76.7	19.0	3.9	0.4	100.0	23.3	1.1
23.	Madhya Pradesh	163.0	39.9	27.2	13.8	0.7	18.3	0.1	100.0	65.1	77.7	18.4	3.4	0.5	100.0	22.3	1.5
24.	Gujarat	174.6	36.3	28.7	17.5	1.2	14.2	2.0	100.0	63.4	68.9	23.4	7.4	0.3	100.0	31.1	1.3
25.	Daman & Diu	232.6	26.1	35.1	12.0	3.3	23.4	0.3	100.0	60.7	82.3	11.5	5.2	1.0	100.0	17.7	0.7
26.	Dadra & Nagar Haveli	127.0	31.8	43.2	13.9	0.7	10.4	0.0	100.0	40.4	68.5	28.1	3.4	0.0	100.0	31.5	0.7
27.	Maharashtra	292.0	39.3	35.2	8.8	1.2	15.1	0.3	100.0	114.8	68.3	22.8	7.9	1.1	100.0	31.7	1.1
28.	Andhra Pradesh	212.7	40.5	26.1	11.3	0.6	19.6	1.9	100.0	86.1	89.4	6.6	2.9	1.0	100.0	10.6	1.6
29.	Karnataka	206.2	40.4	30.4	6.2	1.8	21.0	0.1	100.0	83.4	85.8	11.4	2.2	0.6	100.0	14.2	1.3
30.	Goa	446.8	29.3	44.8	9.1	3.4	13.4	0.0	100.0	130.8	89.0	5.4	5.4	0.2	100.0	11.0	0.7
31.	Lakshadweep	390.8	15.2	40.1	8.0	3.8	32.5	0.4	100.0	59.4	83.3	13.9	2.8	0.0	100.0	16.7	0.4
32.	Kerala	394.0	25.1	47.0	9.3	1.8	15.6	1.2	100.0	99.0	61.9	21.7	15.7	0.7	100.0	38.1	0.5
33.	Tamil Nadu	222.7	32.2	37.3	7.5	1.5	21.2	0.2	100.0	71.8	81.0	9.9	8.7	0.4	100.0	19.0	0.9
34.	Pondicherry	530.6	22.3	46.9	7.6	1.8	21.5	0.0	100.0	118.4	87.4	7.0	5.4	0.2	100.0	12.6	0.5
35.	Andaman & Nicobar Is.	509.1	13.2	35.6	8.1	0.6	42.6	0.0	100.0	67.1	90.0	2.5	7.5	0.0	100.0	10.0	0.4
	All India	**201.2**	**39.6**	**30.5**	**11.2**	**1.2**	**17.0**	**0.6**	**100.0**	**79.7**	**77.2**	**13.5**	**8.1**	**1.3**	**100.0**	**22.8**	**1.3**

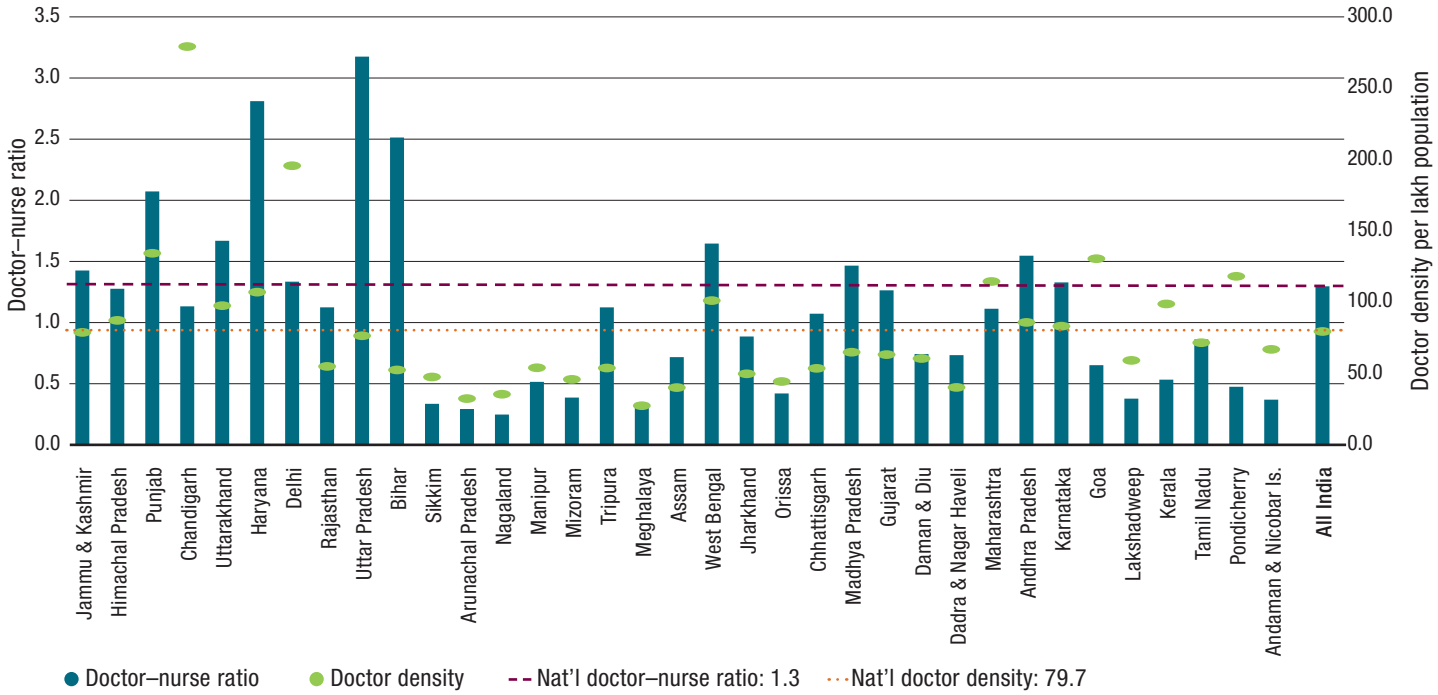
Note: Pharma. refers to pharmacists; ancill. refers to ancillary health professionals; trad'l heal. refers to traditional practitioners & faith healers; allop. refers to allopathic; ayurv. refers to ayurvedic; homeo. refers to homeopathic.

Figure 3.2.1. Percentage of nurses vs percentage of doctors, by state



Note: State two-letter codes are as follows: AN - Andaman & Nicobar Is.; AP - Andhra Pradesh; AR - Arunachal Pradesh; AS - Assam; BR - Bihar; CG - Chhattisgarh; CH - Chandigarh; DD - Daman & Diu; DL - Delhi; DN - Dadra & Nagar Haveli; GA - Goa; GJ - Gujarat; HP - Himachal Pradesh; HR - Haryana; JH - Jharkhand; JK - Jammu & Kashmir; KA - Karnataka; KL - Kerala; LD - Lakshadweep; MH - Maharashtra; ML - Meghalaya; MN - Manipur; MP - Madhya Pradesh; MZ - Mizoram; NL - Nagaland; OR - Orissa; PB - Punjab; PY - Pondicherry; RJ - Rajasthan; SK - Sikkim; TN - Tamil Nadu; TR - Tripura; UK - Uttarakhand; UP - Uttar Pradesh; WB - West Bengal.

Figure 3.2.2. Doctor–nurse ratio and doctor density, by state



We next consider the share of the different doctor categories in the total of all doctors. Nationally, allopathic doctors accounted for 77.2% of all doctors (Table 3.2). In six states, mainly in the north-east, allopathic doctors accounted for more than 90% of all doctors: 97.3% in Mizoram, 96.5% in Sikkim, 93.8% in Nagaland, 91.5% in Jammu and Kashmir, 91.3% in Arunachal Pradesh and 91.1% in Manipur. Allopathic doctors accounted for more than 58% of all doctors in every state.

Nationally, AYUSH doctors accounted for 22.8% of all doctors (Table 3.2). This was composed as follows: 13.5% ayurvedic; 8.1% homeopathic; and 1.3% unani. AYUSH doctors represented 41.7% of all doctors in Tripura, 40.5% in Orissa and 38.1% in Kerala. Ayurvedic doctors accounted for 30.9% of all doctors in Himachal Pradesh and 28.1% in Dadra and Nagar Haveli. Homeopathic doctors constituted 33.0% of all doctors in Tripura, 25.0% in West Bengal, 20.4% in Assam and 20.3% in Orissa – these neighbouring states had the highest percentage of homeopathic doctors among all doctors. (West Bengal having the largest concentration of 30.59% of homeopathic doctors in the nation was due to the state having both a high density of all doctors and a high share of homeopathic doctors among all doctors.) Unani doctors, who comprised just 1.3% of all doctors in the country, were not present in seven states.

3.3 Health worker densities by education, stratum and gender

The density of all health workers nationally was 201.2 per lakh population (Table 3.3.1). There were large variations in this density across states, with a 6-fold interstate differential between the highest and lowest density. Chandigarh had the highest health worker density (683.7 per lakh population) and Bihar the lowest (110.2 per lakh). Some union territories and north-eastern states (Sikkim, Mizoram) had densities that were more than twice the national average.

For the nine individual health worker categories, there were also large variations across states in density. Allopathic doctors had a national density of 61.5 per lakh population, ranging from Chandigarh with a density of 242.2 per lakh population to Meghalaya with a density of 23.8 – more than a 10-fold difference (see Table 3.3.1 and Figure 3.3.1). Homeopathic doctors had a national density of 6.5 per lakh population, ranging from West Bengal with a density of 25.3 to Jammu and Kashmir with a density of 0.3 – an 84-fold difference. Dental practitioners had a national density of 2.4 per lakh population, ranging from Chandigarh with a density of 21.0 to Bihar with a density of only 0.56 per lakh population – a 38-fold difference.

For all doctors, the interstate max-min density differential was 10-fold, and for nurses it was 12-fold. However, for all doctors plus nurses, the max-min differential was 7-fold. At the state level, thus, there is some suggestion of substitution between doctors and nurses, as also indicated in Figure 3.2.1 by the negative correlation across states between the doctor share and the nurse share of all health workers.

Across states the density of nurses was positively correlated with the density of allopathic doctors (Pearson correlation coefficient of 0.5239). Note that cross-state correlation of the densities of two categories of health workers is quite different from cross-state correlation of their shares of all health workers. The density of dentists was even more strongly correlated with that of allopathic doctors (Pearson correlation coefficient of 0.7815).

We find that state density of all health workers was positively but imperfectly correlated with state per capita income for 2000–2001:[5] the Pearson correlation coefficient was 0.7571. The Pearson correlation coefficient between state per capita income and density of individual health worker categories was highest for dental practitioners (0.9306), followed by all doctors and nurses (0.9166). Better-off states seem to afford more dentists per capita, and also more doctors and nurses per capita.

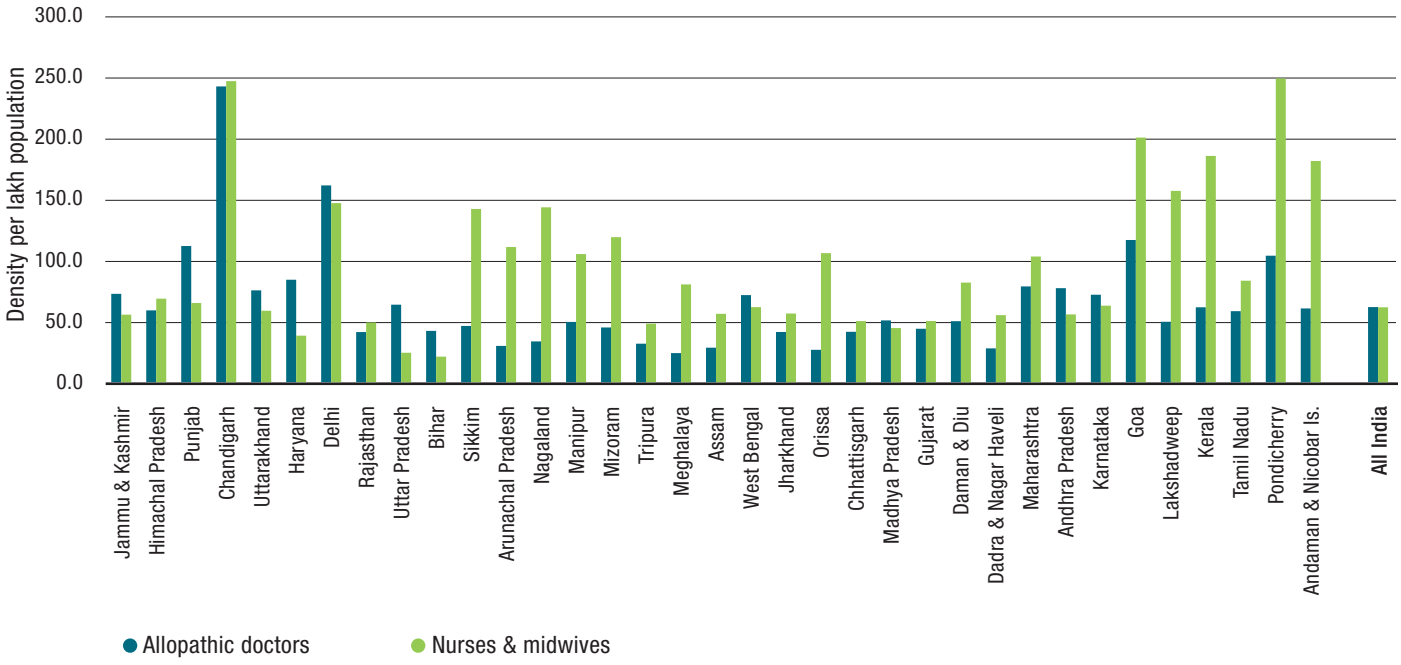
5 The state per capita income refers to state net domestic product per capita, found in: Statement: per capita net state domestic product at constant (1999–2000) prices. Ministry of Statistics and Programme Implementation (MOSPI), Government of India, 12 November 2009 (http://mospi.gov.in/State-wise_SDP_1999-2000_20nov09.pdf).

Table 3.3.1. Density of health workers per lakh population, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	72.3	3.7	0.3	2.6	3.7	55.3	49.9	32.5	0.1	**220.5**	134.3	79.0	6.7
2.	Himachal Pradesh	58.8	27.1	1.5	0.1	5.2	68.4	52.6	45.4	0.1	**259.2**	155.8	87.5	28.7
3.	Punjab	111.5	18.7	3.0	1.5	4.5	64.8	33.3	33.3	0.8	**271.3**	199.4	134.6	23.2
4.	Chandigarh	242.2	28.8	8.1	0.9	21.0	246.5	40.3	92.7	3.3	**683.7**	526.4	279.9	37.8
5.	Uttarakhand	75.2	18.4	3.0	1.2	3.0	58.5	37.0	19.9	0.1	**216.3**	156.3	97.8	22.6
6.	Haryana	83.9	20.4	2.6	0.4	4.7	38.1	29.7	24.6	0.4	**204.8**	145.4	107.3	23.4
7.	Delhi	161.1	22.8	7.2	5.1	13.0	146.6	48.8	76.4	0.4	**481.4**	342.8	196.2	35.1
8.	Rajasthan	41.0	12.2	1.3	0.5	2.1	48.9	25.5	10.8	1.3	**143.7**	104.0	55.1	14.1
9.	Uttar Pradesh	63.5	8.3	2.6	2.3	1.4	24.1	18.8	13.1	0.6	**134.6**	100.8	76.7	13.2
10.	Bihar	42.0	3.0	7.1	0.6	0.6	20.9	20.4	15.7	0.0	**110.2**	73.5	52.6	10.7
11.	Sikkim	46.0	0.6	1.1	0.0	3.1	141.8	8.7	263.1	1.1	**465.6**	189.5	47.7	1.7
12.	Arunachal Pradesh	29.7	0.7	2.1	0.0	2.1	110.7	24.8	100.2	0.1	**270.3**	143.2	32.5	2.8
13.	Nagaland	33.4	1.3	0.9	0.1	1.2	143.2	46.7	46.1	0.0	**272.7**	178.7	35.6	2.2
14.	Manipur	49.3	1.2	3.2	0.5	1.9	104.9	33.8	62.6	1.1	**258.5**	159.1	54.2	4.8
15.	Mizoram	44.8	0.1	1.0	0.1	6.4	118.7	11.9	403.6	1.6	**588.2**	164.8	46.0	1.2
16.	Tripura	31.5	4.7	17.8	0.0	1.6	47.9	23.5	52.3	1.3	**180.6**	101.9	54.0	22.5
17.	Meghalaya	23.8	2.0	1.7	0.0	1.6	80.0	14.3	28.6	0.9	**153.0**	107.6	27.5	3.7
18.	Assam	28.2	3.6	8.2	0.2	0.7	56.0	23.3	25.1	3.1	**148.5**	96.2	40.3	12.0
19.	West Bengal	71.3	4.1	25.3	0.7	1.7	61.4	14.9	63.2	1.1	**243.7**	162.8	101.4	30.1
20.	Jharkhand	41.1	3.0	5.6	0.3	1.2	56.2	18.9	27.5	0.1	**153.8**	106.2	49.9	8.9
21.	Orissa	26.5	7.6	9.0	1.4	0.8	105.7	11.9	36.0	0.4	**199.2**	150.2	44.5	18.0
22.	Chhattisgarh	41.2	10.2	2.1	0.2	1.0	50.0	12.4	45.1	3.0	**165.3**	103.8	53.8	12.5
23.	Madhya Pradesh	50.6	12.0	2.2	0.3	1.1	44.3	22.5	29.7	0.2	**163.0**	109.4	65.1	14.5
24.	Gujarat	43.7	14.8	4.7	0.2	2.2	50.1	30.6	24.8	3.5	**174.6**	113.5	63.4	19.7
25.	Daman & Diu	49.9	7.0	3.2	0.6	7.6	81.5	27.8	54.4	0.6	**232.6**	142.2	60.7	10.7
26.	Dadra & Nagar Haveli	27.7	11.3	1.4	0.0	0.9	54.9	17.7	13.2	0.0	**127.0**	95.2	40.4	12.7
27.	Maharashtra	78.4	26.2	9.0	1.3	3.6	102.9	25.8	44.0	0.9	**292.0**	217.7	114.8	36.4
28.	Andhra Pradesh	77.0	5.7	2.5	0.9	1.3	55.5	24.0	41.7	4.1	**212.7**	141.6	86.1	9.1
29.	Karnataka	71.6	9.5	1.8	0.5	3.8	62.6	12.7	43.4	0.3	**206.2**	146.0	83.4	11.8
30.	Goa	116.4	7.1	7.0	0.2	15.0	200.3	40.8	59.7	0.1	**446.8**	331.1	130.8	14.4
31.	Lakshadweep	49.5	8.2	1.6	0.0	14.8	156.6	31.3	127.0	1.6	**390.8**	216.0	59.4	9.9
32.	Kerala	61.3	21.5	15.5	0.7	7.1	185.3	36.6	61.3	4.8	**394.0**	284.3	99.0	37.7
33.	Tamil Nadu	58.1	7.1	6.3	0.3	3.4	83.1	16.8	47.2	0.5	**222.7**	154.9	71.8	13.7
34.	Pondicherry	103.6	8.3	6.4	0.2	9.3	248.7	40.2	113.9	0.0	**530.6**	367.1	118.4	14.9
35.	Andaman & Nicobar Is.	60.4	1.7	5.1	0.0	3.1	181.1	41.0	216.8	0.0	**509.1**	248.2	67.1	6.7
	All India	**61.5**	**10.7**	**6.5**	**1.0**	**2.4**	**61.3**	**22.5**	**34.1**	**1.2**	**201.2**	**141.0**	**79.7**	**18.2**

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers. All doctors refers to allopathic plus AYUSH doctors. AYUSH doctors include ayurvedic, homeopathic, and unani doctors.

Figure 3.3.1. Allopathic doctors and nurses and midwives: density by state



Health worker densities by education level and medical qualification

Better-off states had more highly educated and medically qualified health workers. Thus, compared to a Pearson correlation coefficient of 0.7571 between state per capita income and state density of all health workers, the cross-state correlation coefficient between per capita income and density of health workers with more than secondary schooling was 0.8975. The cross-state correlation between per capita income and density of health workers with a medical qualification was 0.8989.

The interstate max-min differentials in the density of health workers with any level of education were smaller than those of health workers with more than secondary schooling, which in turn were smaller than those of health workers with a medical qualification (cf. Tables 3.3.1, 3.3.2 and 3.3.3). For all health workers, the differential between states with the highest and lowest density was 6-fold; for all health workers with more than secondary schooling it was 10-fold; and for all health workers with a medical qualification it was 20-fold.

The same was true for specific categories of health workers. For example, for allopathic doctors the differential between states with the highest and lowest density was 10-fold; for allopathic doctors with more than secondary schooling the differential was 11-fold; and for allopathic doctors with a medical qualification it was 17-fold.

It is striking to note the changes in national density of health workers as we consider them by level of education and medical qualification. For all health workers, the national density was 201.2 per lakh population; for the subset with more than secondary schooling, the density fell to 97.8; and for the subset of the latter with a medical qualification it fell to 46.8 (cf. Tables 3.3.1, 3.3.2 and 3.3.3). For allopathic doctors, the corresponding densities were 61.5, 42.2 and 26.2, respectively, and for nurses 61.3, 20.2 and 6.1, respectively. The very sharp decrease in density for nurses as one moves to a higher level of education and medical qualification simply reflects the fact that the proportion of nurses with more than secondary schooling was 32.9% and the proportion of nurses with a medical qualification was 9.9% – see Table 2.1.

Health worker densities by stratum

We can compare interstate differentials in health worker densities in urban and rural areas separately (tables not shown in this study). We find that in general interstate differentials in urban areas are smaller than those in rural areas. The coefficient of variation of density of all health workers across states (counted as units) was 0.3551 in urban areas and 0.5752 in rural areas. The urban density for all health workers in the country was 428.3 per lakh urban population, and across states this ranged from 281 (in Dadra and Nagar Haveli) to 1204 (in Sikkim). The rural density for all health workers nationwide was 113.7 per lakh rural population, and across states this ranged from 70 (in Meghalaya) to 411 (in Andaman and Nicobar Islands). For individual health worker categories, similar findings obtain. For example, the coefficient of variation of the allopathic doctor density in urban areas across states was 0.3480 and in rural areas across states was 0.5809. The coefficient of variation of the nurse density in urban areas across states was 0.4179 and in rural areas across states was 0.7804.

The ratio of urban density to rural density of health workers is shown at the national and state levels in Table 3.3.4. For all health workers in the country, the ratio of urban density to rural density was 428.3/113.7, or 3.8. This ratio was highest in Meghalaya (7.1), and among the lowest in Kerala (1.7). For all health workers, the ratio was greater than unity in every state.

For the categories of allopathic doctors and of nurses, the ratio of urban density to rural density was also greater than 1 in every state (see Table 3.3.4 and Figure 3.3.4).[6] For other health worker categories, the ratio of urban density to rural density was higher than 1 in most states, with a few exceptions in the smaller states (such as Lakshadweep, Daman and Diu, Pondicherry, and Manipur) and among some small health worker categories (such as traditional and faith healers and unani doctors).

6 At the level of district within states, for allopathic doctors the ratio of urban density to rural density was greater than 1 in every district except two: North East *district* in Delhi (with an urban density of 166.0 and a rural density of 192.1) and West district in Sikkim (with an urban density of 0.0 and a rural density of 17.3). (A map is available, upon request from the authors, which disaggregates the state ratios of urban density to rural density, and shows them at the level of district within states.)

Table 3.3.2. Density of health workers with more than secondary schooling, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	60.9	2.5	0.3	2.2	2.4	12.1	11.1	9.2	0.0	100.6	77.9	65.8	5.0
2.	Himachal Pradesh	41.8	22.2	0.9	0.1	3.0	19.4	18.0	15.8	0.0	121.5	84.6	65.1	23.3
3.	Punjab	60.1	12.6	2.1	0.3	2.6	31.3	14.1	11.3	0.2	134.7	106.4	75.1	15.0
4.	Chandigarh	223.2	25.6	7.1	0.4	15.0	129.6	26.9	53.4	2.3	483.5	385.9	256.4	33.2
5.	Uttarakhand	46.3	14.5	2.1	0.4	1.6	16.8	14.0	8.4	0.1	104.2	80.2	63.3	17.0
6.	Haryana	43.9	14.8	1.8	0.2	2.9	17.6	8.3	8.6	0.2	98.2	78.2	60.7	16.7
7.	Delhi	139.4	18.6	6.4	3.8	6.7	56.2	18.4	31.5	0.3	281.2	224.4	168.2	28.9
8.	Rajasthan	27.2	7.8	1.0	0.3	0.7	14.4	9.1	4.1	0.7	65.3	50.6	36.2	9.1
9.	Uttar Pradesh	35.9	6.4	1.8	1.6	0.6	9.3	5.5	5.3	0.3	66.7	55.1	45.7	9.8
10.	Bihar	24.6	2.0	4.2	0.3	0.3	9.3	6.2	6.8	0.0	53.7	40.3	31.0	6.5
11.	Sikkim	40.9	0.4	0.7	0.0	2.0	15.3	1.1	52.3	0.2	113.0	57.3	42.0	1.1
12.	Arunachal Pradesh	25.0	0.3	1.7	0.0	1.5	21.1	9.4	25.6	0.0	84.7	48.2	27.0	2.0
13.	Nagaland	27.9	1.0	0.5	0.0	1.0	22.6	7.9	8.5	0.0	69.4	52.0	29.3	1.5
14.	Manipur	41.7	0.3	2.3	0.0	1.2	35.6	16.8	25.1	0.6	123.7	79.9	44.3	2.6
15.	Mizoram	32.5	0.1	0.7	0.0	2.8	14.9	1.8	59.8	0.6	113.1	48.2	33.3	0.8
16.	Tripura	22.4	1.3	6.5	0.0	0.7	12.2	9.2	11.3	0.7	64.1	42.3	30.2	7.8
17.	Meghalaya	21.1	0.3	0.7	0.0	1.3	11.9	2.9	11.1	0.5	49.8	34.0	22.1	1.0
18.	Assam	21.1	1.3	2.5	0.0	0.4	8.2	5.9	6.7	1.1	47.1	33.0	24.8	3.8
19.	West Bengal	42.4	1.2	14.2	0.1	1.0	21.7	3.9	20.0	0.3	104.7	79.6	57.9	15.5
20.	Jharkhand	24.9	1.3	2.9	0.1	0.4	24.7	5.1	9.8	0.0	69.2	53.8	29.1	4.3
21.	Orissa	21.5	4.0	5.6	0.4	0.3	20.5	6.0	10.0	0.1	68.4	52.0	31.5	10.0
22.	Chhattisgarh	26.3	7.6	1.5	0.1	0.5	15.4	3.5	15.5	1.1	71.4	50.9	35.5	9.2
23.	Madhya Pradesh	36.2	9.7	1.9	0.2	0.7	13.0	6.9	10.9	0.1	79.6	61.0	48.0	11.8
24.	Gujarat	39.8	13.1	4.1	0.1	1.9	17.7	7.3	13.0	1.8	98.7	74.8	57.1	17.3
25.	Daman & Diu	45.5	5.1	3.2	0.6	7.0	32.2	11.4	12.0	0.6	117.6	86.6	54.4	8.8
26.	Dadra & Nagar Haveli	25.4	10.0	0.9	0.0	0.9	21.8	7.7	3.6	0.0	70.3	58.1	36.3	10.9
27.	Maharashtra	64.5	24.5	8.6	1.1	2.8	22.2	5.8	18.7	0.6	148.8	120.9	98.7	34.2
28.	Andhra Pradesh	44.9	3.0	2.2	0.6	1.0	17.7	6.8	19.0	1.2	96.3	68.4	50.7	5.8
29.	Karnataka	56.0	7.8	1.4	0.3	2.2	19.0	3.8	17.9	0.1	108.6	84.6	65.5	9.5
30.	Goa	110.9	6.1	6.5	0.1	12.4	52.0	17.7	23.0	0.0	228.8	175.7	123.7	12.8
31.	Lakshadweep	49.5	8.2	1.6	0.0	11.5	51.1	16.5	49.5	0.0	188.0	110.5	59.4	9.9
32.	Kerala	59.2	12.9	12.1	0.2	5.9	94.8	21.3	31.8	0.9	239.2	179.3	84.4	25.2
33.	Tamil Nadu	43.9	3.7	3.0	0.1	1.8	29.7	7.8	20.1	0.2	110.3	80.4	50.7	6.8
34.	Pondicherry	87.9	5.4	3.9	0.1	7.7	111.9	22.9	52.9	0.0	292.6	209.2	97.3	9.4
35.	Andaman & Nicobar Is.	41.0	0.8	3.7	0.0	2.5	53.9	17.7	43.0	0.0	162.6	99.4	45.5	4.5
	All India	**42.2**	**8.0**	**4.3**	**0.6**	**1.5**	**20.2**	**7.2**	**13.4**	**0.5**	**97.8**	**75.3**	**55.1**	**13.0**

Note: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers.

Table 3.3.3. Density of health workers with a medical qualification, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	48.1	2.2	0.2	1.8	1.3	1.3	1.3	0.6	0.0	**56.7**	53.6	52.4	4.2
2.	Himachal Pradesh	30.2	18.0	0.4	0.1	1.9	4.5	6.5	1.8	0.0	**63.4**	53.2	48.7	18.5
3.	Punjab	40.3	11.3	1.3	0.0	2.1	13.3	6.6	1.8	0.0	**76.6**	66.2	52.9	12.6
4.	Chandigarh	180.4	23.6	5.4	0.0	12.8	64.6	9.7	11.7	1.2	**309.4**	274.1	209.5	29.1
5.	Uttarakhand	20.0	12.3	1.0	0.2	0.5	1.6	3.2	1.1	0.0	**39.8**	35.0	33.4	13.5
6.	Haryana	28.0	12.9	1.0	0.0	2.0	6.2	3.4	1.2	0.0	**54.9**	48.3	42.1	14.0
7.	Delhi	101.5	15.0	4.6	3.2	3.5	23.0	4.3	3.3	0.0	**158.5**	147.3	124.2	22.8
8.	Rajasthan	16.1	3.3	0.5	0.2	0.3	1.7	0.9	0.6	0.0	**23.7**	21.9	20.2	4.0
9.	Uttar Pradesh	11.7	5.2	0.9	1.3	0.2	0.5	0.5	0.6	0.0	**20.9**	19.6	19.1	7.4
10.	Bihar	10.9	1.1	1.6	0.2	0.1	0.2	0.3	1.0	0.0	**15.4**	14.0	13.7	2.9
11.	Sikkim	35.5	0.2	0.2	0.0	2.0	4.3	0.0	7.4	0.2	**49.7**	40.1	35.9	0.4
12.	Arunachal Pradesh	23.6	0.3	1.4	0.0	1.4	3.2	4.6	6.0	0.0	**40.4**	28.4	25.2	1.6
13.	Nagaland	22.6	1.0	0.3	0.0	0.8	5.5	2.7	1.0	0.0	**33.8**	29.3	23.9	1.3
14.	Manipur	33.7	0.1	1.4	0.0	0.9	6.9	3.6	4.6	0.0	**51.1**	42.0	35.2	1.5
15.	Mizoram	27.1	0.1	0.5	0.0	2.3	3.9	1.1	4.8	0.2	**40.1**	31.6	27.7	0.6
16.	Tripura	19.6	0.6	2.2	0.0	0.4	0.5	2.6	2.1	0.0	**27.9**	22.8	22.3	2.8
17.	Meghalaya	18.4	0.2	0.2	0.0	1.0	1.1	0.7	4.6	0.0	**26.2**	19.9	18.8	0.4
18.	Assam	17.7	0.8	1.1	0.0	0.2	1.7	1.5	2.0	0.3	**25.3**	21.3	19.5	1.8
19.	West Bengal	25.5	0.6	6.5	0.0	0.5	1.2	0.7	1.9	0.0	**37.0**	33.9	32.7	7.1
20.	Jharkhand	13.6	0.5	1.1	0.0	0.1	1.3	0.4	1.3	0.0	**18.3**	16.5	15.2	1.6
21.	Orissa	16.3	2.9	3.7	0.2	0.1	2.4	2.9	1.8	0.0	**30.3**	25.4	23.0	6.7
22.	Chhattisgarh	13.0	6.1	0.9	0.0	0.3	2.4	0.4	2.4	0.3	**25.8**	22.3	20.0	7.0
23.	Madhya Pradesh	17.9	7.6	1.1	0.1	0.4	1.6	0.7	1.2	0.0	**30.5**	28.2	26.7	8.7
24.	Gujarat	31.6	10.1	3.1	0.1	1.5	9.3	2.9	2.0	0.3	**60.8**	54.1	44.8	13.2
25.	Daman & Diu	40.5	2.5	2.5	0.6	7.0	19.0	7.0	3.2	0.6	**82.8**	65.1	46.1	5.7
26.	Dadra & Nagar Haveli	20.9	8.2	0.5	0.0	0.9	14.1	3.6	0.9	0.0	**49.0**	43.5	29.5	8.6
27.	Maharashtra	44.8	23.2	7.8	1.0	2.4	6.8	1.5	4.7	0.2	**92.5**	83.7	76.9	32.1
28.	Andhra Pradesh	30.1	2.0	1.8	0.4	0.8	3.6	1.8	2.0	0.2	**42.7**	38.0	34.4	4.3
29.	Karnataka	41.2	6.7	1.2	0.2	1.5	5.9	1.1	3.8	0.0	**61.7**	55.1	49.3	8.1
30.	Goa	96.5	5.2	5.6	0.1	10.8	27.8	8.2	5.0	0.0	**159.2**	135.2	107.4	11.0
31.	Lakshadweep	44.5	8.2	1.6	0.0	6.6	31.3	13.2	13.2	0.0	**118.7**	85.7	54.4	9.9
32.	Kerala	53.8	10.6	10.0	0.1	5.2	75.5	12.9	2.3	0.2	**170.6**	150.0	74.4	20.6
33.	Tamil Nadu	28.4	1.3	1.2	0.0	1.0	7.6	2.5	2.9	0.1	**45.0**	38.5	30.9	2.5
34.	Pondicherry	71.3	3.6	2.3	0.0	6.3	65.5	12.3	4.8	0.0	**166.1**	142.7	77.2	5.9
35.	Andaman & Nicobar Is.	32.3	0.6	3.1	0.0	2.2	41.3	12.6	7.6	0.0	**99.7**	77.2	35.9	3.7
	All India	**26.2**	**6.4**	**2.7**	**0.5**	**1.0**	**6.1**	**1.9**	**2.0**	**0.1**	**46.8**	**41.9**	**35.8**	**9.6**

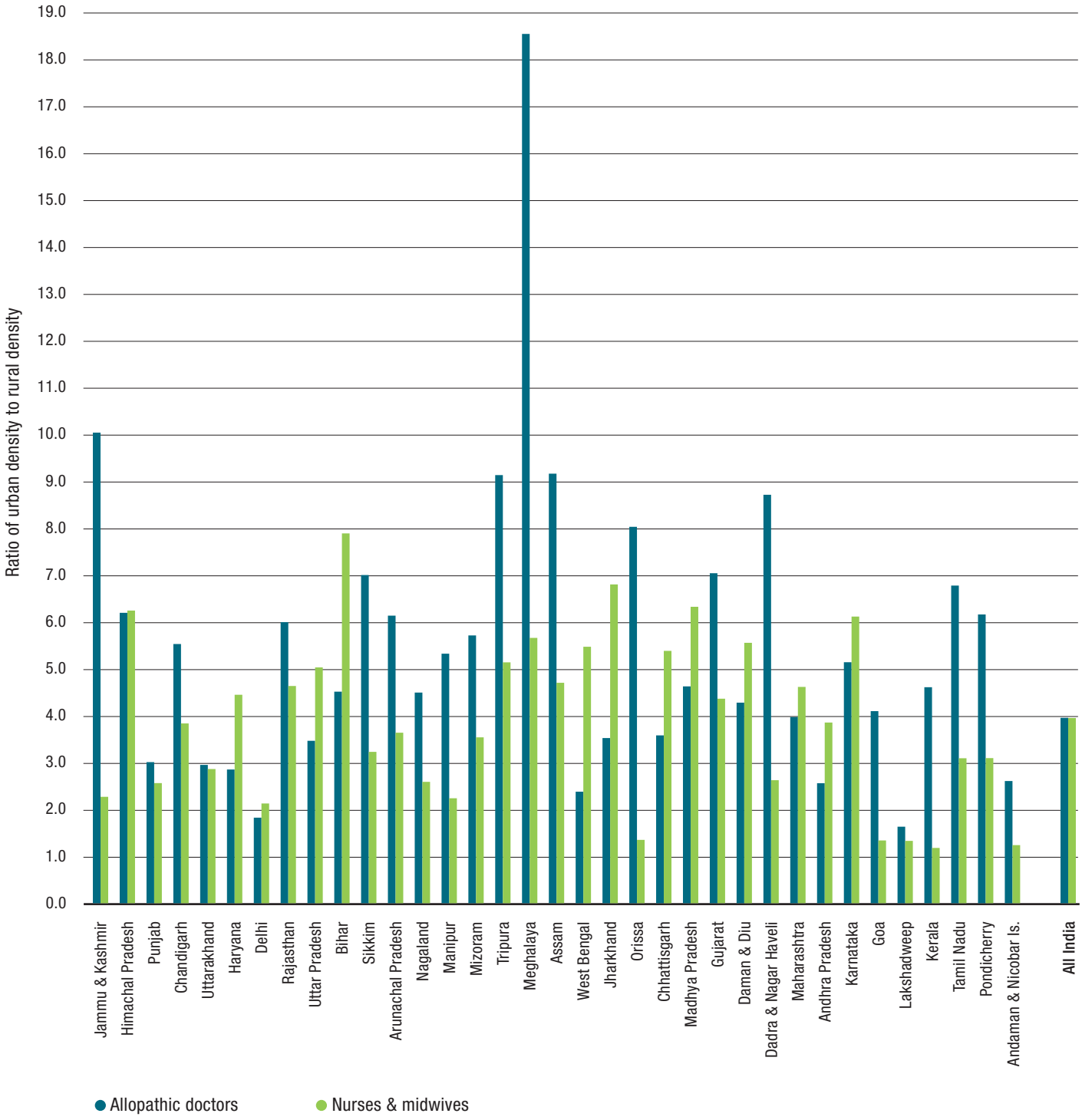
Note: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers.

Table 3.3.4. Ratio of urban density to rural density of health workers, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	10.0	4.6	3.6	2.7	5.4	2.3	1.7	3.0	..	**3.6**	4.9	9.1	3.7
2.	Himachal Pradesh	6.2	3.2	6.0	..	9.1	6.2	2.1	4.0	..	**4.5**	5.6	5.1	3.3
3.	Punjab	3.0	4.9	5.7	3.3	7.8	2.6	2.4	2.8	1.8	**2.9**	3.0	3.3	4.9
4.	Chandigarh	5.5	5.8	8.2	..	3.5	3.8	2.6	1.5	0.2	**3.3**	4.6	5.6	6.3
5.	Uttarakhand	3.0	2.9	4.9	3.7	4.5	2.9	2.3	3.6	..	**2.9**	2.9	3.0	3.2
6.	Haryana	2.9	5.2	5.6	8.1	8.7	4.5	2.5	3.4	4.1	**3.4**	3.5	3.2	5.3
7.	Delhi	1.8	1.4	2.0	10.2	1.8	2.1	0.9	1.3	..	**1.6**	1.9	1.8	1.7
8.	Rajasthan	6.0	3.2	12.0	8.3	7.3	4.6	3.6	4.2	3.1	**4.6**	5.0	5.3	3.7
9.	Uttar Pradesh	3.5	5.1	6.9	8.7	8.5	5.0	4.0	4.6	1.9	**4.1**	4.1	3.8	5.9
10.	Bihar	4.5	5.7	6.1	4.8	15.5	7.9	5.3	6.6	3.4	**5.7**	5.5	4.8	5.9
11.	Sikkim	7.0	4.0	16.1	..	7.1	3.2	2.8	2.7	1.6	**3.2**	4.0	7.1	10.0
12.	Arunachal Pradesh	6.1	6.4	4.2	..	8.7	3.6	2.6	3.1	..	**3.5**	4.1	6.0	4.6
13.	Nagaland	4.5	7.2	8.8	4.8	4.8	2.6	2.6	2.3	..	**2.8**	2.9	4.6	7.6
14.	Manipur	5.3	0.8	2.7	0.0	3.0	2.2	2.2	2.6	0.6	**2.7**	2.9	4.8	1.7
15.	Mizoram	5.7	..	3.6	..	56.8	3.5	2.3	2.2	3.7	**2.6**	4.0	5.7	4.6
16.	Tripura	9.1	2.0	3.0	..	7.3	5.1	4.0	3.6	5.3	**4.6**	5.3	5.5	2.7
17.	Meghalaya	18.6	1.4	6.6	..	11.5	5.7	6.0	8.9	1.6	**7.1**	6.9	13.4	3.0
18.	Assam	9.2	2.7	4.3	1.8	17.0	4.7	4.1	4.3	2.8	**5.0**	5.6	7.0	3.7
19.	West Bengal	2.4	1.2	2.0	1.0	5.6	5.5	3.2	3.6	0.3	**3.2**	3.1	2.2	1.9
20.	Jharkhand	3.5	3.0	5.3	5.1	8.6	6.8	3.1	5.2	2.1	**4.8**	5.0	3.7	4.3
21.	Orissa	8.0	2.2	3.4	2.4	6.6	1.4	4.2	3.2	0.2	**2.5**	2.2	5.3	2.8
22.	Chhattisgarh	3.6	3.3	6.9	4.0	16.5	5.4	4.4	2.3	0.8	**3.6**	4.4	3.6	3.7
23.	Madhya Pradesh	4.6	5.0	12.2	26.1	42.8	6.3	4.3	3.3	0.9	**4.8**	5.4	4.9	5.8
24.	Gujarat	7.0	3.6	5.6	1.7	26.6	4.4	3.7	4.3	3.0	**4.7**	5.1	5.8	3.9
25.	Daman & Diu	4.3	1.5	1.2	0.0	3.5	5.6	2.8	1.4	0.0	**3.1**	4.4	3.4	1.2
26.	Dadra & Nagar Haveli	8.7	2.2	6.7	..	..	2.6	2.6	3.1	..	**3.5**	3.6	5.7	2.5
27.	Maharashtra	4.0	2.4	3.7	13.6	24.8	4.6	3.6	2.9	3.9	**3.8**	4.0	3.5	2.7
28.	Andhra Pradesh	2.6	2.3	5.6	12.5	12.7	3.9	2.7	3.7	0.8	**3.1**	3.1	2.6	3.3
29.	Karnataka	5.1	3.4	3.4	6.0	14.3	6.1	3.7	4.1	0.9	**5.0**	5.3	4.9	3.5
30.	Goa	4.1	2.1	2.5	2.0	3.2	1.3	1.4	1.6	..	**1.9**	1.9	3.8	2.3
31.	Lakshadweep	1.6	0.3	0.0	..	4.4	1.3	0.9	0.9	..	**1.2**	1.3	1.2	0.2
32.	Kerala	4.6	1.6	1.9	1.6	3.4	1.2	1.4	1.6	1.0	**1.7**	1.7	3.1	1.7
33.	Tamil Nadu	6.8	3.1	1.7	5.7	6.3	3.1	3.8	3.3	2.3	**3.8**	3.9	5.3	2.4
34.	Pondicherry	6.2	6.3	3.4	0.5	8.6	3.1	2.2	2.3	..	**3.2**	3.7	5.9	4.4
35.	Andaman & Nicobar Is.	2.6	4.1	1.7	..	3.6	1.2	1.5	2.1	..	**1.7**	1.5	2.5	2.1
	All India	**4.0**	**3.5**	**3.1**	**5.4**	**9.9**	**4.0**	**3.2**	**3.6**	**1.5**	**3.8**	**3.9**	**3.8**	**3.4**

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers. The notation '..' in a cell refers to the situation in which the rural density is zero.

Figure 3.3.4. Allopathic doctors and nurses and midwives: ratio of urban density to rural density, by state



Despite the ratio of urban density to rural density being greater than 1 in every state, this ratio was smaller for nurses than for allopathic doctors in the majority of states – in 22 out of 35 states (see Table 3.3.4). For example, in Orissa, the ratio of urban density to rural density for nurses was 1.4 and for allopathic doctors 8.0; and in Jammu and Kashmir the ratio of urban density to rural density for nurses was 2.3 and for allopathic doctors 10.0.

In general, states with a high density of health workers in a health worker category had a low ratio of urban density to rural density for that category. For example, for allopathic doctors the negative correlation across states between density and ratio of urban density to rural density was –0.3274, for nurses this correlation was –0.5934, and for pharmacists –0.6537.

Health worker densities by education and stratum

Urban–rural differentials in density are intensified when we consider health workers with more than secondary schooling, and further those with a medical qualification. Nationally we find that the ratio of urban density to rural density for all health workers was 3.8 (see Table 3.3.4), compared to 5.4 for those with more than secondary schooling, and to 7.5 for those with a medical qualification (tables not shown in this study). For every state, the ratio of urban density to rural density was smaller for all health workers (with any level of education) than for those with more than secondary schooling, which in turn was smaller than for those with a medical qualification.

For allopathic doctors, the same pattern obtained as for all health workers but was numerically even sharper (tables not shown in this study). Thus, the national ratio of urban density to rural density for all allopathic doctors was 4.0, for those with more than secondary schooling it was 7.2, and for those with a medical qualification it was 12.3. For allopathic doctors this pattern held in every state.

For pharmacists and ancillary health professionals, similar patterns in urban–rural differentials in density are observed with a few exceptions. For nurses, however, the situation is somewhat different. Nationally, the ratio of urban density to rural density for all nurses was 4.0 and for those with more than secondary schooling was also 4.0. For those with a medical qualification, this ratio was smaller at 3.4 (tables not shown in this study).

Health worker densities by gender

In this study, we define the male (female) health worker density as the number of male (female) health workers per lakh persons (both male *and* female) in a given population. In disaggregating density of health workers by gender, we find that the interstate max-min differential of female health worker density was larger than that of male health worker density (tables not shown in this study). For example, the differential between states with the highest and lowest female health worker densities was 14-fold (Chandigarh 337.8 compared to Bihar 24.6), whereas the differential between states of male health worker densities was 6 fold (Chandigarh 346.0 compared to Meghalaya 54.7). Similar findings are observed for individual health worker categories.

3.4 Health worker distribution by gender, education and stratum

In this section we discuss interstate differences in the distribution of health workers by gender, by secondary schooling and medical qualification, and by urban–rural stratum.

Health worker distribution by gender

The percentage of all health workers who were female in the country was 38.0%, but there was great variation across states (see Table 3.4.1). In general, northern states had a lower-than-average share of female health workers. Nine states in the country, including several in the east, had a female share of health workers greater than 50%. The states with the highest share of female health workers were Kerala (64.5%) and Meghalaya (64.2%), and the states with the lowest were Uttar Pradesh (19.9%) and Bihar (22.3%).

Nationally, only 16.8% of allopathic doctors were female, and this percentage ranged across states from 6.5% in Bihar to 42.8% in Meghalaya (see Figure 3.4.1).[7]

Nationally, 23.6% of dental practitioners were female, which ranged from 2.6% in Jharkhand to 60.5% in Meghalaya. Apart from Meghalaya, two other states had a female share of dental practitioners greater than 50%: Goa with 60.4% and Andaman and Nicobar Islands with 54.5%.

Health worker distribution by education

Secondary schooling

Better-off states have been shown to have a higher density of health workers and also a higher density of better-educated workers (the interstate correlation coefficients are noted in section 3.3). However, states with a high density of health workers were not necessarily states with a higher share of more highly educated workers. For all health workers, the Pearson correlation coefficient between worker density and percentage with more than secondary schooling was 0.0634. For allopathic doctors this correlation was 0.0997, and for nurses it was 0.0907.

As seen in the national profile (section 2), 48.6% of all health workers in the country were educated to more than secondary school level; in other words, 51.4% of all health workers were educated to secondary school level or *less* (see Table 3.4.2). The states with the highest proportion of health workers with more than secondary schooling were Chandigarh (70.7%), Kerala (60.7%), Delhi (58.4%) and Gujarat (56.5%). States with the lowest proportions were Mizoram (19.2%), Sikkim (24.3%), Nagaland (25.4%), Arunachal Pradesh (31.3%) and Assam (31.7%).

Among allopathic doctors, 68.6% had more than secondary schooling (Table 3.4.2). Across states this percentage was less than 60% in Haryana (52.4%), Punjab (53.9%), Uttar Pradesh (56.6%), Andhra Pradesh (58.3%), Bihar (58.5%) and West Bengal (59.4%) (see Table 3.4.2 and Figure 3.4.2). The percentage of allopathic doctors with more than secondary schooling was higher than 80% in 17 states, including five north-eastern states.

Nationally, a greater fraction of ayurvedic doctors than allopathic doctors had more than secondary schooling: 74.8% compared to 68.6% (Table 3.4.2). However, in some eastern states less than 50% of ayurvedic doctors had more than secondary schooling: Meghalaya, Manipur, Tripura, West Bengal, Assam and Arunachal Pradesh.

Homeopathic and unani doctors were slightly less well educated than allopathic doctors. Compared to 68.6% of allopathic doctors with more than secondary schooling, 66.9% of homeopathic doctors and 60.9% of unani doctors had more than secondary schooling. In 31 states the majority of homeopathic doctors had more than secondary schooling, and in 21 states the majority of unani doctors had more than secondary schooling. By contrast, in every state the majority of allopathic doctors had more than secondary schooling.

7 At the level of district within states, a map is available upon request from the authors, which illustrates the geographical differences in female share of allopathic doctors.

Table 3.4.1. Percentage of health workers who are female, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	23.6	12.9	12.1	5.6	14.4	65.0	7.8	17.4	0.0	**28.9**	40.0	22.5	10.0
2.	Himachal Pradesh	17.0	10.9	4.4	0.0	17.6	93.0	9.3	34.5	0.0	**37.9**	49.2	14.9	10.6
3.	Punjab	15.5	16.1	23.1	2.4	21.9	89.6	15.0	23.8	3.2	**34.3**	39.6	15.6	16.1
4.	Chandigarh	32.2	29.7	37.0	12.5	36.0	81.5	42.1	24.2	10.0	**49.4**	55.2	32.0	30.9
5.	Uttarakhand	11.1	7.0	12.5	0.0	4.7	69.1	2.7	28.0	0.0	**26.4**	32.3	10.2	7.3
6.	Haryana	13.3	15.0	17.1	4.7	18.6	90.9	6.8	17.2	2.5	**27.5**	33.9	13.7	15.1
7.	Delhi	29.7	18.6	40.7	15.6	17.8	83.2	9.1	18.2	6.5	**41.2**	51.9	28.4	22.7
8.	Rajasthan	14.0	4.5	11.8	7.6	6.9	69.9	2.1	13.8	20.2	**30.0**	39.1	11.8	5.3
9.	Uttar Pradesh	7.6	5.4	6.4	4.0	6.4	70.9	3.3	26.7	6.4	**19.9**	22.4	7.2	5.3
10.	Bihar	6.5	4.4	3.1	4.4	5.6	91.0	1.2	14.3	0.0	**22.3**	30.1	5.9	3.5
11.	Sikkim	41.4	0.0	0.0	..	17.6	89.7	23.4	32.5	50.0	**50.4**	77.2	39.9	0.0
12.	Arunachal Pradesh	27.3	0.0	13.0	..	13.0	73.5	6.3	20.6	0.0	**41.5**	62.7	25.8	9.7
13.	Nagaland	18.8	16.0	0.0	0.0	29.2	88.2	19.4	28.8	..	**57.0**	74.2	18.2	9.1
14.	Manipur	28.2	0.0	42.0	0.0	42.9	88.7	16.5	37.9	29.2	**53.7**	68.1	28.1	27.6
15.	Mizoram	32.4	0.0	11.1	100.0	35.1	93.2	19.8	45.2	35.7	**53.2**	76.1	32.0	18.2
16.	Tripura	8.9	9.4	3.5	..	12.0	82.5	6.4	38.6	4.8	**36.2**	42.6	7.2	4.7
17.	Meghalaya	42.8	10.6	0.0	..	60.5	92.4	16.9	35.7	33.3	**64.2**	78.4	37.8	5.8
18.	Assam	15.9	4.7	5.2	7.0	13.1	87.3	2.8	17.7	6.3	**40.0**	56.0	12.6	5.1
19.	West Bengal	8.8	4.0	7.4	0.7	6.4	87.0	6.3	36.9	5.1	**35.4**	37.9	8.2	6.8
20.	Jharkhand	10.8	6.5	7.5	2.7	2.6	88.4	2.8	13.5	0.0	**38.4**	51.6	10.2	7.0
21.	Orissa	15.6	7.2	8.7	2.7	6.1	90.5	2.9	24.5	15.5	**55.4**	67.3	12.3	7.6
22.	Chhattisgarh	12.0	7.3	15.1	10.0	13.1	81.0	7.3	16.3	8.2	**33.4**	44.8	11.2	8.6
23.	Madhya Pradesh	13.6	6.6	15.7	5.8	11.6	82.4	4.9	18.5	1.5	**31.5**	40.7	12.3	7.9
24.	Gujarat	19.1	16.5	20.6	2.0	33.5	87.4	8.7	22.7	13.9	**37.2**	48.9	18.5	17.4
25.	Daman & Diu	15.2	18.2	0.0	100.0	8.3	86.0	13.6	16.3	0.0	**39.9**	56.0	15.6	17.6
26.	Dadra & Nagar Haveli	23.0	32.0	0.0	..	50.0	93.4	7.7	27.6	..	**52.5**	64.3	24.7	28.6
27.	Maharashtra	26.2	25.1	37.6	22.0	39.5	79.3	19.1	24.3	22.8	**44.4**	51.6	26.8	28.1
28.	Andhra Pradesh	14.3	10.3	22.7	19.1	24.6	80.5	8.7	21.9	6.7	**32.4**	40.3	14.4	14.6
29.	Karnataka	23.3	20.5	22.1	16.6	35.1	84.4	9.5	33.2	17.1	**43.1**	49.3	22.9	20.6
30.	Goa	32.9	41.7	43.2	33.3	60.4	89.0	34.0	35.2	50.0	**59.7**	67.2	33.9	42.3
31.	Lakshadweep	13.3	0.0	100.0	..	22.2	83.2	10.5	22.1	0.0	**44.3**	64.1	13.9	16.7
32.	Kerala	34.1	24.3	40.6	6.8	36.6	92.5	42.4	52.2	7.4	**64.5**	71.7	32.8	30.7
33.	Tamil Nadu	32.9	18.1	13.4	13.5	26.7	83.1	19.4	29.1	24.0	**48.7**	58.3	29.6	15.8
34.	Pondicherry	27.9	24.7	17.7	0.0	49.5	82.7	16.1	26.7	..	**52.6**	64.8	27.1	21.4
35.	Andaman & Nicobar Is.	36.7	33.3	22.2	..	54.5	87.8	22.6	27.1	..	**49.6**	73.6	35.6	25.0
	All India	**16.8**	**14.7**	**16.0**	**8.3**	**23.6**	**83.4**	**9.9**	**27.3**	**10.3**	**38.0**	**45.5**	**16.4**	**14.8**

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers. The notation '..' in a cell refers to the situation in which there are no health workers of that category in the state.

Figure 3.4.1. Allopathic doctors and nurses and midwives: percentage who are female, by state

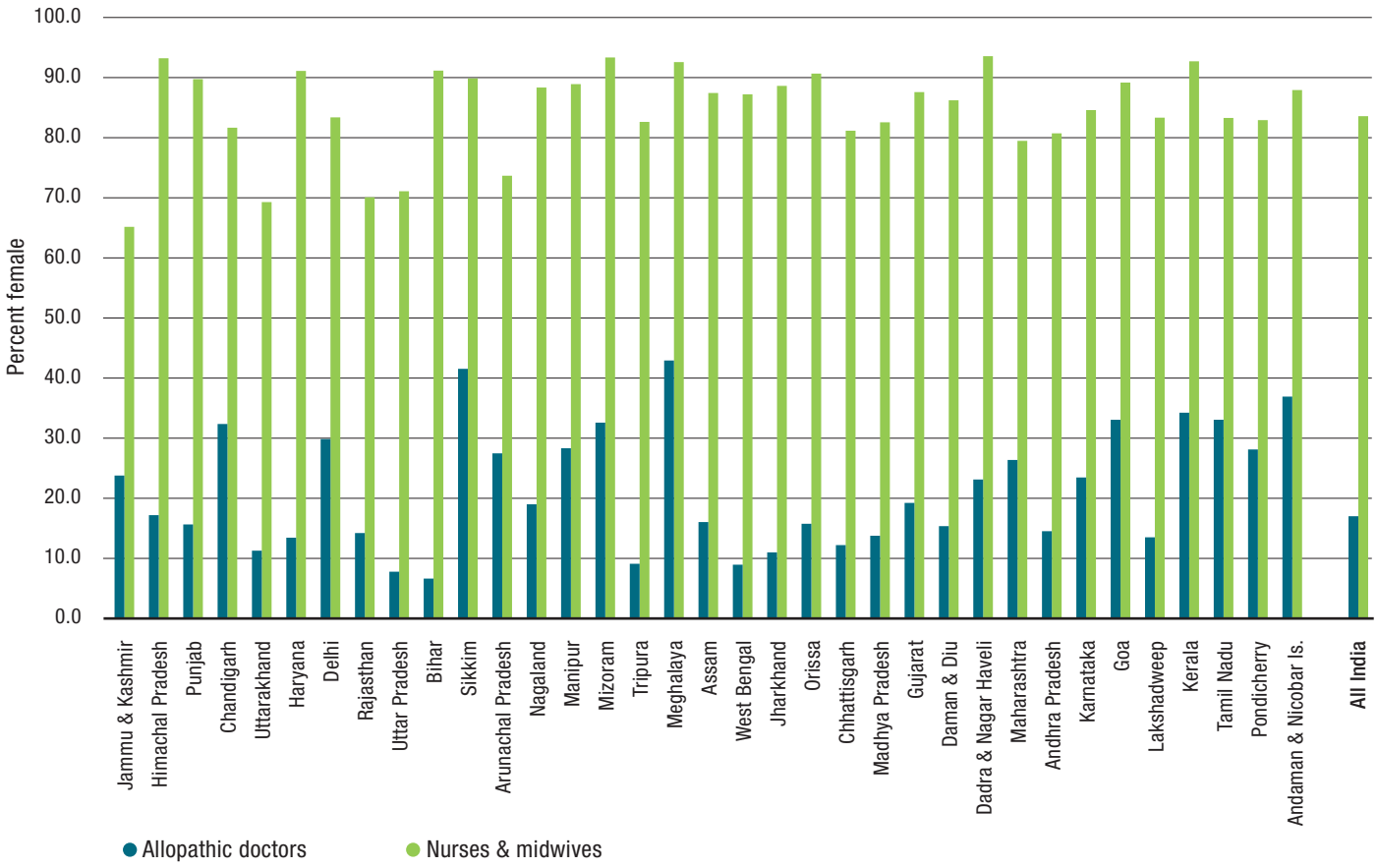
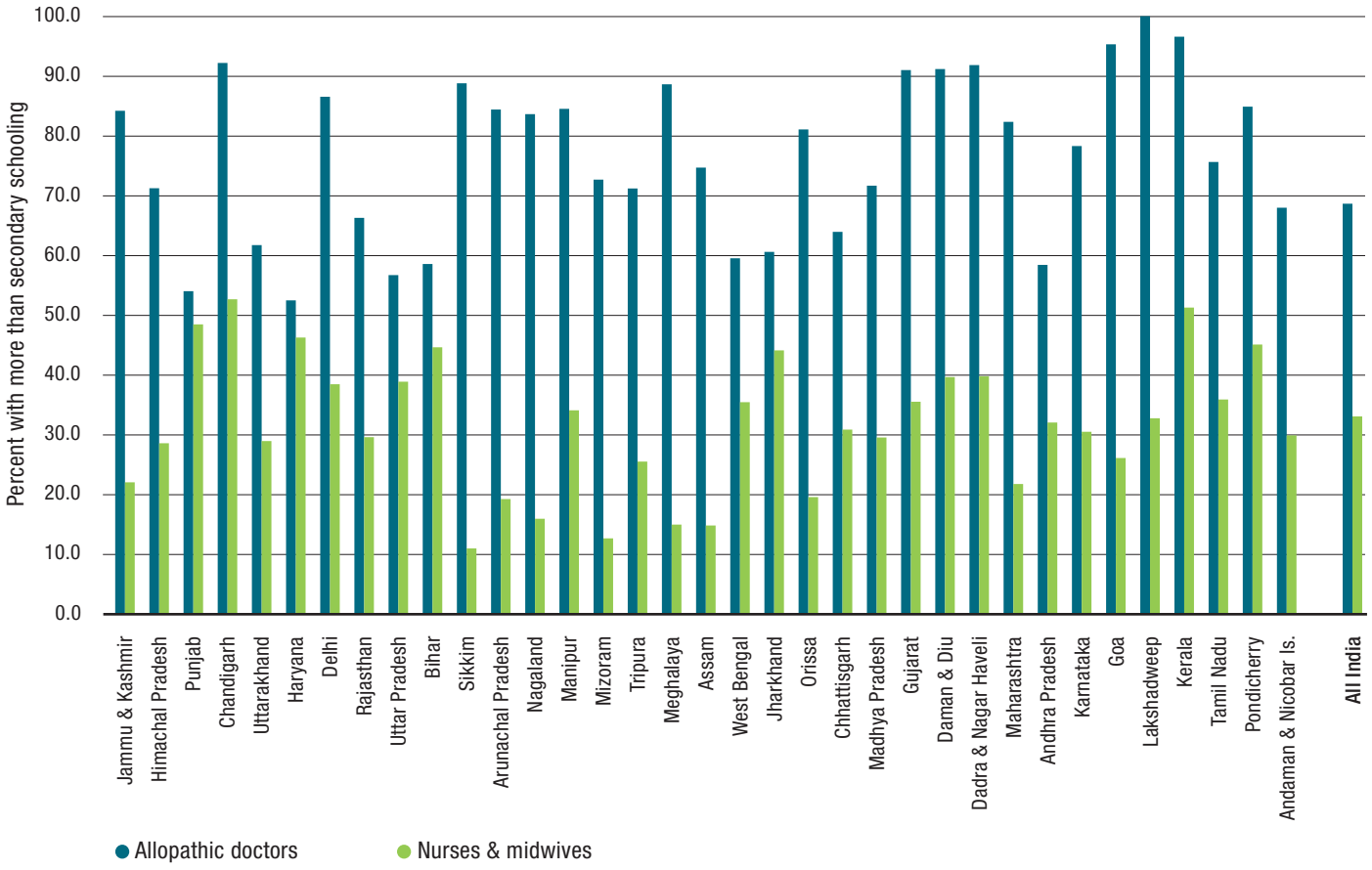


Table 3.4.2. Percentage of health workers with more than secondary schooling, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	84.1	67.9	78.8	83.1	64.3	21.9	22.3	28.2	66.7	**45.7**	58.0	83.3	74.4
2.	Himachal Pradesh	71.2	82.1	60.4	100.0	57.5	28.4	34.3	34.9	0.0	**46.9**	54.3	74.4	81.1
3.	Punjab	53.9	67.8	70.0	18.1	57.9	48.4	42.3	33.9	32.4	**49.6**	53.4	55.8	64.7
4.	Chandigarh	92.2	89.2	87.7	50.0	71.4	52.6	66.7	57.6	70.0	**70.7**	73.3	91.6	87.9
5.	Uttarakhand	61.6	78.8	69.6	33.0	52.0	28.8	37.7	42.3	100.0	**48.2**	51.3	64.8	75.1
6.	Haryana	52.4	72.5	67.3	38.4	61.2	46.2	27.8	35.0	61.3	**48.0**	53.8	56.5	71.4
7.	Delhi	86.5	81.9	88.8	75.4	51.8	38.3	37.6	41.2	61.3	**58.4**	65.5	85.8	82.4
8.	Rajasthan	66.2	63.7	72.8	56.1	35.6	29.5	35.6	38.0	55.1	**45.4**	48.7	65.7	64.2
9.	Uttar Pradesh	56.6	76.6	70.2	69.9	40.7	38.8	29.4	40.4	45.2	**49.6**	54.7	59.6	74.2
10.	Bihar	58.5	66.6	59.3	50.2	59.6	44.5	30.5	43.6	100.0	**48.8**	54.9	59.0	60.9
11.	Sikkim	88.8	66.7	66.7	..	64.7	10.8	12.8	19.9	16.7	**24.3**	30.2	88.0	66.7
12.	Arunachal Pradesh	84.4	37.5	82.6	..	73.9	19.1	37.9	25.5	0.0	**31.3**	33.7	83.2	71.0
13.	Nagaland	83.6	80.0	52.9	0.0	83.3	15.8	16.9	18.5	..	**25.4**	29.1	82.5	65.9
14.	Manipur	84.5	26.9	72.5	0.0	64.3	34.0	49.6	40.1	58.3	**47.8**	50.2	81.8	54.3
15.	Mizoram	72.6	100.0	66.7	0.0	43.9	12.5	15.1	14.8	35.7	**19.2**	29.2	72.4	63.6
16.	Tripura	71.1	27.5	36.3	..	44.0	25.4	39.0	21.6	50.0	**35.5**	41.5	55.8	34.4
17.	Meghalaya	88.6	14.9	43.6	..	78.9	14.8	20.2	38.9	57.1	**32.6**	31.6	80.4	27.9
18.	Assam	74.6	35.0	30.2	10.5	60.8	14.7	25.2	26.8	33.8	**31.7**	34.3	61.7	31.3
19.	West Bengal	59.4	28.3	56.1	20.0	58.3	35.3	25.9	31.7	23.3	**43.0**	48.9	57.1	51.5
20.	Jharkhand	60.5	43.0	52.0	23.0	37.8	44.0	27.0	35.7	12.5	**45.0**	50.7	58.3	48.0
21.	Orissa	81.0	52.8	62.2	27.5	41.3	19.4	50.4	27.8	36.4	**34.4**	34.6	70.7	55.5
22.	Chhattisgarh	63.9	73.9	73.5	32.5	46.6	30.7	27.8	34.3	37.7	**43.2**	49.0	66.0	73.2
23.	Madhya Pradesh	71.6	80.8	86.4	59.6	65.4	29.4	30.5	36.7	25.8	**48.8**	55.8	73.7	81.1
24.	Gujarat	91.0	88.6	87.1	48.0	85.8	35.4	23.7	52.2	51.8	**56.5**	65.9	90.0	87.9
25.	Daman & Diu	91.1	72.7	100.0	100.0	91.7	39.5	40.9	22.1	100.0	**50.5**	60.9	89.6	82.4
26.	Dadra & Nagar Haveli	91.8	88.0	66.7	..	100.0	39.7	43.6	27.6	..	**55.4**	61.0	89.9	85.7
27.	Maharashtra	82.3	93.6	95.0	88.1	79.5	21.6	22.3	42.5	61.5	**50.9**	55.5	85.9	93.8
28.	Andhra Pradesh	58.3	52.8	87.2	65.8	76.8	31.9	28.3	45.5	28.0	**45.3**	48.3	58.9	63.5
29.	Karnataka	78.2	81.7	78.3	67.2	58.3	30.4	30.1	41.3	32.2	**52.7**	57.9	78.6	80.6
30.	Goa	95.3	85.4	92.6	66.7	82.7	26.0	43.5	38.5	0.0	**51.2**	53.1	94.6	88.7
31.	Lakshadweep	100.0	100.0	100.0	..	77.8	32.6	52.6	39.0	0.0	**48.1**	51.1	100.0	100.0
32.	Kerala	96.6	60.3	78.0	26.5	83.4	51.2	58.3	51.9	18.6	**60.7**	63.1	85.3	66.9
33.	Tamil Nadu	75.6	51.9	48.1	35.2	52.5	35.8	46.4	42.6	40.3	**49.5**	51.9	70.7	49.7
34.	Pondicherry	84.8	65.4	61.3	50.0	82.4	45.0	56.9	46.4	..	**55.1**	57.0	82.1	63.4
35.	Andaman & Nicobar Is.	67.9	50.0	72.2	..	81.8	29.8	43.2	19.8	..	**31.9**	40.0	67.8	66.7
	All India	**68.6**	**74.8**	**66.9**	**60.9**	**62.1**	**32.9**	**31.8**	**39.2**	**37.2**	**48.6**	**53.4**	**69.2**	**71.2**

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers. The notation '..' in a cell refers to the situation in which there are no health workers of that category in the state.

Figure 3.4.2. Allopathic doctors and nurses and midwives: percentage with more than secondary schooling, by state



Not unexpectedly, nurses were less well educated than doctors, nationally and in every state. Only 32.9% of all nurses had more than secondary schooling. The situation was worse in Orissa and in six north-eastern states, where less than 20% of nurses had more than secondary schooling. (As indicated above, this contrasts with the better education of allopathic doctors in some north-eastern states.) States where a high proportion of nurses had more than secondary schooling included Punjab and Haryana – which happen to be states with the lowest proportions of allopathic doctors with more than secondary schooling. In Kerala and Chandigarh, both allopathic doctors and nurses were relatively well educated – these two states being among the top three in terms of proportion with more than secondary schooling for allopathic doctors and nurses.

Medical qualification

Less than a quarter (23.3%) of the national health workforce had a medical qualification (Table 3.4.3). In some states, including several in the east, the percentage of all health workers with a medical qualification was very low: Mizoram (6.8%), Sikkim (10.7%), Jharkhand (11.9%), Nagaland (12.4%) and Bihar (14.0%). The percentage with a medical qualification was highest in Chandigarh (45.3%), followed by Kerala (43.3%), Dadra and Nagar Haveli (38.6%) and Goa (35.6%).

Only 45.0% of all doctors in the nation had a medical qualification (Table 3.4.3). This percentage was as low as 24.9% (in Uttar Pradesh) and 26.1% (in Bihar). This percentage was high in most north-eastern states, and was high in the major western and southern states – Gujarat (70.7%), Maharashtra (67.0%), Kerala (75.1%) – with the exception of Tamil Nadu with 43.1% (see Table 3.4.3).

Among allopathic doctors, the percentage with a medical qualification nationally was 42.7%. This percentage was lowest in Uttar Pradesh (18.4%), Bihar (25.9%) and Uttarakhand (26.5%) (Table 3.4.3 and Figure 3.4.3). In 12 states, including six northern states, the majority of allopathic doctors did *not* have a medical qualification.

Among AYUSH doctors, the percentage with a medical qualification nationally was 52.8%. This percentage varied from 10.5% (in Meghalaya) to 88.1% (in Maharashtra) – excluding the union territories.

Among dental practitioners, the percentage with a medical qualification nationally was 42.3%, similar to that among allopathic doctors. In 21 states, the majority of dental practitioners did *not* have a medical qualification.

The proportion of nurses with a medical qualification was 9.9% nationally, and this percentage ranged across states from 1.0% in Tripura to 40.8% in Kerala. Although Bihar was the state with the second lowest percentage of nurses with a medical qualification (1.2%), as many as 44.5% of nurses in that state had more than secondary schooling (the sixth highest in the nation).

Health worker distribution by education and stratum

As expected, the proportion of health workers with more than secondary schooling was higher in urban than in rural areas. For all health workers nationally, the percentage with more than secondary schooling in urban areas was 55.4% and in rural areas 38.7% (see Table 2.5). In each state a higher proportion of urban workers than rural workers had more than secondary schooling (corresponding state tables are not shown in this study).

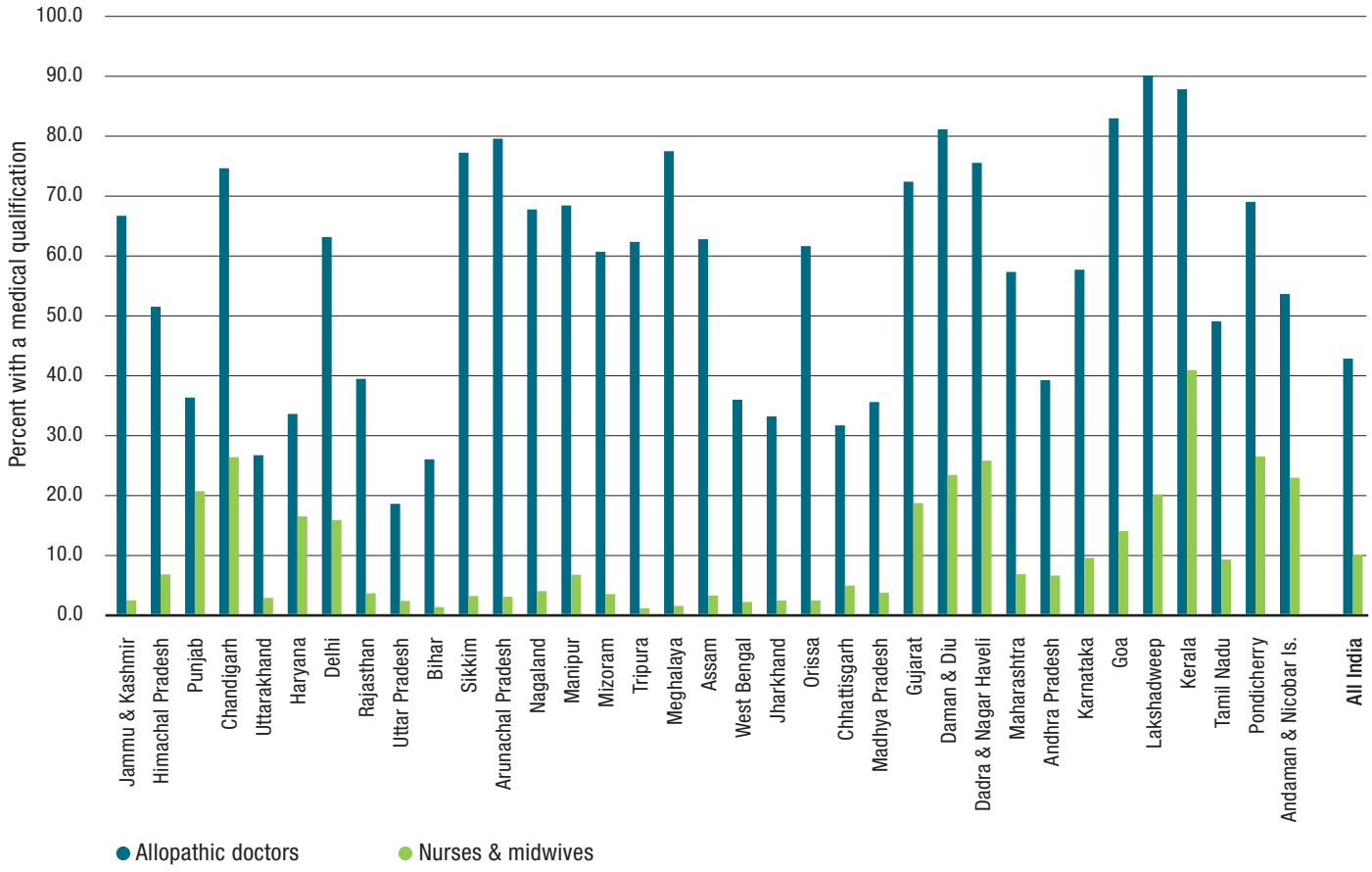
These urban–rural patterns in secondary schooling were similar for allopathic doctors. For allopathic doctors, the proportion with more than secondary schooling was 83.4% in urban areas and 45.9% in rural areas. The proportion of allopathic doctors with more than secondary schooling was higher in urban than in rural areas in every state (statewise tables are not shown in this study). Nationally, the urban–rural differential in education (expressed as the ratio of percentage with more than secondary schooling in urban areas divided by percentage with more than secondary schooling in rural areas) was large for allopathic doctors, and larger for allopathic doctors than for any other health worker category. The situation for nurses was somewhat different. As seen in Table 2.5, nationally the percentage of nurses with more than secondary schooling in rural areas was slightly higher than in urban areas (33.3% compared to 32.7%).

Table 3.4.3. Percentage of health workers with a medical qualification, by state

NO.	STATE OR UT	ALLOPATHIC DOCTORS	AYURVEDIC DOCTORS	HOMEO. DOCTORS	UNANI DOCTORS	DENTAL PRACT.	NURSES & MIDWIVES	PHARMA.	ANCILL. HEALTH	TRAD'L & FAITH HEAL.	ALL HEALTH WORKERS	ALL DOCTORS & NURSES	ALL DOCTORS	AYUSH DOCTORS
1.	Jammu & Kashmir	66.6	58.9	60.6	69.5	34.9	2.3	2.5	1.7	0.0	**25.7**	39.9	66.3	63.2
2.	Himachal Pradesh	51.4	66.4	29.7	50.0	37.1	6.6	12.3	3.9	0.0	**24.5**	34.1	55.7	64.4
3.	Punjab	36.2	60.3	43.3	1.1	45.8	20.5	19.8	5.3	4.3	**28.2**	33.2	39.3	54.2
4.	Chandigarh	74.5	82.2	67.1	0.0	60.8	26.2	24.0	12.6	36.7	**45.3**	52.1	74.9	77.1
5.	Uttarakhand	26.5	67.0	31.9	14.6	17.2	2.7	8.8	5.3	0.0	**18.4**	22.4	34.2	59.5
6.	Haryana	33.4	63.3	40.1	8.1	43.3	16.3	11.3	4.8	0.0	**26.8**	33.2	39.2	59.8
7.	Delhi	63.0	66.0	63.5	62.3	27.0	15.7	8.8	4.4	9.7	**32.9**	43.0	63.3	64.9
8.	Rajasthan	39.3	27.0	40.3	37.2	12.8	3.5	3.3	6.0	2.7	**16.5**	21.0	36.6	28.6
9.	Uttar Pradesh	18.4	62.2	35.2	56.0	12.3	2.2	2.7	4.4	7.3	**15.5**	19.4	24.9	55.9
10.	Bihar	25.9	38.1	22.4	27.3	24.2	1.2	1.4	6.3	0.0	**14.0**	19.0	26.1	27.1
11.	Sikkim	77.1	33.3	16.7	..	64.7	3.0	0.0	2.8	16.7	**10.7**	21.2	75.2	22.2
12.	Arunachal Pradesh	79.4	37.5	65.2	..	65.2	2.9	18.7	6.0	0.0	**15.0**	19.8	77.6	58.1
13.	Nagaland	67.6	80.0	35.3	0.0	66.7	3.8	5.7	2.2	..	**12.4**	16.4	67.1	59.1
14.	Manipur	68.3	7.7	43.5	0.0	47.6	6.6	10.7	7.3	0.0	**19.8**	26.4	64.9	30.5
15.	Mizoram	60.6	100.0	44.4	0.0	35.1	3.3	9.4	1.2	14.3	**6.8**	19.2	60.1	45.5
16.	Tripura	62.2	12.1	12.3	..	28.0	1.0	10.9	3.9	0.0	**15.4**	22.4	41.4	12.2
17.	Meghalaya	77.4	10.6	10.3	..	60.5	1.3	5.1	16.0	0.0	**17.1**	18.5	68.3	10.5
18.	Assam	62.7	21.4	13.0	0.0	35.8	3.1	6.6	8.0	9.2	**17.0**	22.1	48.5	15.2
19.	West Bengal	35.8	14.1	25.8	3.2	32.7	2.0	4.5	3.0	2.6	**15.2**	20.8	32.2	23.7
20.	Jharkhand	33.0	16.4	19.9	8.1	9.0	2.3	2.2	4.6	0.0	**11.9**	15.5	30.4	18.3
21.	Orissa	61.5	37.8	41.1	10.7	17.1	2.3	24.6	5.0	7.8	**15.2**	16.9	51.7	37.3
22.	Chhattisgarh	31.5	59.3	41.6	10.0	30.6	4.8	3.2	5.4	9.8	**15.6**	21.5	37.1	55.5
23.	Madhya Pradesh	35.4	63.0	48.0	35.6	39.6	3.6	2.9	4.0	0.0	**18.7**	25.8	40.9	60.1
24.	Gujarat	72.3	68.0	65.8	29.0	67.8	18.5	9.3	8.1	9.9	**34.8**	47.7	70.7	67.1
25.	Daman & Diu	81.0	36.4	80.0	100.0	91.7	23.3	25.0	5.8	100.0	**35.6**	45.8	76.0	52.9
26.	Dadra & Nagar Haveli	75.4	72.0	33.3	..	100.0	25.6	20.5	6.9	..	**38.6**	45.7	73.0	67.9
27.	Maharashtra	57.2	88.8	86.6	83.4	66.1	6.6	5.9	10.8	18.3	**31.7**	38.5	67.0	88.1
28.	Andhra Pradesh	39.1	35.3	73.7	48.2	60.3	6.4	7.4	4.8	4.0	**20.1**	26.8	40.0	47.2
29.	Karnataka	57.6	70.1	65.9	41.1	40.2	9.4	8.9	8.8	17.1	**29.9**	37.8	59.1	68.2
30.	Goa	82.9	72.9	80.0	66.7	72.3	13.9	20.0	8.3	0.0	**35.6**	40.8	82.1	76.3
31.	Lakshadweep	90.0	100.0	100.0	..	44.4	20.0	42.1	10.4	0.0	**30.4**	39.7	91.7	100.0
32.	Kerala	87.7	49.3	64.3	8.5	73.7	40.8	35.3	3.8	5.1	**43.3**	52.7	75.1	54.7
33.	Tamil Nadu	48.9	18.4	18.4	11.4	28.9	9.1	15.0	6.2	15.6	**20.2**	24.9	43.1	18.2
34.	Pondicherry	68.9	43.2	35.5	0.0	67.0	26.3	30.6	4.2	..	**31.3**	38.9	65.2	39.3
35.	Andaman & Nicobar Is.	53.5	33.3	61.1	..	72.7	22.8	30.8	3.5	..	**19.6**	31.1	53.6	54.2
	All India	**42.7**	**60.1**	**41.8**	**45.8**	**42.3**	**9.9**	**8.3**	**5.8**	**7.2**	**23.3**	**29.7**	**45.0**	**52.8**

Notes: Homeo. refers to homeopathic; Dental pract. refers to dental practitioners; Pharma. refers to pharmacists; Ancill. health refers to ancillary health professionals; Trad'l & faith heal. refers to traditional practitioners & faith healers. The notation '..' in a cell refers to the situation in which there are no health workers of that category in the state.

Figure 3.4.3. Allopathic doctors and nurses and midwives: percentage with a medical qualification, by state



We next examine urban–rural differentials in health workers with a medical qualification. For all health workers in the country, the percentage of workers in urban areas with a medical qualification was 29.2% and in rural areas half that at 14.6% (see Table 2.5). In every state a higher proportion of urban workers than rural workers had a medical qualification (statewise tables are not shown in this study).

The findings for allopathic doctors are similar. For allopathic doctors in the country, the proportion with a medical qualification in urban areas was 58.4% and in rural areas 18.8%. This urban–rural differential obtained in almost every state (statewise tables are not shown in this study).[8] For nurses at the national level, the percentage with a medical qualification in urban areas was 9.3% and in rural areas 10.8%.

Health worker distribution by education and gender

At the national level we observed that for every health worker category except ancillary health professionals, the percentage with more than secondary schooling was higher for females than for males (see Table 2.5). At the state level this educational difference between females and males obtained for most states and most health worker categories (statewise tables are not shown in this study).

At the national level, we also found that the percentage with a medical qualification was higher among females than among males for *every* health worker category (Table 2.5). At the state level, this finding also obtained for most states and health worker categories.

3.5 Interdistrict differentials within states

We have compared states in terms of per capita availability of health workers, i.e. through the density of health workers in a state. However, each state consists of a number of districts, which will have different densities of health workers. We have health worker information from the census for all 593 districts in the country. Thus, within each state we can measure interdistrict inequality in health worker density. This amounts to constructing a health workforce distribution for a state, which assigns to each person in a district within the state the health worker density of that district. We measure inequality in the distribution of health workers within a state by calculating an interdistrict Gini coefficient. We also identify the minimum and maximum district densities within each state, and the fraction of districts in a state below the national density.

We investigate the interdistrict distribution of health workers within states for selected health worker categories. For each health worker category three distributions are examined: the distribution of (A) health workers in the category with any level of education, (B) health workers with more than secondary schooling, and (C) health workers with a medical qualification. See Table 3.5.1 for summary statistics of these three distributions for the aggregate category of all health workers. We have also estimated these distributions for other health worker categories, viz. allopathic doctors (Table 3.5.2), nurses and midwives (Table 3.5.3), pharmacists (Table 3.5.4), AYUSH doctors (Table 3.5.5) and dental practitioners (Table 3.5.6). We provide corresponding figures for each of these health worker categories with the same numbering as the tables (see Figures 3.5.1 – 3.5.6).

The national interdistrict Gini for all health workers with any level of education was calculated as 0.2858 – see distribution labelled (A) in Table 3.5.1. At the state level, the interdistrict Gini is highest for Manipur at 0.3266. There are three states with a single district only, in which there will be no interdistrict inequality, viz. Chandigarh, Dadra and Nagar Haveli, and Lakshadweep. For states with more than one district, there is no necessary relationship between the level of inequality and the number of districts in the state.

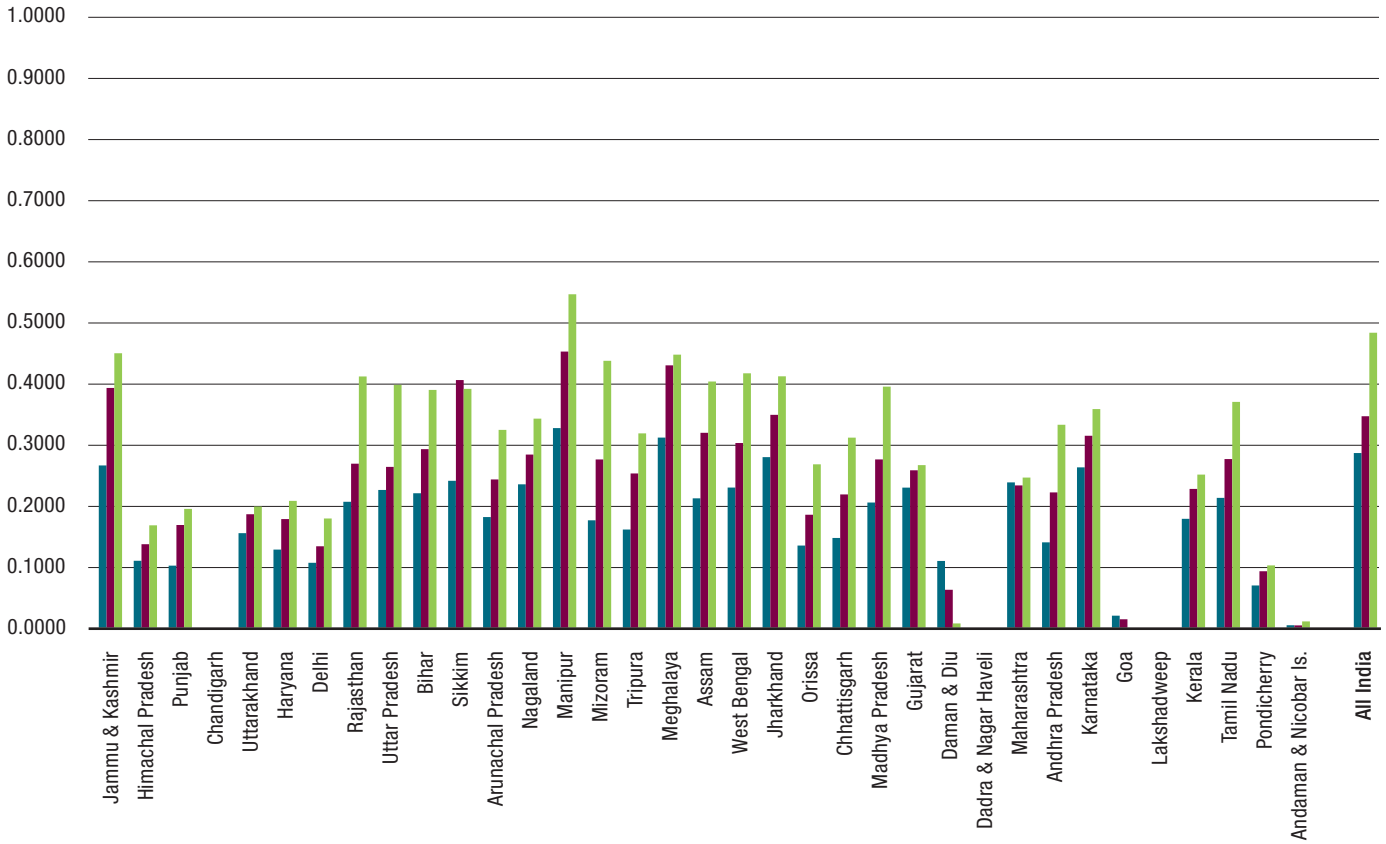
As we move from distribution (A) to the distribution of all health workers with more than secondary schooling (B) and then to those with a medical qualification (C), the national interdistrict Gini rises – from 0.2858 for (A) to 0.3460 for (B) to 0.4828 for (C) (Table 3.5.1 and Figure 3.5.1). For most states, state interdistrict inequality also rises in moving from distribution (A) to (B) to (C). Thus, comparing all health workers with any level of education (A) and all health workers with more than secondary schooling (B), the Gini coefficient is higher for

8 The exception is Lakshadweep, which has 17 urban allopathic doctors of whom 14 are medically qualified, and all of its 13 rural allopathic doctors are medically qualified.

Table 3.5.1. All health workers by education levels (A), (B), and (C): interdistrict differentials, by state

NO.	STATE OR UT	(A) WITH ANY LEVEL OF EDUCATION					(B) WITH MORE THAN SECONDARY SCHOOLING					(C) WITH A MEDICAL QUALIFICATION				
		District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini
		Mean	Min	Max			Mean	Min	Max			Mean	Min	Max		
1.	Jammu & Kashmir	220.5	102.4	665.3	10/14	0.2655	100.6	33.3	253.6	11/14	0.3924	56.7	13.2	147.8	10/14	0.4492
2.	Himachal Pradesh	259.2	185.1	421.4	2/12	0.1094	121.5	72.5	205.8	3/12	0.1365	63.4	30.1	109.1	4/12	0.1674
3.	Punjab	271.3	165.2	338.8	2/17	0.1014	134.7	74.5	191.1	5/17	0.1679	76.6	33.5	114.7	3/17	0.1943
4.	Chandigarh	683.7	683.7	683.7	0/1	0.0000	483.5	483.5	483.5	0/1	0.0000	309.4	309.4	309.4	0/1	0.0000
5.	Uttarakhand	216.3	117.1	293.3	7/13	0.1546	104.2	49.3	156.5	10/13	0.1856	39.8	9.2	62.6	11/13	0.1982
6.	Haryana	204.8	146.1	339.7	9/19	0.1277	98.2	55.7	248.1	11/19	0.1776	54.9	25.0	150.1	8/19	0.2074
7.	Delhi	481.4	324.5	719.1	0/9	0.1060	281.2	153.7	402.0	0/9	0.1331	158.5	65.7	257.9	0/9	0.1786
8.	Rajasthan	143.7	59.6	262.3	29/32	0.2060	65.3	23.8	152.1	30/32	0.2683	23.7	5.9	73.1	31/32	0.4112
9.	Uttar Pradesh	134.6	56.2	378.8	64/70	0.2253	66.7	28.2	255.1	63/70	0.2631	20.9	3.4	121.6	66/70	0.3975
10.	Bihar	110.2	53.7	282.2	36/37	0.2199	53.7	20.2	185.4	36/37	0.2921	15.4	3.7	68.5	36/37	0.3892
11.	Sikkim	465.6	226.4	644.4	0/4	0.2403	113.0	31.6	190.6	3/4	0.4053	49.7	15.4	82.4	3/4	0.3909
12.	Arunachal Pradesh	270.3	190.6	522.1	4/13	0.1809	84.7	48.6	176.2	11/13	0.2425	40.4	16.7	106.6	10/13	0.3237
13.	Nagaland	272.7	97.1	427.3	2/8	0.2346	69.4	19.9	123.2	7/8	0.2833	33.8	5.4	63.9	5/8	0.3421
14.	Manipur	258.5	80.7	507.2	6/9	0.3266	123.7	17.9	295.7	7/9	0.4520	51.1	4.5	141.8	7/9	0.5458
15.	Mizoram	588.2	262.2	771.7	0/8	0.1756	113.1	41.4	168.0	5/8	0.2753	40.1	8.1	73.1	7/8	0.4368
16.	Tripura	180.6	84.1	221.8	3/4	0.1605	64.1	25.7	88.7	4/4	0.2523	27.9	12.3	42.0	4/4	0.3180
17.	Meghalaya	153.0	65.4	281.6	6/7	0.3111	49.8	10.9	108.3	6/7	0.4294	26.2	5.9	56.3	6/7	0.4469
18.	Assam	148.5	84.3	288.8	21/23	0.2116	47.1	18.9	133.4	22/23	0.3189	25.3	7.6	80.4	22/23	0.4029
19.	West Bengal	243.7	96.7	559.8	9/18	0.2293	104.7	27.7	325.1	12/18	0.3022	37.0	7.2	155.0	16/18	0.4164
20.	Jharkhand	153.8	59.0	300.8	15/18	0.2791	69.2	20.7	157.4	15/18	0.3484	18.3	4.8	46.7	18/18	0.4114
21.	Orissa	199.2	127.0	282.6	18/30	0.1343	68.4	35.6	127.3	27/30	0.1847	30.3	7.3	67.3	28/30	0.2673
22.	Chhattisgarh	165.3	90.3	222.7	14/16	0.1467	71.4	31.3	108.9	14/16	0.2180	25.8	9.0	47.5	15/16	0.3110
23.	Madhya Pradesh	163.0	82.0	399.0	40/45	0.2047	79.6	22.2	245.7	40/45	0.2753	30.5	2.9	114.7	41/45	0.3945
24.	Gujarat	174.6	64.3	324.5	21/25	0.2292	98.7	32.1	196.5	19/25	0.2575	60.8	13.4	121.3	12/25	0.2660
25.	Daman & Diu	232.6	169.6	257.0	1/2	0.1091	117.6	99.5	124.6	0/2	0.0619	82.8	81.4	83.3	0/2	0.0067
26.	Dadra & Nagar Haveli	127.0	127.0	127.0	1/1	0.0000	70.3	70.3	70.3	1/1	0.0000	49.0	49.0	49.0	0/1	0.0000
27.	Maharashtra	292.0	133.4	718.1	14/35	0.2377	148.8	72.3	340.0	14/35	0.2328	92.5	29.6	205.2	4/35	0.2456
28.	Andhra Pradesh	212.7	142.4	465.1	12/23	0.1395	96.3	53.1	315.2	16/23	0.2213	42.7	16.3	199.6	18/23	0.3321
29.	Karnataka	206.2	79.3	434.5	21/27	0.2623	108.6	30.1	270.3	20/27	0.3141	61.7	14.5	164.4	16/27	0.3578
30.	Goa	446.8	429.1	460.5	0/2	0.0194	228.8	222.5	233.7	0/2	0.0135	159.2	159.0	159.4	0/2	0.0006
31.	Lakshadweep	390.8	390.8	390.8	0/1	0.0000	188.0	188.0	188.0	0/1	0.0000	118.7	118.7	118.7	0/1	0.0000
32.	Kerala	394.0	213.0	692.9	0/14	0.1781	239.2	113.6	463.6	0/14	0.2270	170.6	76.3	357.2	0/14	0.2505
33.	Tamil Nadu	222.7	88.6	487.2	16/30	0.2124	110.3	34.9	289.3	17/30	0.2759	45.0	7.7	175.9	23/30	0.3695
34.	Pondicherry	530.6	375.9	687.0	0/4	0.0689	292.6	184.7	314.1	0/4	0.0922	166.1	79.6	179.4	0/4	0.1018
35.	Andaman & Nicobar Is.	509.1	499.9	577.6	0/2	0.0038	162.6	159.8	183.0	0/2	0.0035	99.7	94.9	135.5	0/2	0.0100
	All India	**201.2**	**53.7**	**771.7**	**383/593**	**0.2858**	**97.8**	**10.9**	**483.5**	**429/593**	**0.3460**	**46.8**	**2.9**	**357.2**	**424/593**	**0.4828**

Figure 3.5.1. All health workers by education levels (A), (B), and (C): interdistrict Gini, by state



(B) than for (A) in 28 states. Comparing all health workers with more than secondary schooling (B) and all health workers with a medical qualification (C), the Gini coefficient is higher for (C) than for (B) in 29 states. In general, as we progress to health workers with a higher level of education and to those with a medical qualification, the state interdistrict distribution becomes more unequal.

Another relevant statistic derived from the interdistrict distribution for a health worker category within a state is the fraction of districts whose density is below the corresponding national density. For the country as a whole for distribution (A) of all health workers with any level of education, 383 out of 593 districts have a density below the national density (Table 3.5.1). There is much variation among states in this fraction. For example, in Bihar 36 out of its 37 districts have a district density below the national density. By contrast, Kerala has *no* district (out of 14) with a density below the national density.

For distribution (B) of all health workers with more than secondary schooling in the country as a whole, the fraction of districts below the corresponding national density was 429/593 – up from 383/593 for distribution (A). For all health workers with a medical qualification (C) in the country as a whole, the fraction of districts below the corresponding national density was 424/593.

In moving from distribution (A) to (B) to (C), the increase in the fraction of districts below the corresponding national density is, in general, a reflection of the increase in interdistrict inequality arising from the same moves.

We next consider the category of allopathic doctors – see Table 3.5.2 and Figure 3.5.2. As we progress from allopathic doctors with any level of education to allopathic doctors with more than secondary schooling and then to those with a medical qualification, the national interdistrict Gini rises from 0.3093 for (A) to 0.3706 for (B) to 0.4873 for (C) (Table 3.5.2). Note that for each of distributions (A), (B) and (C), the interdistrict Gini is higher for allopathic doctors than for all health workers (cf. Tables 3.5.1 and 3.5.2).

Distribution (C) for allopathic doctors, viz. allopathic doctors with a medical qualification, is considered to be of special interest. The interdistrict Gini for this distribution was estimated at a very high level of 0.4873. Moreover, the national density for allopathic doctors with a medical qualification (C) was very low at 26.2 per lakh population. At the state level for this distribution, the interdistrict Ginis were very high again: 0.5854 for Manipur, 0.4972 for Uttar Pradesh, 0.4967 for Madhya Pradesh, 0.4722 for West Bengal, and 0.4708 for Rajasthan. Except for Manipur, these states also had a very low mean density for distribution (C): Uttar Pradesh had 11.7 per lakh population, Madhya Pradesh 17.9, West Bengal 25.5, and Rajasthan 16.1.

In moving from distribution (A) to (B) to (C) for allopathic doctors, interdistrict inequality rose for most states (in parallel with national interdistrict inequality). Comparing distributions (B) and (A), the Gini coefficient was higher for (B) than for (A) in 27 states. Comparing distributions (C) and (B), the Gini coefficient was higher for (C) than for (B) in 26 states.

Similar tables and figures are presented for four other health worker categories: nurses and midwives, pharmacists, AYUSH doctors, and dental practitioners. Tables 3.5.3 to 3.5.6 provide summary statistics of distributions (A), (B) and (C) for these health worker categories. The corresponding Figures 3.5.3 to 3.5.6 show the interdistrict Ginis by state and for all India.

As in the case of all health workers and of allopathic doctors, national interdistrict inequality rose in moving from distribution (A) to (B) to (C) for each of these four other health worker categories. For nurses the national interdistrict Gini was 0.4014 for (A), 0.4302 for (B), and 0.7450 for (C) – see Table 3.5.3. The extremely high value of the Gini for (C) reflects the fact that a large number of districts in the country had a zero density for this distribution. For pharmacists the national interdistrict Gini was 0.2892 for (A), 0.3600 for (B) and 0.6066 for (C) – see Table 3.5.4. For AYUSH doctors the national interdistrict Gini was 0.3523 for (A), 0.4180 for (B) and 0.5057 for (C) – see Table 3.5.5. For dental practitioners the national interdistrict Gini was 0.5604 for (A), 0.6127 for (B) and 0.7003 for (C) – see Table 3.5.6.

Table 3.5.2. Allopathic doctors by education levels (A), (B), and (C): interdistrict differentials, by state

NO.	STATE OR UT	(A) WITH ANY LEVEL OF EDUCATION					(B) WITH MORE THAN SECONDARY SCHOOLING					(C) WITH A MEDICAL QUALIFICATION				
		District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini
		Mean	Min	Max			Mean	Min	Max			Mean	Min	Max		
1.	Jammu & Kashmir	72.3	15.3	201.3	10/14	0.4380	60.9	8.1	184.7	9/14	0.4840	48.1	7.0	141.0	9/14	0.4898
2.	Himachal Pradesh	58.8	29.1	105.2	9/12	0.2296	41.8	15.0	96.3	10/12	0.2406	30.2	14.1	79.2	8/12	0.2742
3.	Punjab	111.5	69.7	143.0	0/17	0.1161	60.1	28.9	95.9	8/17	0.2209	40.3	15.2	68.3	6/17	0.2299
4.	Chandigarh	242.2	242.2	242.2	0/1	0.0000	223.2	223.2	223.2	0/1	0.0000	180.4	180.4	180.4	0/1	0.0000
5.	Uttarakhand	75.2	19.6	120.2	9/13	0.2855	46.3	13.6	76.0	9/13	0.2661	20.0	0.9	40.6	11/13	0.3266
6.	Haryana	83.9	48.0	138.3	3/19	0.1444	43.9	21.7	118.1	11/19	0.2117	28.0	8.2	85.2	11/19	0.2611
7.	Delhi	161.1	78.1	238.6	0/9	0.1598	139.4	52.9	214.4	0/9	0.1831	101.5	23.8	167.9	1/9	0.2239
8.	Rajasthan	41.0	8.6	91.0	28/32	0.3245	27.2	6.0	79.0	28/32	0.3721	16.1	4.3	55.8	27/32	0.4708
9.	Uttar Pradesh	63.5	17.4	174.5	47/70	0.2578	35.9	10.5	154.1	59/70	0.3075	11.7	1.1	94.6	64/70	0.4972
10.	Bihar	42.0	22.3	101.2	35/37	0.1923	24.6	10.4	79.6	36/37	0.2618	10.9	2.4	52.3	36/37	0.4004
11.	Sikkim	46.0	17.0	75.5	3/4	0.3736	40.9	13.0	69.4	3/4	0.4094	35.5	9.7	60.8	3/4	0.4174
12.	Arunachal Pradesh	29.7	11.2	82.0	12/13	0.3204	25.0	7.2	72.9	12/13	0.3659	23.6	6.4	68.9	10/13	0.3764
13.	Nagaland	33.4	9.2	67.1	7/8	0.3445	27.9	5.0	58.0	6/8	0.3831	22.6	3.5	47.7	5/8	0.3956
14.	Manipur	49.3	6.4	135.7	7/9	0.5280	41.7	4.5	119.0	7/9	0.5567	33.7	0.0	101.9	7/9	0.5854
15.	Mizoram	44.8	6.4	76.1	7/8	0.3948	32.5	4.8	63.6	7/8	0.4975	27.1	3.2	52.8	7/8	0.4953
16.	Tripura	31.5	7.1	46.7	4/4	0.3191	22.4	5.5	37.1	4/4	0.4131	19.6	5.5	32.7	3/4	0.4236
17.	Meghalaya	23.8	2.0	54.0	7/7	0.4899	21.1	2.0	47.4	6/7	0.4832	18.4	2.0	40.7	6/7	0.4718
18.	Assam	28.2	7.6	79.8	22/23	0.3483	21.1	3.8	71.7	22/23	0.4293	17.7	2.4	61.6	19/23	0.4550
19.	West Bengal	71.3	29.3	178.4	10/18	0.2517	42.4	9.8	164.4	12/18	0.3808	25.5	4.6	127.1	12/18	0.4722
20.	Jharkhand	41.1	17.4	69.5	16/18	0.2152	24.9	9.5	52.1	16/18	0.3126	13.6	2.4	34.1	16/18	0.4278
21.	Orissa	26.5	7.3	55.8	30/30	0.2791	21.5	3.0	52.0	28/30	0.3229	16.3	1.9	42.0	26/30	0.3420
22.	Chhattisgarh	41.2	9.6	74.5	14/16	0.3101	26.3	6.9	47.1	14/16	0.3104	13.0	2.7	25.2	16/16	0.3460
23.	Madhya Pradesh	50.6	12.1	135.4	39/45	0.2647	36.2	6.7	125.5	40/45	0.3306	17.9	1.4	90.3	41/45	0.4967
24.	Gujarat	43.7	13.4	86.8	24/25	0.2356	39.8	13.4	83.9	20/25	0.2618	31.6	8.0	71.2	16/25	0.2829
25.	Daman & Diu	49.9	40.7	53.5	2/2	0.0744	45.5	38.4	48.3	1/2	0.0625	40.5	38.4	41.2	0/2	0.0200
26.	Dadra & Nagar Haveli	27.7	27.7	27.7	1/1	0.0000	25.4	25.4	25.4	1/1	0.0000	20.9	20.9	20.9	1/1	0.0000
27.	Maharashtra	78.4	32.4	193.0	15/35	0.2110	64.5	21.4	168.4	14/35	0.2593	44.8	8.2	120.8	14/35	0.3004
28.	Andhra Pradesh	77.0	42.6	202.2	7/23	0.2016	44.9	21.1	190.2	14/23	0.2781	30.1	11.0	161.7	15/23	0.3731
29.	Karnataka	71.6	19.1	157.7	15/27	0.2873	56.0	13.7	143.1	16/27	0.3326	41.2	9.2	118.2	15/27	0.3868
30.	Goa	116.4	113.9	118.4	0/2	0.0107	110.9	108.5	112.8	0/2	0.0109	96.5	95.7	97.0	0/2	0.0037
31.	Lakshadweep	49.5	49.5	49.5	1/1	0.0000	49.5	49.5	49.5	0/1	0.0000	44.5	44.5	44.5	0/1	0.0000
32.	Kerala	61.3	29.7	99.5	9/14	0.2271	59.2	26.0	97.0	4/14	0.2338	53.8	22.8	86.3	2/14	0.2325
33.	Tamil Nadu	58.1	19.2	177.6	24/30	0.3032	43.9	11.6	157.4	22/30	0.3557	28.4	3.8	127.8	22/30	0.4141
34.	Pondicherry	103.6	82.8	109.3	0/4	0.0686	87.9	73.3	91.7	0/4	0.0534	71.3	44.6	74.4	0/4	0.0556
35.	Andaman & Nicobar Is.	60.4	47.5	62.1	1/2	0.0443	41.0	35.7	41.7	2/2	0.0271	32.3	30.9	32.5	0/2	0.0090
	All India	**61.5**	**2.0**	**242.2**	**418/593**	**0.3093**	**42.2**	**2.0**	**223.2**	**441/593**	**0.3706**	**26.2**	**0.0**	**180.4**	**429/593**	**0.4873**

Figure 3.5.2. Allopathic doctors by education levels (A), (B), and (C): interdistrict Gini, by state

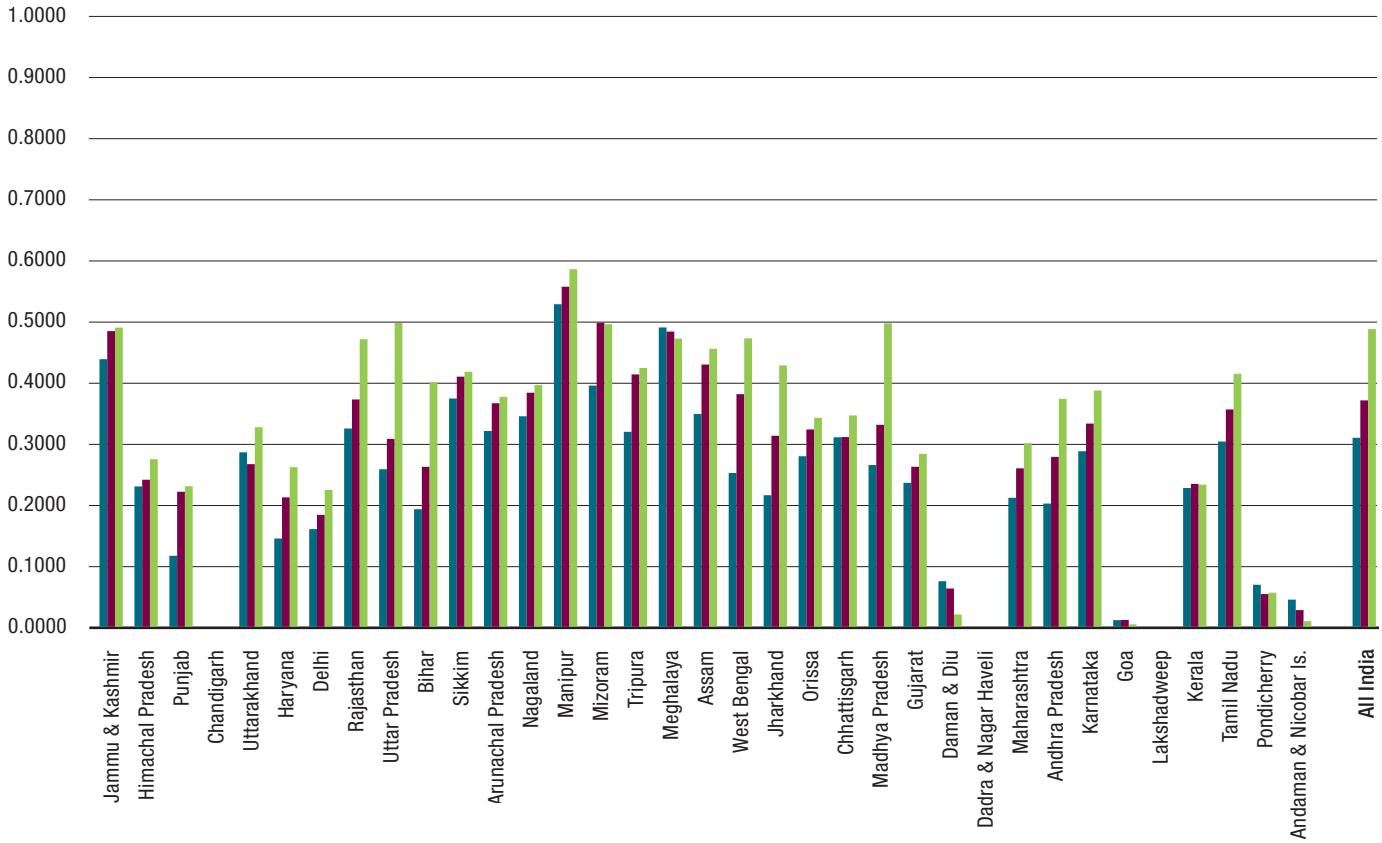


Table 3.5.3. Nurses and midwives by education levels (A), (B), and (C): interdistrict differentials, by state

NO.	STATE OR UT	(A) WITH ANY LEVEL OF EDUCATION					(B) WITH MORE THAN SECONDARY SCHOOLING					(C) WITH A MEDICAL QUALIFICATION				
		District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini
		Mean	Min	Max			Mean	Min	Max			Mean	Min	Max		
1.	Jammu & Kashmir	55.3	27.6	314.8	10/14	0.2719	12.1	1.9	26.5	13/14	0.3386	1.3	0.0	3.5	14/14	0.4753
2.	Himachal Pradesh	68.4	43.4	113.4	7/12	0.1590	19.4	0.0	30.2	9/12	0.2133	4.5	0.0	8.7	9/12	0.2972
3.	Punjab	64.8	19.0	82.0	7/17	0.1440	31.3	9.3	42.1	5/17	0.1700	13.3	3.5	20.8	4/17	0.2429
4.	Chandigarh	246.5	246.5	246.5	0/1	0.0000	129.6	129.6	129.6	0/1	0.0000	64.6	64.6	64.6	0/1	0.0000
5.	Uttarakhand	58.5	25.9	105.8	10/13	0.2272	16.8	4.9	26.0	11/13	0.2267	1.6	0.0	4.3	13/13	0.3830
6.	Haryana	38.1	16.6	76.3	17/19	0.2012	17.6	5.6	39.9	15/19	0.2223	6.2	0.9	16.1	10/19	0.3413
7.	Delhi	146.6	82.7	356.2	0/9	0.1787	56.2	31.6	132.9	0/9	0.1991	23.0	9.9	78.2	0/9	0.3178
8.	Rajasthan	48.9	18.7	80.7	24/32	0.2055	14.4	4.5	23.0	27/32	0.2282	1.7	0.0	7.9	31/32	0.3715
9.	Uttar Pradesh	24.1	8.3	81.2	69/70	0.2547	9.3	2.6	28.0	67/70	0.2681	0.5	0.0	2.8	70/70	0.6293
10.	Bihar	20.9	4.8	66.9	36/37	0.3139	9.3	1.0	37.9	36/37	0.3956	0.2	0.0	1.9	37/37	0.7499
11.	Sikkim	141.8	73.8	188.5	0/4	0.2178	15.3	1.6	28.6	3/4	0.5060	4.3	0.0	7.8	3/4	0.5071
12.	Arunachal Pradesh	110.7	66.5	243.4	0/13	0.2256	21.1	8.4	44.3	8/13	0.3160	3.2	0.0	12.3	12/13	0.5089
13.	Nagaland	143.2	43.0	232.8	1/8	0.2652	22.6	5.8	34.4	2/8	0.2475	5.5	0.0	12.8	4/8	0.3871
14.	Manipur	104.9	35.9	187.9	2/9	0.2629	35.6	9.0	77.6	4/9	0.3753	6.9	0.0	18.0	6/9	0.5008
15.	Mizoram	118.7	43.5	177.2	1/8	0.2748	14.9	2.7	24.3	7/8	0.3603	3.9	0.0	6.8	7/8	0.4170
16.	Tripura	47.9	21.7	64.1	3/4	0.2439	12.2	5.2	15.1	4/4	0.1910	0.5	0.0	1.2	4/4	0.3791
17.	Meghalaya	80.0	33.2	142.2	5/7	0.2939	11.9	0.0	23.3	6/7	0.3665	1.1	0.0	1.7	7/7	0.3214
18.	Assam	56.0	31.1	115.9	17/23	0.2233	8.2	1.8	18.7	23/23	0.3174	1.7	0.0	9.1	22/23	0.5374
19.	West Bengal	61.4	21.9	189.8	13/18	0.2996	21.7	7.5	70.5	12/18	0.2695	1.2	0.0	4.1	18/18	0.3960
20.	Jharkhand	56.2	9.1	160.4	15/18	0.3817	24.7	2.1	80.4	12/18	0.4436	1.3	0.0	5.4	18/18	0.5850
21.	Orissa	105.7	56.3	179.1	1/30	0.1904	20.5	9.1	35.1	14/30	0.1811	2.4	0.0	5.3	30/30	0.3635
22.	Chhattisgarh	50.0	25.7	79.1	13/16	0.1496	15.4	5.0	35.8	13/16	0.2101	2.4	0.7	7.4	14/16	0.4119
23.	Madhya Pradesh	44.3	15.2	130.8	40/45	0.2735	13.0	2.9	45.2	40/45	0.3482	1.6	0.0	6.4	44/45	0.5121
24.	Gujarat	50.1	19.0	97.2	20/25	0.2901	17.7	7.5	34.3	21/25	0.2705	9.3	3.8	16.1	10/25	0.2663
25.	Daman & Diu	81.5	67.9	86.9	0/2	0.0676	32.2	31.7	32.5	0/2	0.0072	19.0	18.1	19.3	0/2	0.0185
26.	Dadra & Nagar Haveli	54.9	54.9	54.9	1/1	0.0000	21.8	21.8	21.8	0/1	0.0000	14.1	14.1	14.1	0/1	0.0000
27.	Maharashtra	102.9	31.6	331.8	15/35	0.3375	22.2	7.0	80.4	29/35	0.3475	6.8	0.7	35.5	26/35	0.4791
28.	Andhra Pradesh	55.5	36.6	115.4	17/23	0.1771	17.7	10.4	38.6	17/23	0.2008	3.6	0.9	9.5	22/23	0.2596
29.	Karnataka	62.6	21.1	177.0	20/27	0.3620	19.0	4.9	56.4	22/27	0.4044	5.9	0.7	22.2	22/27	0.5439
30.	Goa	200.3	199.7	201.0	0/2	0.0014	52.0	49.1	54.3	0/2	0.0280	27.8	27.7	27.8	0/2	0.0012
31.	Lakshadweep	156.6	156.6	156.6	0/1	0.0000	51.1	51.1	51.1	0/1	0.0000	31.3	31.3	31.3	0/1	0.0000
32.	Kerala	185.3	84.2	396.6	0/14	0.2288	94.8	34.5	257.4	0/14	0.3200	75.5	23.7	220.2	0/14	0.3587
33.	Tamil Nadu	83.1	29.3	164.9	9/30	0.2133	29.7	9.3	55.5	10/30	0.2517	7.6	1.0	21.0	15/30	0.3823
34.	Pondicherry	248.7	111.5	261.8	0/4	0.0692	111.9	38.2	121.3	0/4	0.1119	65.5	21.7	72.3	0/4	0.1374
35.	Andaman & Nicobar Is.	181.1	171.6	252.0	0/2	0.0109	53.9	50.6	78.4	0/2	0.0127	41.3	36.9	73.7	0/2	0.0219
	All India	**61.3**	**4.8**	**396.6**	**373/593**	**0.4014**	**20.2**	**0.0**	**257.4**	**430/593**	**0.4302**	**6.1**	**0.0**	**220.2**	**472/593**	**0.7450**

Figure 3.5.3. Nurses and midwives by education levels (A), (B), and (C): interdistrict Gini, by state

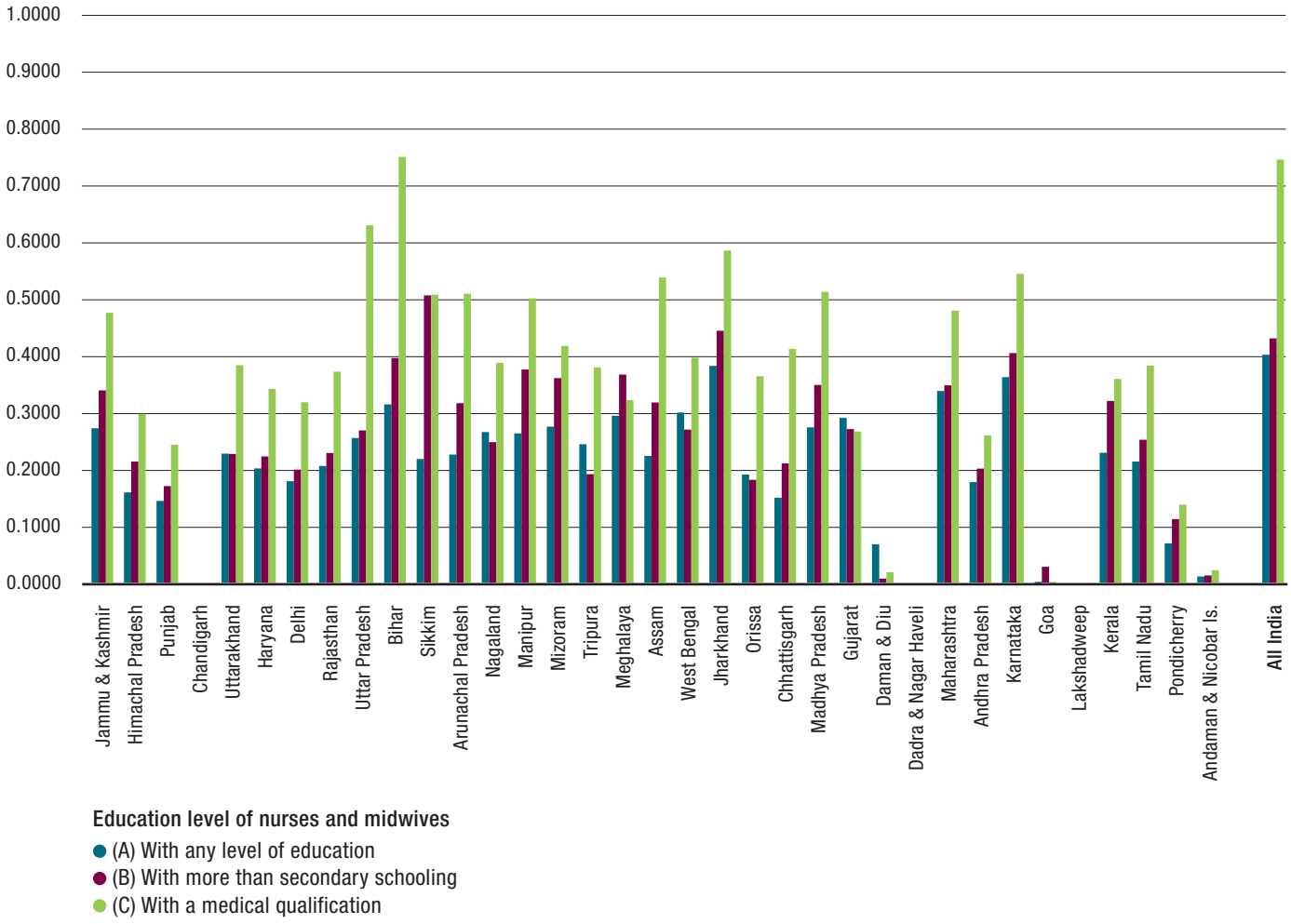


Table 3.5.4. Pharmacists by education levels (A), (B), and (C): interdistrict differentials, by state

NO.	STATE OR UT	(A) WITH ANY LEVEL OF EDUCATION					(B) WITH MORE THAN SECONDARY SCHOOLING					(C) WITH A MEDICAL QUALIFICATION				
		District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini
		Mean	Min	Max			Mean	Min	Max			Mean	Min	Max		
1.	Jammu & Kashmir	49.9	24.6	152.7	0/14	0.1733	11.1	1.7	20.0	5/14	0.2659	1.3	0.0	3.2	10/14	0.4880
2.	Himachal Pradesh	52.6	31.9	150.5	0/12	0.1142	18.0	0.0	28.4	1/12	0.1275	6.5	0.0	15.8	1/12	0.2256
3.	Punjab	33.3	27.7	41.0	0/17	0.0624	14.1	8.2	23.5	0/17	0.1389	6.6	2.4	12.1	0/17	0.1463
4.	Chandigarh	40.3	40.3	40.3	0/1	0.0000	26.9	26.9	26.9	0/1	0.0000	9.7	9.7	9.7	0/1	0.0000
5.	Uttarakhand	37.0	15.1	48.2	1/13	0.1208	14.0	7.0	24.0	1/13	0.1967	3.2	0.8	11.1	3/13	0.3648
6.	Haryana	29.7	20.0	44.8	5/19	0.1425	8.3	3.5	20.5	11/19	0.2670	3.4	1.3	8.4	3/19	0.2720
7.	Delhi	48.8	35.3	56.6	0/9	0.0805	18.4	12.4	21.7	0/9	0.0979	4.3	2.1	6.1	0/9	0.1237
8.	Rajasthan	25.5	4.0	49.3	14/32	0.2741	9.1	1.1	16.7	12/32	0.3057	0.9	0.0	2.9	27/32	0.4755
9.	Uttar Pradesh	18.8	4.5	45.1	56/70	0.2537	5.5	1.0	19.0	63/70	0.2812	0.5	0.0	2.1	69/70	0.5058
10.	Bihar	20.4	6.6	46.6	26/37	0.2390	6.2	1.0	22.5	30/37	0.3657	0.3	0.0	1.4	37/37	0.6296
11.	Sikkim	8.7	4.9	11.4	4/4	0.2011	1.1	0.0	1.6	4/4	0.2999	0.0	0.0	0.0	4/4	0.0000
12.	Arunachal Pradesh	24.8	16.7	41.0	6/13	0.1565	9.4	6.0	14.8	3/13	0.1698	4.6	3.0	9.0	0/13	0.1734
13.	Nagaland	46.7	13.8	94.3	2/8	0.2859	7.9	2.9	18.0	4/8	0.2953	2.7	0.7	6.8	1/8	0.2876
14.	Manipur	33.8	3.2	54.2	3/9	0.2913	16.8	0.0	27.7	3/9	0.3210	3.6	0.0	6.6	5/9	0.4517
15.	Mizoram	11.9	1.4	17.8	8/8	0.2844	1.8	0.0	3.2	8/8	0.4006	1.1	0.0	3.2	6/8	0.5337
16.	Tripura	23.5	6.2	28.0	2/4	0.1745	9.2	1.3	11.5	2/4	0.2142	2.6	0.0	4.0	2/4	0.2449
17.	Meghalaya	14.3	3.4	25.7	6/7	0.3152	2.9	0.0	6.8	7/7	0.5771	0.7	0.0	2.6	6/7	0.4332
18.	Assam	23.3	9.4	40.3	13/23	0.1944	5.9	1.6	13.6	20/23	0.2707	1.5	0.0	4.0	19/23	0.3682
19.	West Bengal	14.9	1.2	27.9	16/18	0.2875	3.9	0.5	7.3	17/18	0.2754	0.7	0.0	1.6	18/18	0.4198
20.	Jharkhand	18.9	5.9	35.8	14/18	0.2147	5.1	0.9	9.0	16/18	0.2442	0.4	0.0	1.6	18/18	0.6070
21.	Orissa	11.9	1.3	20.9	30/30	0.1996	6.0	0.0	12.0	24/30	0.2401	2.9	0.0	5.7	9/30	0.2466
22.	Chhattisgarh	12.4	2.7	26.0	13/16	0.3849	3.5	1.1	6.9	16/16	0.3409	0.4	0.0	1.1	16/16	0.5293
23.	Madhya Pradesh	22.5	7.4	51.5	29/45	0.2168	6.9	2.7	16.4	32/45	0.2401	0.7	0.0	2.1	44/45	0.4938
24.	Gujarat	30.6	2.7	58.7	7/25	0.2326	7.3	2.5	15.9	17/25	0.2889	2.9	0.0	5.8	12/25	0.2905
25.	Daman & Diu	27.8	9.0	35.1	1/2	0.2717	11.4	4.5	14.0	1/2	0.2426	7.0	4.5	7.9	0/2	0.1407
26.	Dadra & Nagar Haveli	17.7	17.7	17.7	1/1	0.0000	7.7	7.7	7.7	0/1	0.0000	3.6	3.6	3.6	0/1	0.0000
27.	Maharashtra	25.8	7.5	62.5	22/35	0.2460	5.8	0.8	10.4	30/35	0.2490	1.5	0.0	3.4	30/35	0.4080
28.	Andhra Pradesh	24.0	8.2	38.6	8/23	0.1744	6.8	3.9	17.2	19/23	0.1825	1.8	0.7	6.1	18/23	0.2726
29.	Karnataka	12.7	1.3	19.9	27/27	0.2216	3.8	0.0	9.4	26/27	0.3239	1.1	0.0	2.9	25/27	0.3685
30.	Goa	40.8	36.2	44.4	0/2	0.0561	17.7	17.4	18.2	0/2	0.0093	8.2	8.1	8.2	0/2	0.0009
31.	Lakshadweep	31.3	31.3	31.3	0/1	0.0000	16.5	16.5	16.5	0/1	0.0000	13.2	13.2	13.2	0/1	0.0000
32.	Kerala	36.6	27.0	47.5	0/14	0.1160	21.3	14.6	29.4	0/14	0.1237	12.9	8.1	17.7	0/14	0.1502
33.	Tamil Nadu	16.8	3.7	31.7	27/30	0.2469	7.8	1.7	16.0	19/30	0.2947	2.5	0.3	6.2	12/30	0.3183
34.	Pondicherry	40.2	29.3	78.7	0/4	0.0803	22.9	15.9	27.2	0/4	0.0735	12.3	9.6	16.3	0/4	0.0525
35.	Andaman & Nicobar Is.	41.0	38.8	57.1	0/2	0.0109	17.7	15.3	35.7	0/2	0.0283	12.6	11.5	21.4	0/2	0.0193
	All India	**22.5**	**1.2**	**152.7**	**341/593**	**0.2892**	**7.2**	**0.0**	**35.7**	**391/593**	**0.3600**	**1.9**	**0.0**	**21.4**	**395/593**	**0.6066**

Figure 3.5.4. Pharmacists by education levels (A), (B), and (C): interdistrict Gini, by state

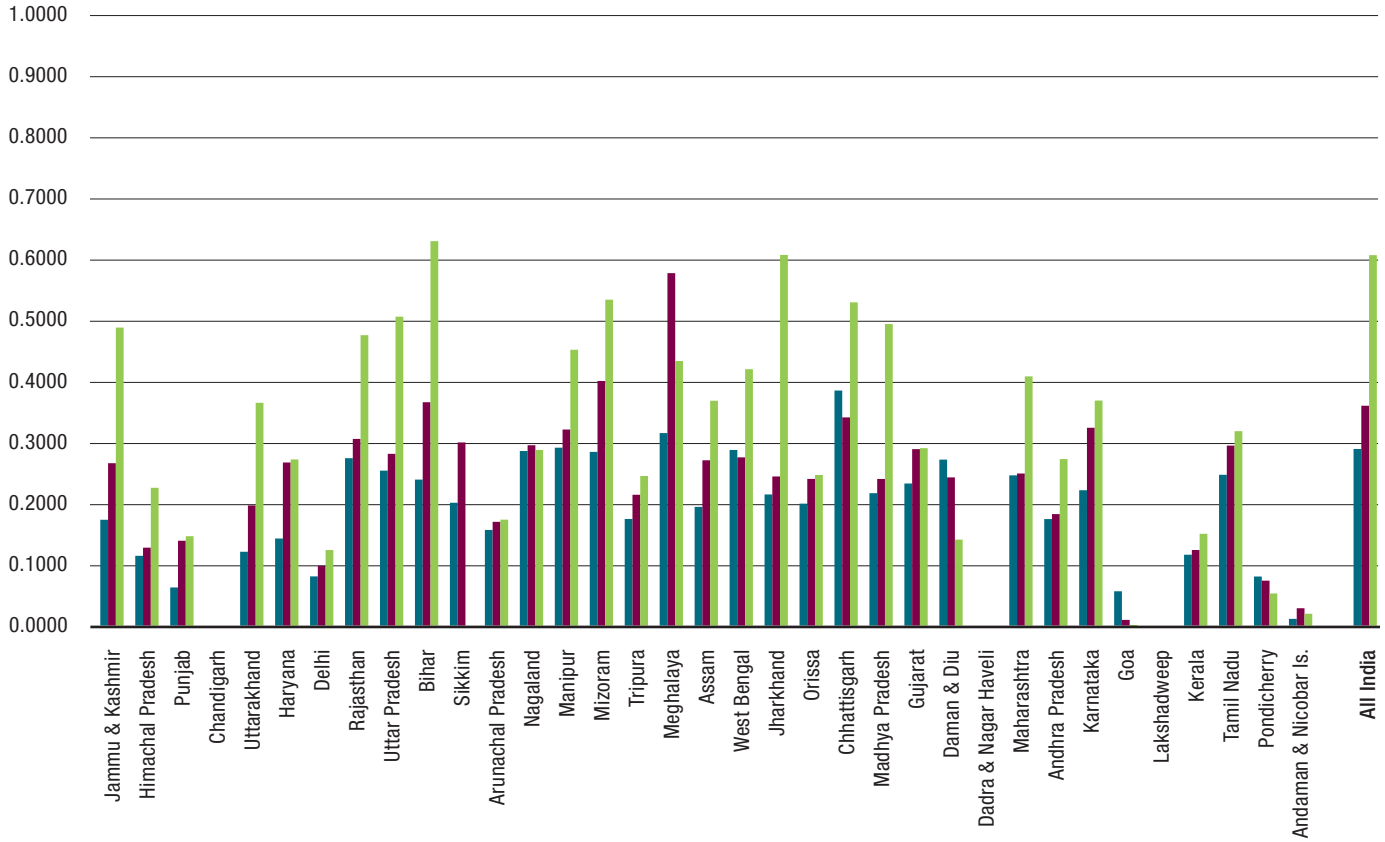


Table 3.5.5. AYUSH doctors by education levels (A), (B), and (C): interdistrict differentials, by state

NO.	STATE OR UT	(A) WITH ANY LEVEL OF EDUCATION					(B) WITH MORE THAN SECONDARY SCHOOLING					(C) WITH A MEDICAL QUALIFICATION				
		District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini
		Mean	Min	Max			Mean	Min	Max			Mean	Min	Max		
1.	Jammu & Kashmir	6.7	1.7	11.3	14/14	0.2593	5.0	1.4	9.4	14/14	0.3179	4.2	0.0	8.1	14/14	0.3137
2.	Himachal Pradesh	28.7	14.2	43.1	1/12	0.1497	23.3	12.3	35.9	1/12	0.1416	18.5	8.6	29.6	1/12	0.1648
3.	Punjab	23.2	15.4	33.0	2/17	0.1252	15.0	6.4	25.4	9/17	0.2125	12.6	5.4	23.0	9/17	0.2409
4.	Chandigarh	37.8	37.8	37.8	0/1	0.0000	33.2	33.2	33.2	0/1	0.0000	29.1	29.1	29.1	0/1	0.0000
5.	Uttarakhand	22.6	8.0	37.9	8/13	0.2453	17.0	5.8	29.0	7/13	0.2697	13.5	3.1	22.9	7/13	0.2651
6.	Haryana	23.4	14.0	44.5	5/19	0.1686	16.7	8.4	32.0	4/19	0.1891	14.0	7.7	28.2	5/19	0.2017
7.	Delhi	35.1	19.0	48.0	0/9	0.0885	28.9	19.0	39.6	0/9	0.0805	22.8	14.5	33.7	0/9	0.0819
8.	Rajasthan	14.1	3.8	26.1	25/32	0.2530	9.1	2.2	19.0	29/32	0.2686	4.0	0.8	9.9	31/32	0.3383
9.	Uttar Pradesh	13.2	1.7	32.4	60/70	0.2771	9.8	0.7	27.7	60/70	0.3037	7.4	0.7	20.3	55/70	0.3309
10.	Bihar	10.7	2.6	23.5	35/37	0.2553	6.5	1.0	18.5	36/37	0.2970	2.9	0.0	9.1	37/37	0.3867
11.	Sikkim	1.7	0.0	3.3	4/4	0.5772	1.1	0.0	2.0	4/4	0.5269	0.4	0.0	0.8	4/4	0.4347
12.	Arunachal Pradesh	2.8	0.0	7.2	13/13	0.3338	2.0	0.0	7.2	13/13	0.4044	1.6	0.0	7.2	13/13	0.4212
13.	Nagaland	2.2	0.0	7.4	8/8	0.6084	1.5	0.0	3.9	8/8	0.5943	1.3	0.0	3.7	8/8	0.5793
14.	Manipur	4.8	0.0	9.6	9/9	0.4992	2.6	0.0	5.6	9/9	0.5424	1.5	0.0	3.8	9/9	0.6034
15.	Mizoram	1.2	0.0	1.8	8/8	0.3632	0.8	0.0	1.6	8/8	0.4726	0.6	0.0	1.6	8/8	0.6022
16.	Tripura	22.5	8.1	49.2	2/4	0.2543	7.8	4.2	9.5	4/4	0.1728	2.8	0.7	4.5	4/4	0.4123
17.	Meghalaya	3.7	0.0	6.7	7/7	0.4471	1.0	0.0	2.4	7/7	0.5157	0.4	0.0	1.0	7/7	0.6166
18.	Assam	12.0	3.0	24.7	20/23	0.2620	3.8	0.0	9.8	23/23	0.3063	1.8	0.0	5.8	23/23	0.4111
19.	West Bengal	30.1	8.9	44.1	4/18	0.1895	15.5	2.9	24.5	8/18	0.2557	7.1	0.7	12.4	12/18	0.3279
20.	Jharkhand	8.9	3.3	22.1	17/18	0.2527	4.3	1.0	10.1	18/18	0.2859	1.6	0.0	4.1	18/18	0.3757
21.	Orissa	18.0	4.3	34.1	20/30	0.2537	10.0	2.5	20.4	24/30	0.2639	6.7	1.0	13.2	25/30	0.2595
22.	Chhattisgarh	12.5	2.7	22.5	14/16	0.3431	9.2	1.2	17.9	13/16	0.3912	7.0	0.7	14.4	13/16	0.4301
23.	Madhya Pradesh	14.5	2.1	28.3	36/45	0.2527	11.8	1.2	26.0	33/45	0.2817	8.7	1.0	21.6	31/45	0.2788
24.	Gujarat	19.7	0.0	34.4	17/25	0.2554	17.3	0.0	32.2	13/25	0.2759	13.2	0.0	25.7	13/25	0.2815
25.	Daman & Diu	10.7	8.8	15.8	2/2	0.0739	8.8	7.0	13.6	1/2	0.0833	5.7	4.4	9.0	2/2	0.0922
26.	Dadra & Nagar Haveli	12.7	12.7	12.7	1/1	0.0000	10.9	10.9	10.9	1/1	0.0000	8.6	8.6	8.6	1/1	0.0000
27.	Maharashtra	36.4	14.1	54.8	2/35	0.1604	34.2	10.5	53.2	1/35	0.1667	32.1	10.5	51.2	0/35	0.1681
28.	Andhra Pradesh	9.1	4.9	22.1	22/23	0.2025	5.8	2.2	18.2	22/23	0.2742	4.3	1.0	14.7	22/23	0.3183
29.	Karnataka	11.8	0.8	26.3	22/27	0.2903	9.5	0.8	24.9	20/27	0.3241	8.1	0.4	24.1	19/27	0.3460
30.	Goa	14.4	13.9	14.8	2/2	0.0163	12.8	12.5	13.1	1/2	0.0092	11.0	10.9	11.0	0/2	0.0018
31.	Lakshadweep	9.9	9.9	9.9	1/1	0.0000	9.9	9.9	9.9	1/1	0.0000	9.9	9.9	9.9	0/1	0.0000
32.	Kerala	37.7	23.4	52.4	0/14	0.1369	25.2	12.2	38.7	1/14	0.2069	20.6	10.3	31.6	0/14	0.2108
33.	Tamil Nadu	13.7	3.9	24.4	26/30	0.2077	6.8	1.4	15.7	29/30	0.2764	2.5	0.3	7.2	30/30	0.3688
34.	Pondicherry	14.9	0.0	46.2	3/4	0.2264	9.4	0.0	24.4	3/4	0.2798	5.9	0.0	10.9	3/4	0.2740
35.	Andaman & Nicobar Is.	6.7	2.4	7.3	2/2	0.1348	4.5	0.0	5.1	2/2	0.2083	3.7	0.0	4.1	2/2	0.2083
	All India	**18.2**	**0.0**	**54.8**	**412/593**	**0.3523**	**13.0**	**0.0**	**53.2**	**427/593**	**0.4180**	**9.6**	**0.0**	**51.2**	**426/593**	**0.5057**

Figure 3.5.5. AYUSH doctors by education levels (A), (B), and (C): interdistrict Gini, by state

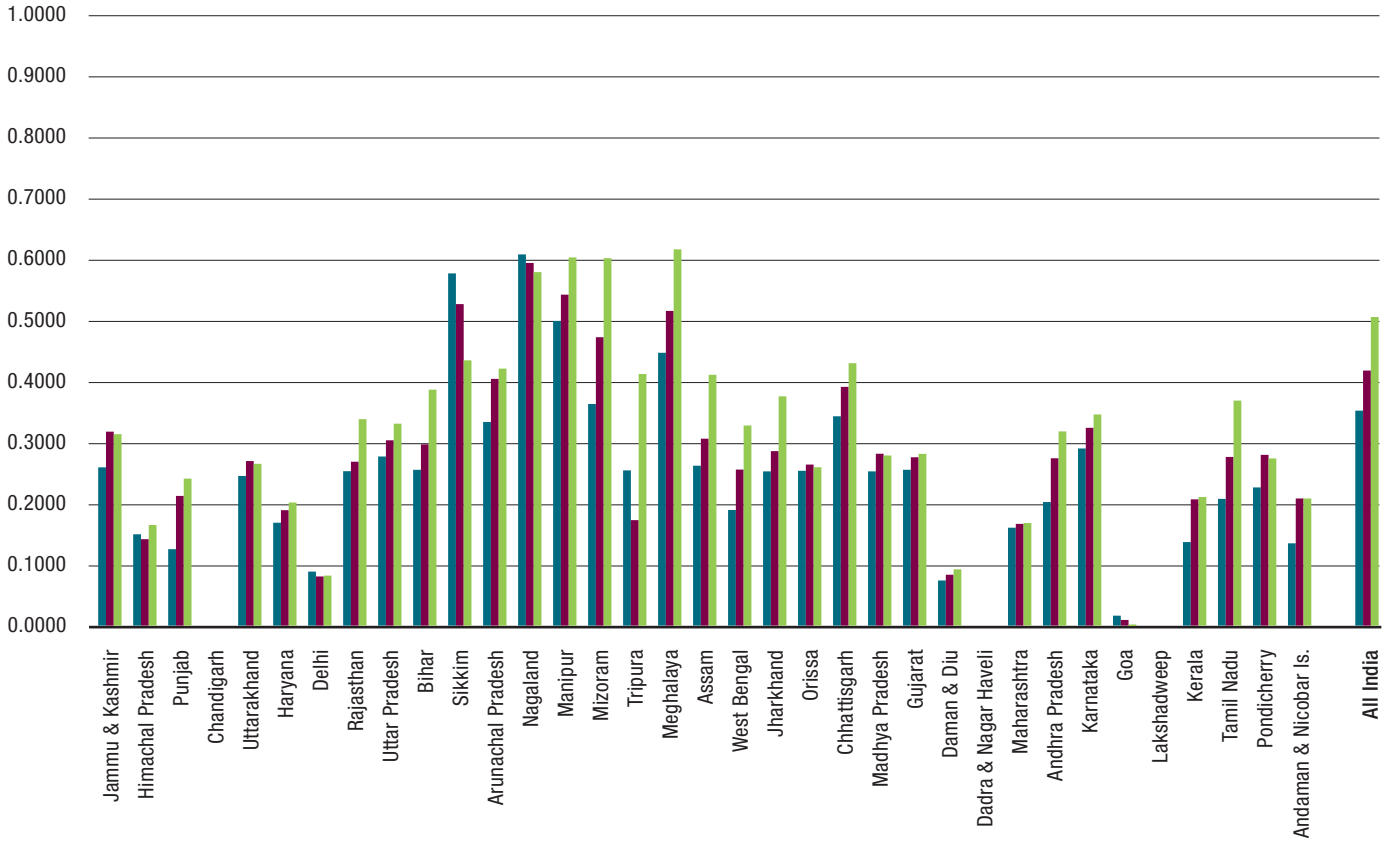
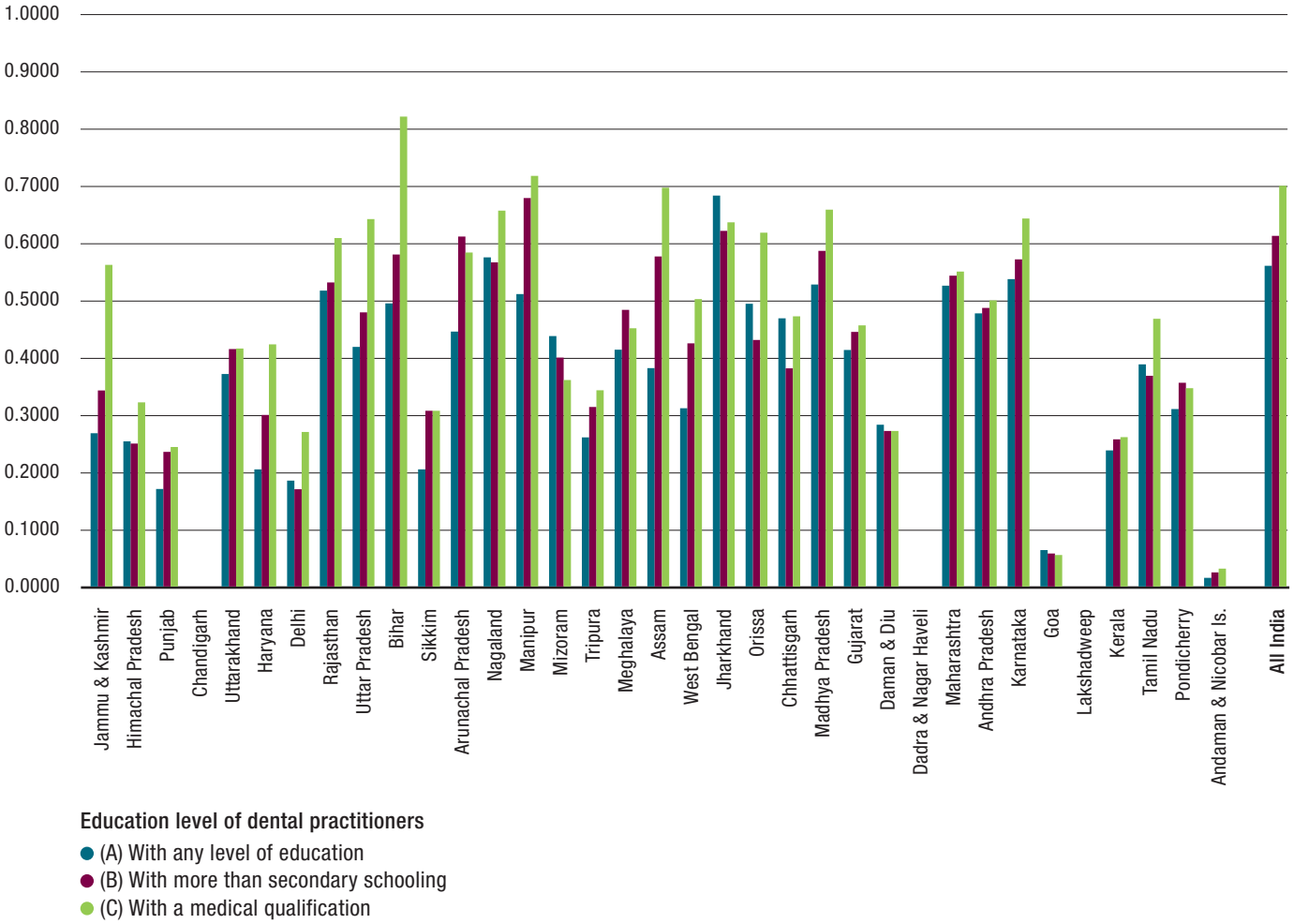


Table 3.5.6. Dental practitioners by education levels (A), (B), and (C): interdistrict differentials, by state

NO.	STATE OR UT	(A) WITH ANY LEVEL OF EDUCATION					(B) WITH MORE THAN SECONDARY SCHOOLING					(C) WITH A MEDICAL QUALIFICATION				
		District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini	District density per lakh population			No. of districts below nat'l density / No. of districts	Interdistrict Gini
		Mean	Min	Max			Mean	Min	Max			Mean	Min	Max		
1.	Jammu & Kashmir	3.7	0.0	10.2	6/14	0.2678	2.4	0.0	10.2	5/14	0.3426	1.3	0.0	10.2	10/14	0.5620
2.	Himachal Pradesh	5.2	0.0	9.6	2/12	0.2536	3.0	0.0	5.5	2/12	0.2497	1.9	0.0	4.2	5/12	0.3217
3.	Punjab	4.5	1.9	6.6	1/17	0.1704	2.6	0.7	4.3	4/17	0.2352	2.1	0.3	3.8	3/17	0.2438
4.	Chandigarh	21.0	21.0	21.0	0/1	0.0000	15.0	15.0	15.0	0/1	0.0000	12.8	12.8	12.8	0/1	0.0000
5.	Uttarakhand	3.0	0.0	6.6	6/13	0.3713	1.6	0.0	3.6	8/13	0.4149	0.5	0.0	1.1	12/13	0.4158
6.	Haryana	4.7	2.7	17.7	0/19	0.2046	2.9	0.7	15.8	3/19	0.2998	2.0	0.3	14.5	6/19	0.4231
7.	Delhi	13.0	7.8	39.3	0/9	0.1850	6.7	3.1	11.4	0/9	0.1699	3.5	0.8	6.1	1/9	0.2700
8.	Rajasthan	2.1	0.0	8.6	27/32	0.5170	0.7	0.0	2.8	30/32	0.5313	0.3	0.0	1.0	31/32	0.6089
9.	Uttar Pradesh	1.4	0.0	5.2	61/70	0.4187	0.6	0.0	3.7	66/70	0.4790	0.2	0.0	1.3	69/70	0.6420
10.	Bihar	0.6	0.0	2.6	35/37	0.4947	0.3	0.0	1.9	36/37	0.5801	0.1	0.0	1.4	36/37	0.8211
11.	Sikkim	3.1	0.8	4.9	1/4	0.2046	2.0	0.0	2.9	1/4	0.3070	2.0	0.0	2.9	1/4	0.3070
12.	Arunachal Pradesh	2.1	0.0	5.2	8/13	0.4454	1.5	0.0	5.2	8/13	0.6115	1.4	0.0	4.1	7/13	0.5836
13.	Nagaland	1.2	0.0	3.5	7/8	0.5751	1.0	0.0	3.2	7/8	0.5664	0.8	0.0	3.2	6/8	0.6568
14.	Manipur	1.9	0.0	4.3	7/9	0.5110	1.2	0.0	3.4	7/9	0.6788	0.9	0.0	2.9	7/9	0.7175
15.	Mizoram	6.4	0.0	11.4	2/8	0.4376	2.8	0.0	4.6	4/8	0.4000	2.3	0.0	3.7	2/8	0.3608
16.	Tripura	1.6	0.0	3.0	3/4	0.2605	0.7	0.0	1.0	4/4	0.3137	0.4	0.0	0.7	4/4	0.3429
17.	Meghalaya	1.6	0.0	3.7	6/7	0.4138	1.3	0.0	3.7	4/7	0.4834	1.0	0.0	2.0	4/7	0.4512
18.	Assam	0.7	0.0	1.7	23/23	0.3816	0.4	0.0	1.4	23/23	0.5767	0.2	0.0	1.1	22/23	0.6969
19.	West Bengal	1.7	0.4	4.4	16/18	0.3115	1.0	0.2	3.3	15/18	0.4249	0.5	0.0	2.3	16/18	0.5022
20.	Jharkhand	1.2	0.0	6.9	17/18	0.6831	0.4	0.0	1.6	17/18	0.6214	0.1	0.0	0.4	18/18	0.6363
21.	Orissa	0.8	0.0	3.3	27/30	0.4940	0.3	0.0	1.3	30/30	0.4308	0.1	0.0	1.3	29/30	0.6183
22.	Chhattisgarh	1.0	0.0	2.7	15/16	0.4686	0.5	0.0	1.4	16/16	0.3812	0.3	0.0	1.0	15/16	0.4721
23.	Madhya Pradesh	1.1	0.0	4.3	40/45	0.5277	0.7	0.0	3.4	39/45	0.5865	0.4	0.0	2.4	41/45	0.6585
24.	Gujarat	2.2	0.0	6.4	22/25	0.4133	1.9	0.0	5.8	17/25	0.4449	1.5	0.0	4.6	16/25	0.4563
25.	Daman & Diu	7.6	2.3	9.7	1/2	0.2827	7.0	2.3	8.8	0/2	0.2717	7.0	2.3	8.8	0/2	0.2717
26.	Dadra & Nagar Haveli	0.9	0.9	0.9	1/1	0.0000	0.9	0.9	0.9	1/1	0.0000	0.9	0.9	0.9	1/1	0.0000
27.	Maharashtra	3.6	0.2	14.5	27/35	0.5257	2.8	0.1	11.9	24/35	0.5432	2.4	0.1	9.0	22/35	0.5503
28.	Andhra Pradesh	1.3	0.1	8.2	22/23	0.4773	1.0	0.1	5.8	21/23	0.4868	0.8	0.0	4.4	19/23	0.5000
29.	Karnataka	3.8	0.6	13.1	17/27	0.5371	2.2	0.2	8.3	18/27	0.5716	1.5	0.0	6.3	18/27	0.6430
30.	Goa	15.0	13.1	17.5	0/2	0.0636	12.4	10.9	14.3	0/2	0.0576	10.8	9.6	12.4	0/2	0.0550
31.	Lakshadweep	14.8	14.8	14.8	0/1	0.0000	11.5	11.5	11.5	0/1	0.0000	6.6	6.6	6.6	0/1	0.0000
32.	Kerala	7.1	2.2	11.9	1/14	0.2378	5.9	1.8	11.0	0/14	0.2571	5.2	1.6	10.0	0/14	0.2610
33.	Tamil Nadu	3.4	0.3	12.8	17/30	0.3882	1.8	0.0	6.0	18/30	0.3682	1.0	0.0	4.8	22/30	0.4678
34.	Pondicherry	9.3	0.0	16.3	2/4	0.3101	7.7	0.0	9.9	2/4	0.3560	6.3	0.0	8.0	2/4	0.3465
35.	Andaman & Nicobar Is.	3.1	2.9	4.8	0/2	0.0151	2.5	2.2	4.8	0/2	0.0246	2.2	1.9	4.8	0/2	0.0312
	All India	**2.4**	**0.0**	**39.3**	**420/593**	**0.5604**	**1.5**	**0.0**	**15.8**	**430/593**	**0.6127**	**1.0**	**0.0**	**14.5**	**445/593**	**0.7003**

Figure 3.5.6. Dental practitioners by education levels (A), (B), and (C): interdistrict Gini, by state



Also at the national level for these four health worker categories, the number of districts with density below the corresponding national density rose in moving from (A) to (B) to (C) – with a slight exception for AYUSH doctors in moving from (B) to (C).

At the level of states for these health worker categories, the state interdistrict Ginis rose in moving from distribution (A) to (B) to (C), with some minor exceptions. As at the national level, for each health worker category, in moving from distribution (A) to (B) to (C) the fraction of districts in a state below the corresponding national density also rose, with a few minor exceptions.

4. Interdistrict differentials in India

In this section, we examine interdistrict variation in health worker densities across the nation. To illustrate the variation, we present histograms of health worker densities for the nation's 593 districts, smoothed through the use of various kernels. The distributions of health worker density across districts are examined in terms of interdistrict range, skewness, the number of districts below the corresponding national density, and interdistrict inequality as measured by the Gini coefficient.

We are especially interested in the bottom and top ends of the distribution across districts of health worker density by education and medical qualification. The extremes identify districts that have very low and high availability of health workers per capita. For each of the main health worker categories we provide a list of the lowest 30 and highest 30 districts ranked by health worker density, separately for (A) health workers with any level of education in the category, (B) those with more than secondary schooling, and (C) those with a medical qualification. This labelling of distributions of health workers with any level of education, of those with more than secondary schooling, and of those with a medical qualification, is the same as in section 3.

We examine the bottom and top ends of the distributions across districts for the following health worker categories: all health workers, allopathic doctors, nurses and midwives, pharmacists, AYUSH doctors, ayurvedic doctors, homeopathic doctors, unani doctors, and dental practitioners. For the category of all health workers and the category of pharmacists, we consider distributions (A) and (B) only. For the categories of allopathic doctors, nurses, AYUSH doctors and dental practitioners, we consider distributions (A), (B), and (C).

4.1 All health workers

We first consider distribution (A) for all health workers. To illustrate interdistrict variation, a histogram of densities for the nation's 593 districts is shown in Figure 4.1, together with an Epanechnikov kernel density estimate (with bandwidth 21.78)[9]. There are other kernels that can also be used to smooth a histogram to provide a kernel density estimate. In Figure 4.2 we present five alternative kernel density estimates for the distribution of all health workers. These correspond to using the following kernels for smoothing: Gaussian, Cosine, Parzen, Rectangle, and Triangle. As can be seen from Figures 4.1 and 4.2, the shape of the estimated function is similar using the different kernels, but is smoothest for the Epanechnikov and Gaussian kernels.

From Figure 4.1 we can identify the characteristics, of the distribution e.g. its shape and skewness. It is clear that the distribution is positively skewed; in other words, the right tail is longer than the left tail and the mass of the distribution is concentrated to the left of the mean (i.e. national) density (the vertical red line). Formally, the third moment of this distribution is positive.

Using the unsmoothed distribution of density across districts for all health workers, we can count the number of districts with health worker density below the national density, yielding the fraction of districts that have below-average per capita availability of health workers. Inequalities in health worker density can be examined through the interdistrict range (difference between the maximum and minimum district density) and the interdistrict Gini coefficient.

We compare the distribution (A) of all health workers with any level of education, to the distribution (B) of those with more than secondary schooling. As seen in Table 3.5.1, the national interdistrict Gini coefficient for all health workers (A) was 0.2858. Figure 4.1, which refers to distribution (A), indicates positive skewness. This implies that more than half the districts had a density lower than the national average: in fact, 383 out of 593 districts had a density below the national average (of 201.2 per lakh population).

9 The bandwidth for each distribution in Figures 4.1 to 4.5 was generated automatically by Stata MP 11.0 in order to minimize the mean integrated squared error.

Figure 4.1. District density of all health workers: histogram (593 bins) and Epanechnikov kernel estimate

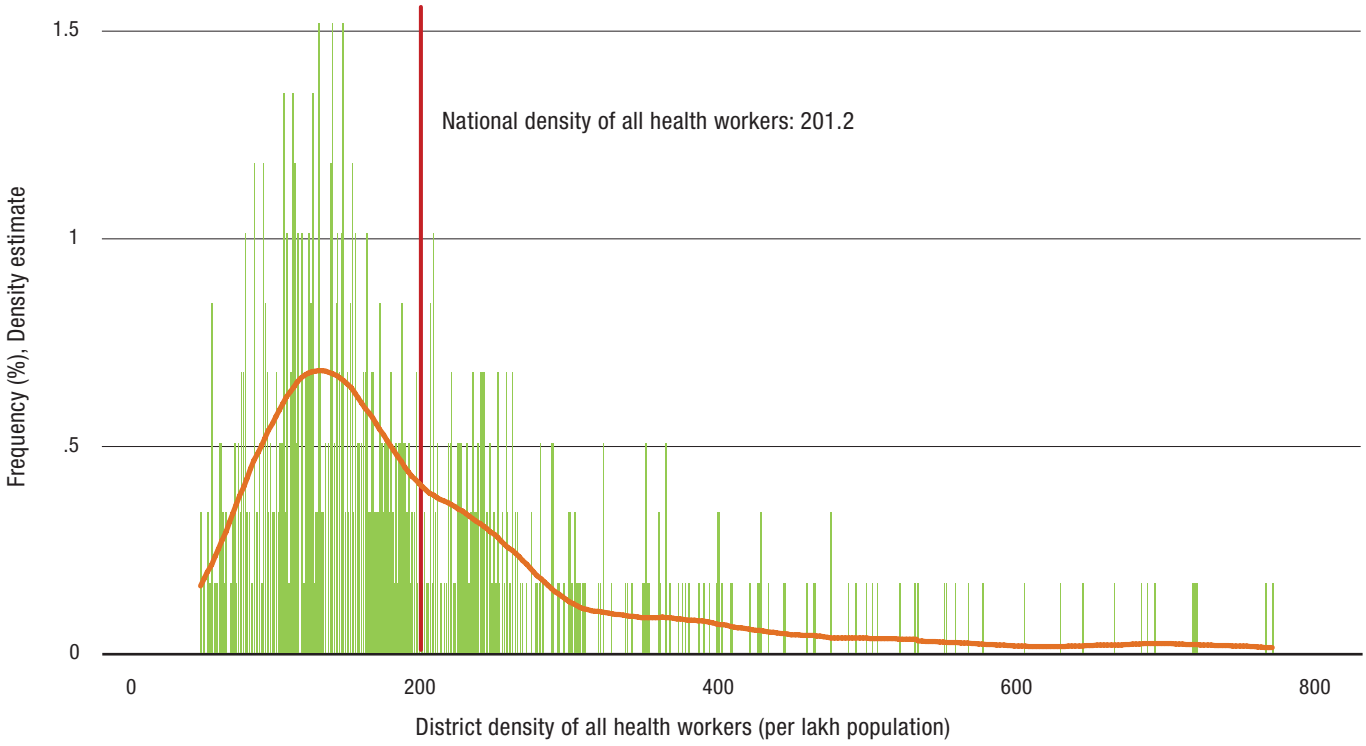
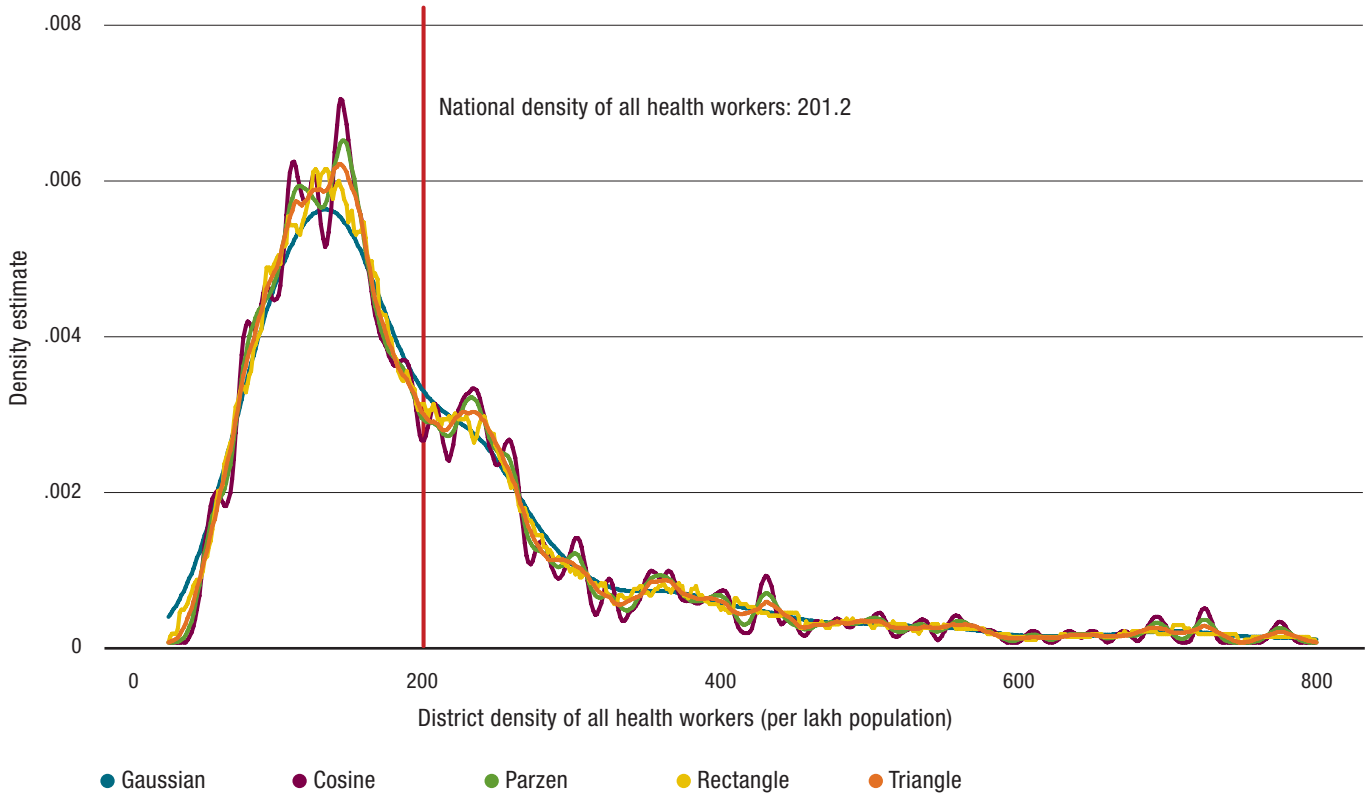


Figure 4.2. District density of all health workers: alternative kernel estimates



In the ranking of the country's 593 districts by health worker density – for all health workers with any level of education, i.e. distribution (A) – Kolasib in Mizoram had the highest density of all health workers (771.7 per lakh population),[10] and Supaul in Bihar had the lowest density (53.7 per lakh) – see Table 4.1-(A). This indicates a 14-fold differential between the district with the highest and the lowest density. By contrast, there was a 6-fold differential between the state with the highest and the lowest density of all health workers (see section 3.3).

Instead of identifying the single districts with the highest and the lowest density, it is useful to explore the ends of the district distribution in greater detail. We examine subgroups of districts with very low and with very high density of health workers – by identifying the lowest 5% and highest 5% of districts ranked by density. This corresponds to identifying approximately 30 districts (out of 593) at each end. Table 4.1-(A) shows the lowest 30 and the highest 30 districts ranked by density of all health workers with any level of education, i.e. the lowest 30 and highest 30 districts of distribution (A). Almost all the lowest 30 districts were found in the north of the country. The composition of the lowest 30 was dominated by districts in the states of Bihar (11 districts) and Uttar Pradesh (nine). The highest 30 districts were more dispersed across the states of India – we find six in Delhi, five in Mizoram[11] and four in Kerala.

In moving from distribution (A) to distribution (B) for all health workers, the national interdistrict Gini went up from 0.2858 to 0.3460, and the fraction of districts below the mean of distribution (B) (of 97.8 per lakh population) was 429 out of 593 districts (see Table 3.5.1). In other words, both inequality and skewness were higher for distribution (B) than for distribution (A).

The district with the highest density of health workers in distribution (B) was Chandigarh (483.5 per lakh) and that with the lowest was South Garo Hills in Meghalaya (10.9) – see Table 4.1-(B). This indicates a 44-fold differential between the district with the highest and lowest density of health workers with more than secondary schooling. By contrast, there was a 10-fold differential between the *state* with the highest and lowest density of all health workers with more than secondary schooling (see section 3.3).

Table 4.1-(B) shows the lowest 30 and the highest 30 districts in distribution (B), i.e. districts ranked by density of health workers with more than secondary schooling. A majority (18) of the lowest 30 districts were now found in north-eastern states. Among the highest 30 districts in distribution (B), eight were in Kerala and eight in Delhi.

4.2 Allopathic doctors

We next consider the category of allopathic doctors, who form a subset of all health workers, and we examine all three distributions (A), (B), and (C) for them. Figure 4.3 presents a histogram of district densities of allopathic doctors for distribution (A) and an Epanechnikov kernel density estimate (with bandwidth 7.07). Like distribution (A) for all health workers, we find distribution (A) for allopathic doctors to be positively skewed. Using the cut-off national density of 61.5 per lakh population for distribution (A), we find 418 out of 593 districts (or 70.5%) with a density below the national mean (see Table 3.5.2).

Figure 4.4 shows the kernel density estimates of allopathic doctors for distribution (A) (with bandwidth 7.07), distribution (B) (with bandwidth 4.57) and distribution (C) (with bandwidth 3.86). The figure indicates greater skewness in distributions (B) and (C) than in distribution (A). In distribution (B), 441 out of 593 districts (or 74.4%) had a density lower than the mean density of (B) (42.2 per lakh population) (see Table 3.5.2). In distribution (C), 429 out of 593 districts (or 72.3%) had a density lower than the mean density of (C) (26.2 per lakh

10 Of Kolasib's 509 health workers, 422 or 82.9% were ancillary health professionals. Of these 422 workers, 356 workers or 84.4% were educated to secondary school level or less, and only five workers or 1.2% had a medical qualification.

11 As we noted in section 3.2, ancillary health professionals accounted for 68.6% of Mizoram's health workforce. Mizoram's health worker density *excluding* ancillary health professionals was 588.2 – 403.6 = 184.6 per lakh population (see Table 3.3.1).

Table 4.1-(A). All health workers with any level of education: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	Supaul	Bihar	53.7	30	Thrissur	Kerala	445.7
592	Madhepura	Bihar	53.8	29	North Goa	Goa	460.5
591	Balrampur	Uttar Pradesh	56.2	28	Hyderabad	Andhra Pradesh	465.1
590	Chatra	Jharkhand	59.0	27	North	Delhi	475.7
589	Jaisalmer	Rajasthan	59.6	26	East	Delhi	476.2
588	Barmer	Rajasthan	60.4	25	Chennai	Tamil Nadu	487.2
587	Jamui	Bihar	61.1	24	Mumbai (Suburban)	Maharashtra	492.5
586	Siddharthnagar	Uttar Pradesh	61.2	23	Andamans	Andaman & Nicobar Is.	499.9
585	Garhwa	Jharkhand	61.3	22	West	Delhi	503.7
584	Sheohar	Bihar	61.4	21	Imphal West	Manipur	507.2
583	Araria	Bihar	61.6	20	Papum Pare	Arunachal Pradesh	522.1
582	The Dangs	Gujarat	64.3	19	Pathanamthitta	Kerala	531.4
581	Ri Bhoi	Meghalaya	65.4	18	Lunglei	Mizoram	534.2
580	Pashchim Champaran	Bihar	67.3	17	Champhai	Mizoram	551.7
579	Shrawasti	Uttar Pradesh	67.6	16	Pondicherry	Pondicherry	552.9
578	Jalor	Rajasthan	68.3	15	Kolkata	West Bengal	559.8
577	Mahrajganj	Uttar Pradesh	68.3	14	Ernakulam	Kerala	567.3
576	Madhubani	Bihar	69.3	13	Nicobars	Andaman & Nicobar Is.	577.6
575	Nagaur	Rajasthan	69.9	12	Central	Delhi	605.2
574	Kaimur (Bhabua)	Bihar	71.5	11	South	Delhi	629.2
573	Banka	Bihar	71.9	10	East	Sikkim	644.4
572	Dohad	Gujarat	74.5	9	Leh (Ladakh)	Jammu & Kashmir	665.3
571	Saharsa	Bihar	76.3	8	Chandigarh	Chandigarh	683.7
570	Bahraich	Uttar Pradesh	76.4	7	Mahe	Pondicherry	687.0
569	Chitrakoot	Uttar Pradesh	77.4	6	Kottayam	Kerala	692.9
568	Kaushambi	Uttar Pradesh	77.5	5	Mumbai	Maharashtra	718.1
567	Kheri	Uttar Pradesh	77.9	4	New Delhi	Delhi	719.1
566	Sant Kabir Nagar	Uttar Pradesh	78.1	3	Aizawl	Mizoram	720.0
565	Chamarajanagar	Karnataka	79.3	2	Serchhip	Mizoram	766.8
564	Purba Champaran	Bihar	79.5	1	Kolasib	Mizoram	771.7

Table 4.1-(B). All health workers with more than secondary schooling: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	South Garo Hills	Meghalaya	10.9	30	Karaikal	Pondicherry	235.4
592	West Khasi Hills	Meghalaya	17.9	29	Idukki	Kerala	240.1
591	Tamenglong	Manipur	17.9	28	Mumbai (Suburban)	Maharashtra	241.2
590	Kokrajhar	Assam	18.9	27	Bhopal	Madhya Pradesh	245.7
589	Ri Bhoi	Meghalaya	19.2	26	Panchkula	Haryana	248.1
588	Mon	Nagaland	19.9	25	North West	Delhi	249.4
587	Jamui	Bihar	20.2	24	Srinagar	Jammu & Kashmir	253.6
586	Garhwa	Jharkhand	20.7	23	Lucknow	Uttar Pradesh	255.1
585	Dhubri	Assam	21.3	22	South West	Delhi	255.7
584	Banka	Bihar	21.7	21	Kollam	Kerala	256.7
583	Dindori	Madhya Pradesh	22.2	20	Alappuzha	Kerala	257.5
582	Supaul	Bihar	22.2	19	North	Delhi	267.0
581	Senapati	Manipur	22.4	18	Bangalore	Karnataka	270.3
580	Chatra	Jharkhand	22.5	17	Thrissur	Kerala	271.3
579	Madhepura	Bihar	23.1	16	Thiruvananthapuram	Kerala	274.5
578	Karbi Anglong	Assam	23.6	15	East	Delhi	287.2
577	Karimganj	Assam	23.7	14	Chennai	Tamil Nadu	289.3
576	Jaisalmer	Rajasthan	23.8	13	Imphal West	Manipur	295.7
575	East Garo Hills	Meghalaya	25.1	12	West	Delhi	306.2
574	Dhalai	Tripura	25.7	11	Pondicherry	Pondicherry	314.1
573	Darrang	Assam	25.9	10	Hyderabad	Andhra Pradesh	315.2
572	Tuensang	Nagaland	26.0	9	Pathanamthitta	Kerala	321.5
571	North Cachar Hills	Assam	26.1	8	Kolkata	West Bengal	325.1
570	Pashchim Champaran	Bihar	26.2	7	Mumbai	Maharashtra	340.0
569	Goalpara	Assam	26.2	6	Central	Delhi	363.9
568	Dhemaji	Assam	26.6	5	Ernakulam	Kerala	376.8
567	Jalor	Rajasthan	27.2	4	South	Delhi	385.1
566	Araria	Bihar	27.3	3	New Delhi	Delhi	402.0
565	Barmer	Rajasthan	27.6	2	Kottayam	Kerala	463.6
564	Uttar Dinajpur	West Bengal	27.7	1	Chandigarh	Chandigarh	483.5

Figure 4.3. District density of allopathic doctors: histogram (593 bins) and Epanechnikov kernel estimate

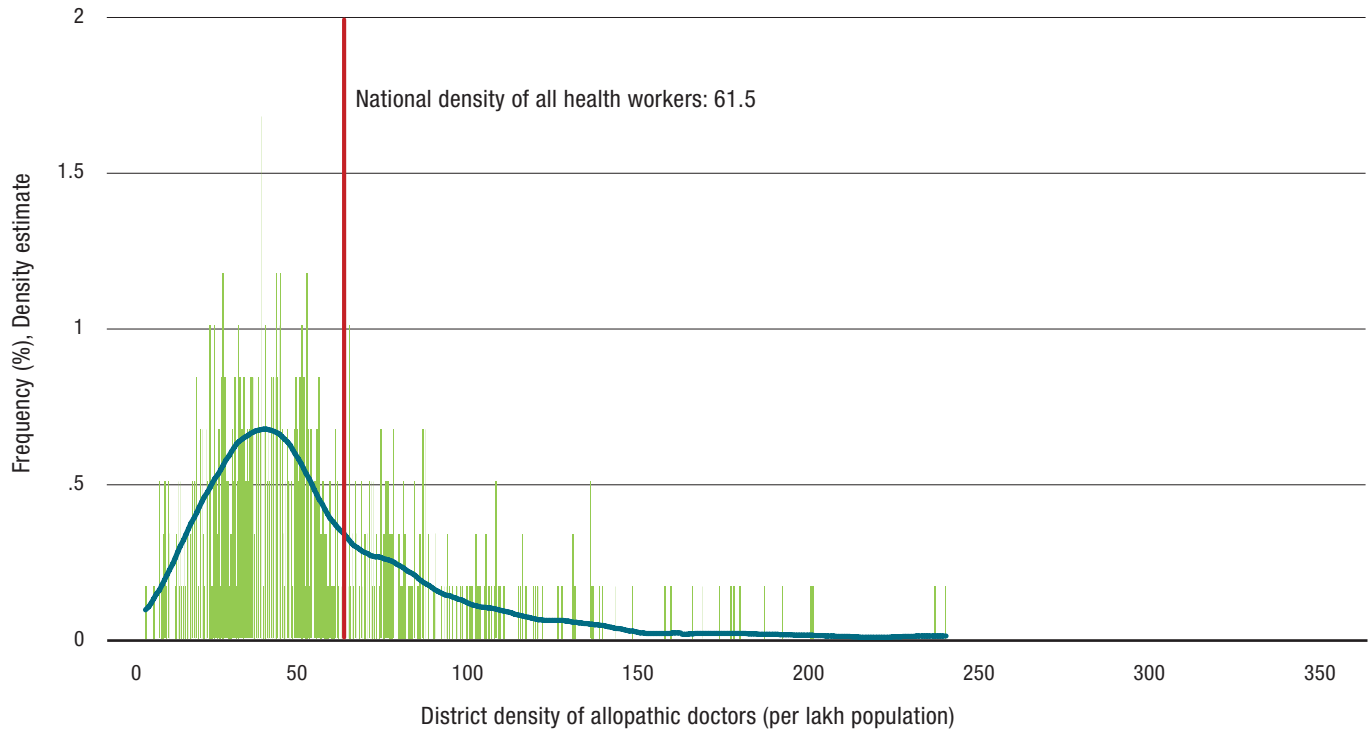
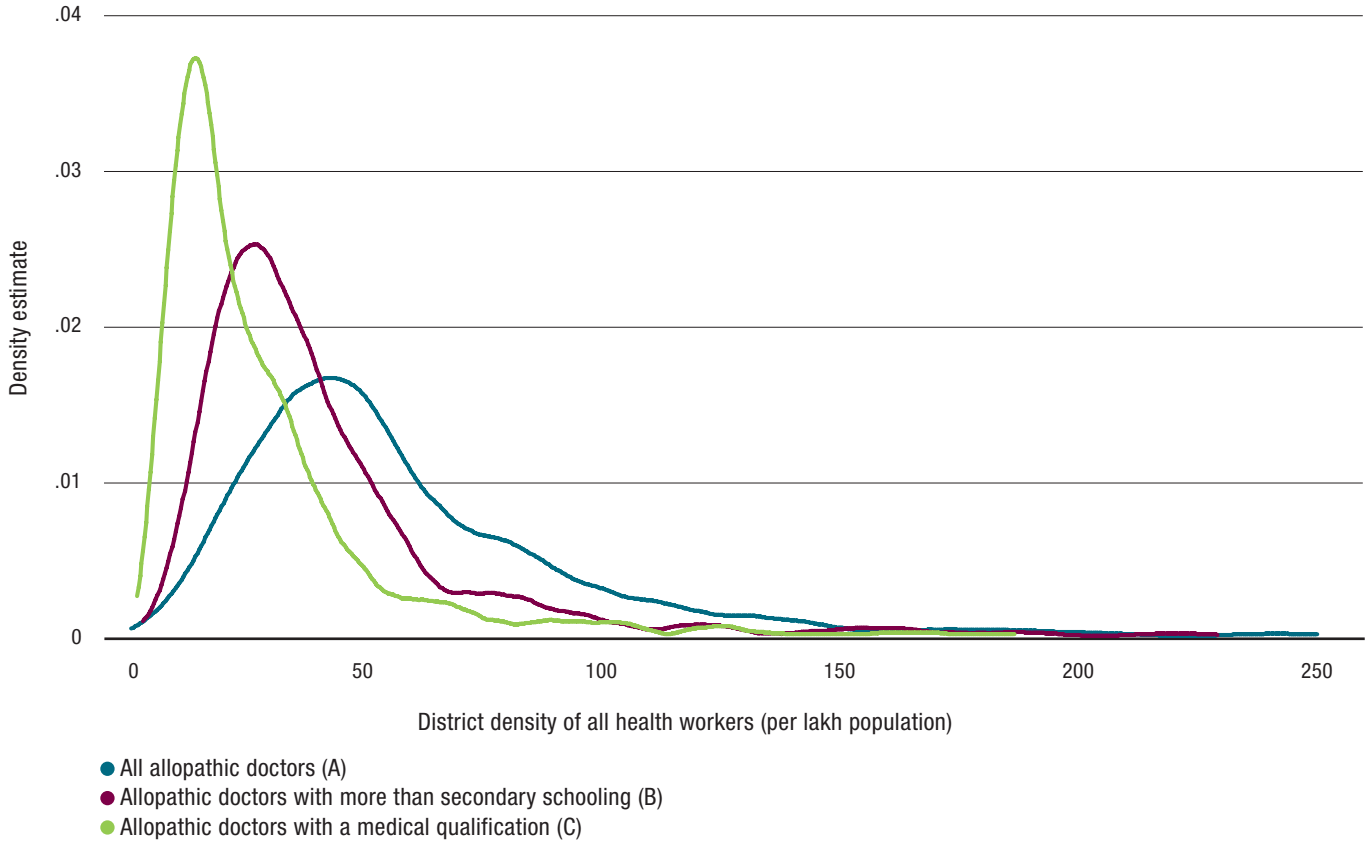


Figure 4.4. District density of allopathic doctors by education levels (A), (B), and (C): Epanechnikov kernel estimates



population) (see Table 3.5.2). The national interdistrict Gini coefficient for distribution (A) was 0.3093, for distribution (B) the Gini was 0.3706, and for distribution (C) the Gini was 0.4873 (see Table 3.5.2).

In distribution (A) of district densities of allopathic doctors, the district with the highest density was Chandigarh (242.2 per lakh population) and the district with the lowest density was South Garo Hills in Meghalaya (2.0 per lakh population) – see Table 4.2-(A). There was a 121-fold differential between the district with the highest and the lowest density of allopathic doctors. This contrasts with a 10-fold differential between the *state* with the highest and the lowest density (see section 3.3).

In distribution (B) of densities of allopathic doctors with more than secondary schooling, the district with the highest density was still Chandigarh (223.2 per lakh population) and the district with the lowest density remained South Garo Hills (2.0) – see Table 4.2-(B) – indicating a 112-fold differential. In contrast, there was an 11-fold differential between the *state* with the highest and the lowest density of allopathic doctors with more than secondary schooling (see section 3.3).

In distribution (C) of densities of allopathic doctors with a medical qualification, the district with the highest density was again Chandigarh (180.4 per lakh population) and the district with the lowest density was Tamenglong in Manipur (density 0.0) – see Table 4.2-(C). At the state level, there was a 17-fold differential between the state with the highest and the lowest density of allopathic doctors with a medical qualification (see section 3.3).

Instead of simply identifying the lowest-ranked and the highest-ranked district in each distribution, it is useful to investigate the lowest 30 and highest 30 districts at either end of distributions (A), (B) and (C). Health workers with a medical qualification (C) are a subset of those with more than secondary schooling (B), who in turn are a subset of those with any level of education (A). Hence, in moving from distribution (A) to (B) to (C) for any health worker category, we will observe successively smaller densities of health workers at the district level. However, because the reduction in densities will not be the same for each district, the relative ranking of districts can in general be different for (A), (B) and (C). (The relative rankings will be unaffected if the absolute reduction in density is the *same* for all districts.)

We now examine the changes in district rankings at the bottom and top ends of distributions (A), (B) and (C). This is done by examining the *overlap of districts* among the lowest 30 districts and among the highest 30 districts in each of distributions (A), (B) and (C). We also examine the change in district ranking across the *entire range* of distributions (A), (B) and (C) through Spearman rank correlation coefficients of the district densities.

We begin by looking at the composition of the lowest 30 and the highest 30 districts in each of distributions (A), (B) and (C). We go on to identify the overlap among the lowest 30 districts, and separately among the highest 30 districts, each in pair of distributions (A), (B) and (C). We define ℓ(A) as the set of 30 districts that have the lowest density in distribution (A), and h(A) as the set of 30 districts that have the highest density in distribution (A). The definitions of ℓ(B) and ℓ(C) are similar to that of ℓ(A), and the definitions of h(B) and h(C) are similar to that of h(A).

The overlap or intersection among the lowest 30 districts in distributions (A) and (B) is denoted as $\ell(A)\cap\ell(B)$, the overlap among the lowest 30 districts in (B) and (C) as $\ell(B)\cap\ell(C)$, the overlap among the lowest 30 districts in (C) and (A) as $\ell(C)\cap\ell(A)$ – and finally the overlap among the lowest 30 districts in (A), (B) and (C) as $\ell(A)\cap\ell(B)\cap\ell(C)$. Similarly, the overlap or intersection among the highest 30 districts in distributions (A) and (B) is denoted as $h(A)\cap h(B)$, the overlap among the highest 30 districts in (B) and (C) as $h(B)\cap h(C)$, the overlap among the highest 30 districts in (C) and (A) as $h(C)\cap h(A)$ – and finally the overlap among the highest 30 districts in (A), (B) and (C) as $h(A)\cap h(B)\cap h(C)$. This notation applies to distributions (A), (B) and (C) for each health worker category in section 4.

Table 4.2-(A) shows the lowest 30 and the highest 30 districts ranked by density of allopathic doctors with any level of education, i.e. it shows the sets ℓ(A) and h(A) in the left and right panels of the table, respectively. Half (15) of the lowest 30 districts are in the north-eastern

Table 4.2-(A). Allopathic doctors with any level of education: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	South Garo Hills	Meghalaya	2.0	30	Leh (Ladakh)	Jammu & Kashmir	121.1
592	West Khasi Hills	Meghalaya	4.7	29	Mumbai (Suburban)	Maharashtra	125.7
591	Ri Bhoi	Meghalaya	6.2	28	Gautam Buddha Nagar	Uttar Pradesh	127.0
590	Mamit	Mizoram	6.4	27	Gwalior	Madhya Pradesh	130.0
589	Senapati	Manipur	6.4	26	Patiala	Punjab	130.0
588	Dhalai	Tripura	7.1	25	Amritsar	Punjab	130.6
587	Debagarh	Orissa	7.3	24	Faridkot	Punjab	130.9
586	Dhubri	Assam	7.6	23	Bhopal	Madhya Pradesh	135.4
585	Malkangiri	Orissa	7.7	22	Ghaziabad	Uttar Pradesh	135.5
584	Kokrajhar	Assam	7.8	21	Meerut	Uttar Pradesh	135.6
583	Nabarangapur	Orissa	8.0	20	Imphal West	Manipur	135.7
582	Goalpara	Assam	8.4	19	Ludhiana	Punjab	136.1
581	Barmer	Rajasthan	8.6	18	Panchkula	Haryana	138.3
580	Kalahandi	Orissa	8.9	17	Jammu	Jammu & Kashmir	139.2
579	Tamenglong	Manipur	9.0	16	Jalandhar	Punjab	143.0
578	Mon	Nagaland	9.2	15	North West	Delhi	148.2
577	Jaisalmer	Rajasthan	9.4	14	Bangalore	Karnataka	157.7
576	Jashpur	Chhattisgarh	9.6	13	South West	Delhi	159.8
575	Changlang	Arunachal Pradesh	11.2	12	East	Delhi	166.4
574	Tuensang	Nagaland	11.3	11	Central	Delhi	168.9
573	Jalor	Rajasthan	11.6	10	Lucknow	Uttar Pradesh	174.5
572	Dindori	Madhya Pradesh	12.1	9	Chennai	Tamil Nadu	177.6
571	Rajsamand	Rajasthan	12.1	8	Kolkata	West Bengal	178.4
570	Nagaur	Rajasthan	12.1	7	West	Delhi	180.2
569	Kandhamal	Orissa	12.5	6	New Delhi	Delhi	187.6
568	Baudh	Orissa	12.6	5	Mumbai	Maharashtra	193.0
567	Jaintia Hills	Meghalaya	12.7	4	Srinagar	Jammu & Kashmir	201.3
566	East Garo Hills	Meghalaya	12.8	3	Hyderabad	Andhra Pradesh	202.2
565	Kawardha	Chhattisgarh	13.2	2	South	Delhi	238.6
564	The Dangs	Gujarat	13.4	1	Chandigarh	Chandigarh	242.2

Table 4.2-(B). Allopathic doctors with more than secondary schooling: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	South Garo Hills	Meghalaya	2.0	30	Jalandhar	Punjab	92.6
592	Nabarangapur	Orissa	3.0	29	Ernakulam	Kerala	94.5
591	Dhubri	Assam	3.8	28	Gautam Buddha Nagar	Uttar Pradesh	94.8
590	West Khasi Hills	Meghalaya	4.1	27	Ludhiana	Punjab	95.9
589	Malkangiri	Orissa	4.2	26	Shimla	Himachal Pradesh	96.3
588	Kokrajhar	Assam	4.2	25	Thiruvananthapuram	Kerala	97.0
587	Tamenglong	Manipur	4.5	24	Gwalior	Madhya Pradesh	99.4
586	Mamit	Mizoram	4.8	23	Indore	Madhya Pradesh	107.9
585	Mon	Nagaland	5.0	22	South Goa	Goa	108.5
584	Dhalai	Tripura	5.5	21	North Goa	Goa	112.8
583	Goalpara	Assam	5.7	20	Mumbai (Suburban)	Maharashtra	115.4
582	Debagarh	Orissa	5.8	19	Panchkula	Haryana	118.1
581	Barmer	Rajasthan	6.0	18	Jammu	Jammu & Kashmir	119.0
580	Ri Bhoi	Meghalaya	6.2	17	Imphal West	Manipur	119.0
579	Senapati	Manipur	6.4	16	North West	Delhi	124.2
578	Kalahandi	Orissa	6.7	15	Bhopal	Madhya Pradesh	125.5
577	Dindori	Madhya Pradesh	6.7	14	South West	Delhi	139.9
576	Lawngtlai	Mizoram	6.8	13	Bangalore	Karnataka	143.1
575	Jashpur	Chhattisgarh	6.9	12	East	Delhi	146.8
574	Changlang	Arunachal Pradesh	7.2	11	Central	Delhi	153.8
573	Jaisalmer	Rajasthan	7.7	10	Lucknow	Uttar Pradesh	154.1
572	Tuensang	Nagaland	7.7	9	West	Delhi	157.0
571	Punch	Jammu & Kashmir	8.1	8	Chennai	Tamil Nadu	157.4
570	Karimganj	Assam	8.2	7	Kolkata	West Bengal	164.4
569	Nagaur	Rajasthan	8.4	6	Mumbai	Maharashtra	168.4
568	Darrang	Assam	8.6	5	New Delhi	Delhi	177.5
567	Bongaigaon	Assam	8.8	4	Srinagar	Jammu & Kashmir	184.7
566	Bishnupur	Manipur	9.1	3	Hyderabad	Andhra Pradesh	190.2
565	Jalor	Rajasthan	9.2	2	South	Delhi	214.4
564	Champhai	Mizoram	9.2	1	Chandigarh	Chandigarh	223.2

Table 4.2-(C). Allopathic doctors with a medical qualification: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	Tamenglong	Manipur	0.0	30	Ahmadabad	Gujarat	71.2
592	Rudraprayag	Uttarakhand	0.9	29	Mahe	Pondicherry	73.3
591	Balrampur	Uttar Pradesh	1.1	28	Pondicherry	Pondicherry	74.4
590	Kaushambi	Uttar Pradesh	1.2	27	Shimla	Himachal Pradesh	79.2
589	Dindori	Madhya Pradesh	1.4	26	Indore	Madhya Pradesh	79.6
588	Kanpur Dehat	Uttar Pradesh	1.8	25	Kottayam	Kerala	80.2
587	Nabarangapur	Orissa	1.9	24	Panchkula	Haryana	85.2
586	Kannauj	Uttar Pradesh	1.9	23	Ernakulam	Kerala	85.7
585	South Garo Hills	Meghalaya	2.0	22	Thiruvananthapuram	Kerala	86.3
584	Siddharthnagar	Uttar Pradesh	2.2	21	North West	Delhi	87.7
583	Fatehpur	Uttar Pradesh	2.3	20	Mumbai (Suburban)	Maharashtra	88.7
582	Shrawasti	Uttar Pradesh	2.3	19	Bhopal	Madhya Pradesh	90.3
581	Chatra	Jharkhand	2.4	18	Lucknow	Uttar Pradesh	94.6
580	Supaul	Bihar	2.4	17	South Goa	Goa	95.7
579	Dhubri	Assam	2.4	16	North Goa	Goa	97.0
578	Sheopur	Madhya Pradesh	2.7	15	Jammu	Jammu & Kashmir	100.0
577	Araria	Bihar	2.7	14	East	Delhi	101.3
576	Janjgir - Champa	Chhattisgarh	2.7	13	Imphal West	Manipur	101.9
575	Mahrajganj	Uttar Pradesh	2.9	12	South West	Delhi	103.0
574	Kaimur (Bhabua)	Bihar	2.9	11	Central	Delhi	117.9
573	Malkangiri	Orissa	3.0	10	West	Delhi	118.1
572	Hardoi	Uttar Pradesh	3.1	9	Bangalore	Karnataka	118.2
571	Mainpuri	Uttar Pradesh	3.1	8	Mumbai	Maharashtra	120.8
570	Chitrakoot	Uttar Pradesh	3.1	7	Kolkata	West Bengal	127.1
569	Panna	Madhya Pradesh	3.2	6	Chennai	Tamil Nadu	127.8
568	Mamit	Mizoram	3.2	5	Srinagar	Jammu & Kashmir	141.0
567	Senapati	Manipur	3.2	4	New Delhi	Delhi	154.1
566	Kokrajhar	Assam	3.4	3	Hyderabad	Andhra Pradesh	161.7
565	Jamui	Bihar	3.4	2	South	Delhi	167.9
564	Mon	Nagaland	3.5	1	Chandigarh	Chandigarh	180.4

states; the remainder of the lowest 30 are in the central states. The highest 30 districts are generally "urban" districts in state capitals or in the national capital, Delhi. Among the highest 30 districts, 18 districts are in state capitals or in the national capital (there are seven in Delhi).

Table 4.2-(B) shows the lowest 30 and the highest 30 districts ranked by density of allopathic doctors with more than secondary schooling, i.e. the sets ℓ(B) and h(B). Among the lowest 30 districts, there are 19 from north-eastern states. States with the largest number of districts among the highest 30 are Delhi (seven out of its nine) and Madhya Pradesh (three).

Many of the *same* districts are found in the overlap among the lowest 30 in distributions (A) and (B), i.e. in ℓ(A)$\cap\ell$(B). A similar overlap obtains among the highest 30 in (A) and (B), viz. h(A)$\cap h$(B). The overlaps can be examined through a comparison of Tables 4.2-(A) and 4.2-(B). Among the lowest 30 districts in (A) and (B), 23 districts are the same, i.e. are in ℓ(A)$\cap\ell$(B); and 24 out of the highest 30 districts are common to (A) and (B), i.e. are in h(A)$\cap h$(B). See Table 4, which shows the number of common districts among the lowest 30 districts – and separately the number of common districts among the highest 30 districts – in distributions (A), (B) and (C) for allopathic doctors. (Similar statistics are provided in Table 4 for five other categories of health workers.) Of the 23 districts in common among the lowest 30 in distributions (A) and (B) for allopathic doctors, 13 are from north-eastern states. Of the 24 districts in common among the highest 30 in distributions (A) and (B) for allopathic doctors, 18 districts are in state capitals or the national capital.

Next, we consider the lowest 30 and highest 30 districts ranked by density of allopathic doctors with a medical qualification, i.e. the bottom and top ends of distribution (C) – see Table 4.2-(C). The majority of districts (18) among the lowest 30 districts, viz. those in ℓ (C), are found in the north-central states of Uttar Pradesh (11 districts), Bihar (four), and Madhya Pradesh (three). Among the highest 30 districts, there are seven in Delhi, the and others are mainly in state capitals.

There are 10 districts in common among the lowest 30 in distributions (B) and (C), i.e. are in ℓ(B)$\cap\ell$(C), and there are 10 districts in common among the lowest 30 in distributions (C) and (A), i.e. are in ℓ(C)$\cap\ell$(A) – compare Tables 4.2-(A), 4.2-(B) and 4.2-(C). There are also 10 districts in common among the lowest 30 in all *three* distributions, i.e. are in ℓ(A)$\cap\ell$(B)$\cap\ell$(C). (It must therefore follow that the 10 districts in ℓ(B)$\cap\ell$(C) must be the *same* as the 10 in ℓ(C)$\cap\ell$(A).) Of these 10 districts, seven are from north-eastern states, two from Orissa, and the 10th district is in Madhya Pradesh.

By contrast, among the highest 30 districts ranked by density of allopathic doctors with a medical qualification, i.e. distribution (C), there are 26 districts in common with the highest 30 in distribution (B), i.e. are in h(B)$\cap h$(C). There are 20 districts in common among the highest 30 in distributions (A) and (C), i.e. are in h(C)$\cap h$(A). There are also 20 districts in h(A)$\cap h$(B)$\cap h$(C) – see Table 4. It follows that the *same* 20 must also be in h(B)$\cap h$(C) and in h(A)$\cap h$(B). Of the 20 districts in common in all three rankings, only one is not a state capital, viz. Panchkula in Haryana. Compare Tables 4.2-(A), 4.2-(B) and 4.2-(C).

So far we have been comparing the composition and the overlap of the lowest 30 districts, and separately of the highest 30 districts, in the three distributions (A), (B) and (C). However, this comparison of the bottom and top ends of the distributions does not indicate the re-ranking of districts that may be taking place among the 533 districts (almost 90% of the total) that are *between* the top 30 districts and the bottom 30 districts of the distribution (593 – 60, i.e. 533). We get an indication of the re-rankings across all 593 districts by estimating the Spearman rank correlation coefficients between each pair of the distributions (A), (B) and (C).

The Spearman rank correlation coefficient between distributions (A) and (B) for allopathic doctors is large at 0.9076, which is consistent with the large overlaps found at the bottom and top ends of distributions (A) and (B) (23 districts at the bottom, and 24 districts at the top).

Table 4. Number of common districts among lowest 30, and among highest 30, districts ranked by health worker density in distributions (A), (B), and (C)

HEALTH WORKER CATEGORY	NUMBER OF COMMON DISTRICTS AMONG LOWEST 30 RANKED BY DISTRIBUTIONS (A), (B), AND (C)				NUMBER OF COMMON DISTRICTS AMONG HIGHEST 30 RANKED BY DISTRIBUTIONS (A), (B), AND (C)			
	$\ell(A)\cap\ell(B)$	$\ell(B)\cap\ell(C)$	$\ell(C)\cap\ell(A)$	$\ell(A)\cap\ell(B)\cap\ell(C)$	$h(A)\cap h(B)$	$h(B)\cap h(C)$	$h(C)\cap h(A)$	$h(A)\cap h(B)\cap h(C)$
Allopathic doctors	23	10	10	10	24	26	20	20
Nurses & midwives	16	4	5	1	19	22	18	16
Pharmacists	15	7	5	5	9	16	4	3
AYUSH doctors	23	25	23	22	23	26	21	21
All doctors	23	13	13	13	20	28	19	19
All doctors & nurses	15	15	13	10	23	27	25	23

Notes: For each health worker category, distribution (A) refers to health workers with any level of education, distribution (B) refers to those with more than secondary schooling, and distribution (C) refers to those with a medical qualification. The notation ℓ(A) refers to the set of 30 districts which have the lowest density in distribution (A), and h(A) refers to the set of 30 districts which have the highest density in distribution (A). The definitions of ℓ(B) and ℓ(C) are similar to that of ℓ(A), and the definitions of h(B) and h(C) are similar to that of h(A).

The Spearman rank correlation coefficient between distributions (B) and (C) for allopathic doctors is 0.8572, and between (C) and (A) it is 0.6602. The overlaps at the bottom end and top ends of distributions (B) and (C) are 10 and 26, respectively, and the overlaps at the bottom and top ends of distributions (C) and (A) are 10 and 20, respectively. These overlaps are consistent with the Spearman rank correlations observed between the same pairs of distributions.

4.3 Nurses and midwives

We next consider the category of nurses and midwives ("nurses"), which is a subset of all health workers, and consider distributions (A), (B) and (C) for nurses. Figure 4.5 shows a histogram of nurse densities for distribution (A) together with an Epanechnikov kernel density estimate (with bandwidth 8.70). Like the distributions of all health workers and of allopathic doctors, the distribution of nurses is positively skewed. We find that 373 out of 593 districts (or 62.9%) had a density lower than the national density of nurses for distribution (A) (61.3 per lakh population) – see Table 3.5.3.

For distribution (B) for nurses, 430 out of 593 districts (or 72.5%) had a density lower than the corresponding national density (20.2 per lakh population) – see Table 3.5.3. For distribution (C) for nurses, 472 out of 593 districts (or 79.6%) had a density lower than the mean of distribution (C) (6.1 per lakh population). For nurses, positive skewness seems to have increased in moving from distribution (A) to (B) to (C).

The national interdistrict Gini for nurses increased from 0.4014 for distribution (A) to 0.4302 for distribution (B), and rose dramatically to 0.7450 for distribution (C) – see Table 3.5.3. The fact that there were as many as 73 districts with a zero density in distribution (C), as mentioned below and shown in Table 4.3-(C), contributed to the very high level of inequality in distribution (C) for nurses.

The district with the highest density of nurses with any level of education (A) was Kottayam in Kerala at 396.6 per lakh population, and the district with the lowest density was Madhepura in Bihar at 4.8 per lakh population – see Table 4.3-(A) – indicating an 83-fold differential between the district with the highest and the lowest density.

In distribution (A) for nurses, all the lowest 30 districts were found in just three states: Bihar (17 districts), Uttar Pradesh (11), and Jharkhand (two). At the top end among the highest 30, there were seven districts from Kerala (out of its 14), and there were 13 districts that were in state capitals or in the national capital. Among the lowest 30 districts in distribution (A) for nurses, *none* were in common among the lowest 30 in distribution (A) for allopathic doctors. But among the highest 30 districts in distribution (A) for nurses, eight were in common with the highest 30 districts in distribution (A) for allopathic doctors – compare Tables 4.2-(A) and 4.3-(A). Across the entire range of distribution (A) for nurses and distribution (A) for allopathic doctors, the Spearman rank correlation coefficient is estimated to be 0.2017.

In distribution (B) for nurses with more than secondary schooling, the district with the highest density was again Kottayam in Kerala at 257.4 per lakh population – see Table 4.3-(B). At the bottom end, two districts – Lahul and Spiti in Himachal Pradesh and South Garo Hills in Meghalaya – had *no* nurses with more than secondary schooling. In distributions (A) and (B) for nurses, there were 16 districts in common among the lowest 30, and 19 districts in common among the highest 30 – see Table 4.

In distribution (C) for nurses with a medical qualification, as many as 73 districts had *no* nurses with a medical qualification – see Table 4.3-(C). These districts were mainly in Uttar Pradesh (21 districts), Bihar (17) and Jharkhand (six). The district with the highest density of nurses with a medical qualification was again Kottayam in Kerala (220.2 per lakh population).

Numerical information on overlaps between distributions (A), (B) and (C) for nurses at the bottom and top ends is shown in Table 4.

Figure 4.5. District density of nurses and midwives: histogram (593 bins) and Epanechnikov kernel estimate

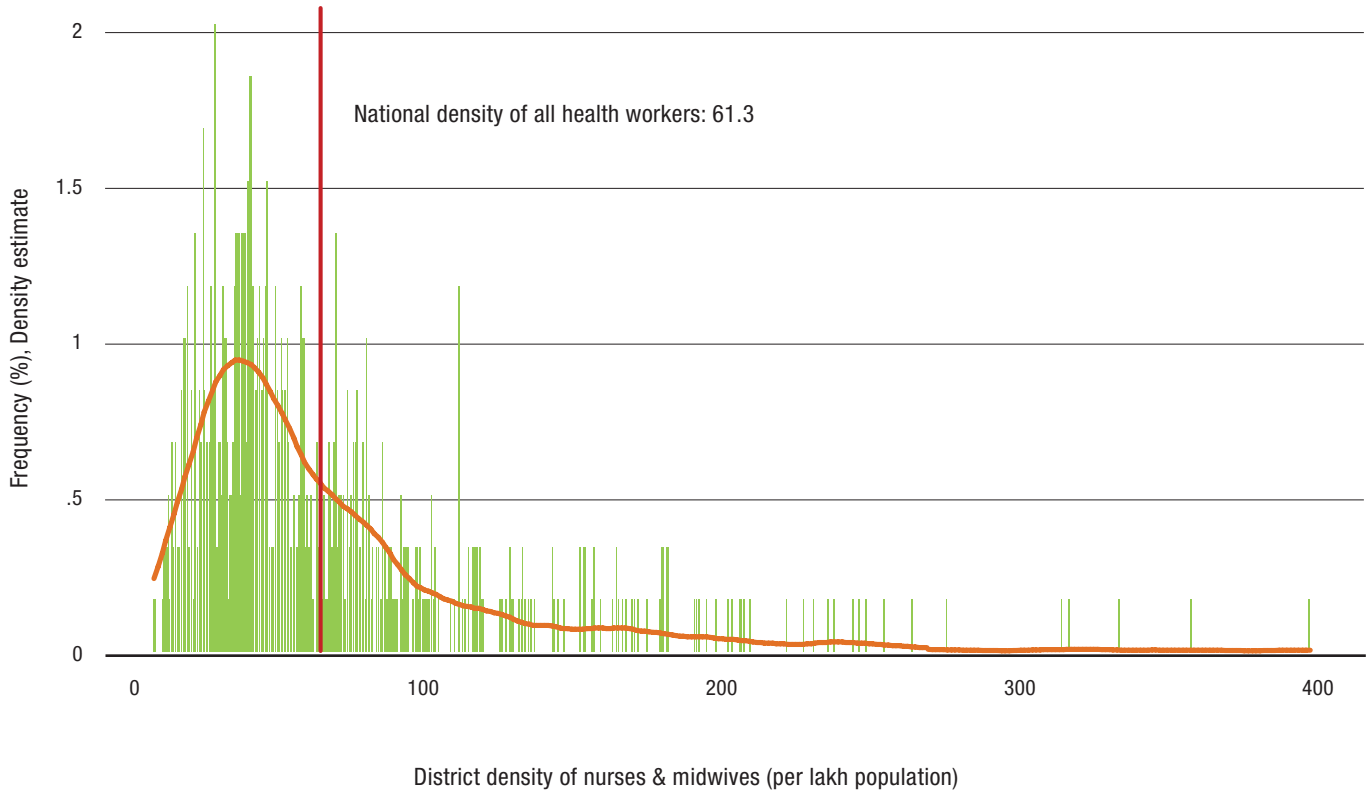


Table 4.3-(A). Nurses and midwives with any level of education: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	Madhepura	Bihar	4.8	30	Udupi	Karnataka	177.0
592	Supaul	Bihar	8.0	29	Aizawl	Mizoram	177.2
591	Siddharthnagar	Uttar Pradesh	8.3	28	Wokha	Nagaland	178.6
590	Jamui	Bihar	8.4	27	Kandhamal	Orissa	179.1
589	Sheohar	Bihar	8.9	26	Imphal West	Manipur	187.9
588	Chatra	Jharkhand	9.1	25	East	Sikkim	188.5
587	Kaimur (Bhabua)	Bihar	9.7	24	Kolkata	West Bengal	189.8
586	Araria	Bihar	9.8	23	Wayanad	Kerala	191.9
585	Balrampur	Uttar Pradesh	9.9	22	Mumbai (Suburban)	Maharashtra	195.8
584	Madhubani	Bihar	10.2	21	North Goa	Goa	199.7
583	Buxar	Bihar	11.1	20	South Goa	Goa	201.0
582	Kheri	Uttar Pradesh	11.2	19	North	Delhi	203.6
581	Saran	Bihar	11.3	18	Thrissur	Kerala	204.6
580	Ambedkar Nagar	Uttar Pradesh	11.3	17	Alappuzha	Kerala	206.7
579	Kushinagar	Uttar Pradesh	11.6	16	Karaikal	Pondicherry	219.0
578	Aurangabad	Bihar	11.6	15	South	Delhi	225.1
577	Sant Ravidas Nagar Bhadohi	Uttar Pradesh	12.4	14	Mokokchung	Nagaland	228.8
576	Purba Champaran	Bihar	12.4	13	Kohima	Nagaland	232.8
575	Etah	Uttar Pradesh	12.5	12	Idukki	Kerala	235.3
574	Saharsa	Bihar	12.5	11	Mahe	Pondicherry	241.7
573	Kaushambi	Uttar Pradesh	13.0	10	Papum Pare	Arunachal Pradesh	243.4
572	Khagaria	Bihar	13.3	9	Chandigarh	Chandigarh	246.5
571	Auraiya	Uttar Pradesh	13.9	8	Nicobars	Andaman & Nicobar Is.	252.0
570	Gopalganj	Bihar	14.0	7	Pondicherry	Pondicherry	261.8
569	Firozabad	Uttar Pradesh	14.3	6	Ernakulam	Kerala	273.6
568	Pashchim Champaran	Bihar	14.5	5	Pathanamthitta	Kerala	312.4
567	Banka	Bihar	14.5	4	Leh (Ladakh)	Jammu & Kashmir	314.8
566	Garhwa	Jharkhand	14.6	3	Mumbai	Maharashtra	331.8
565	Bhojpur	Bihar	14.7	2	New Delhi	Delhi	356.2
564	Kanpur Dehat	Uttar Pradesh	14.8	1	Kottayam	Kerala	396.6

Table 4.3-(B). Nurses and midwives with more than secondary schooling: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
592	Lahul & Spiti	Himachal Pradesh	0.0	30	Andamans	Andaman & Nicobar Is.	50.6
592	South Garo Hills	Meghalaya	0.0	29	Lakshadweep	Lakshadweep	51.1
591	Madhepura	Bihar	1.0	28	Mahe	Pondicherry	54.3
590	West	Sikkim	1.6	27	North Goa	Goa	54.3
589	Goalpara	Assam	1.8	26	Chennai	Tamil Nadu	54.4
588	Punch	Jammu & Kashmir	1.9	25	Coimbatore	Tamil Nadu	55.5
587	Chatra	Jharkhand	2.1	24	Kozhikode	Kerala	56.0
586	Kaimur (Bhabua)	Bihar	2.2	23	West	Delhi	56.2
585	Rajauri	Jammu & Kashmir	2.5	22	Bangalore	Karnataka	56.4
584	Supaul	Bihar	2.6	21	Kolkata	West Bengal	70.5
583	Siddharthnagar	Uttar Pradesh	2.6	20	Thiruvananthapuram	Kerala	72.8
582	Lawngtlai	Mizoram	2.7	19	Imphal West	Manipur	77.6
581	Dindori	Madhya Pradesh	2.9	18	Nicobars	Andaman & Nicobar Is.	78.4
580	Banka	Bihar	3.0	17	Mumbai	Maharashtra	80.4
579	Doda	Jammu & Kashmir	3.0	16	Ranchi	Jharkhand	80.4
578	Khagaria	Bihar	3.0	15	South	Delhi	82.4
577	Dhubri	Assam	3.2	14	North	Delhi	90.0
576	Aurangabad	Bihar	3.2	13	Wayanad	Kerala	95.4
575	Saharsa	Bihar	3.2	12	Central	Delhi	96.2
574	Kokrajhar	Assam	3.4	11	Karaikal	Pondicherry	97.2
573	Buxar	Bihar	3.4	10	Kollam	Kerala	98.1
572	Madhubani	Bihar	3.5	9	Thrissur	Kerala	103.3
571	Golaghat	Assam	3.6	8	Alappuzha	Kerala	108.1
570	Kannauj	Uttar Pradesh	3.7	7	Pondicherry	Pondicherry	121.3
569	Kheri	Uttar Pradesh	3.7	6	Chandigarh	Chandigarh	129.6
568	Jamui	Bihar	3.7	5	Idukki	Kerala	132.4
567	Shivpuri	Madhya Pradesh	3.7	4	New Delhi	Delhi	132.9
566	Balrampur	Uttar Pradesh	3.9	3	Ernakulam	Kerala	160.4
565	Garhwa	Jharkhand	4.1	2	Pathanamthitta	Kerala	168.2
564	Bhojpur	Bihar	4.1	1	Kottayam	Kerala	257.4

Table 4.3-(C). Nurses and midwives with a medical qualification: ranking of districts by density – lowest 73 and highest 17 districts

LOWEST 73 DISTRICTS			
Rank	District	State	Density per lakh pop'n
520	Upper Subansiri	Arunachal Pradesh	0.0
520	East Kameng	Arunachal Pradesh	0.0
520	Hailakandi	Assam	0.0
520	Karimganj	Assam	0.0
520	Goalpara	Assam	0.0
520	North Cachar Hills	Assam	0.0
520	Sheohar	Bihar	0.0
520	Buxar	Bihar	0.0
520	Nawada	Bihar	0.0
520	Sheikhpura	Bihar	0.0
520	Vaishali	Bihar	0.0
520	Saran	Bihar	0.0
520	Lakhisarai	Bihar	0.0
520	Saharsa	Bihar	0.0
520	Kaimur (Bhabua)	Bihar	0.0
520	Purnia	Bihar	0.0
520	Madhubani	Bihar	0.0
520	Araria	Bihar	0.0
520	Katihar	Bihar	0.0
520	Banka	Bihar	0.0
520	Supaul	Bihar	0.0
520	Madhepura	Bihar	0.0
520	Jamui	Bihar	0.0
520	Lahul & Spiti	Himachal Pradesh	0.0
520	Kinnaur	Himachal Pradesh	0.0
520	Kullu	Himachal Pradesh	0.0
520	Rajauri	Jammu & Kashmir	0.0
520	Kargil	Jammu & Kashmir	0.0
520	Kupwara	Jammu & Kashmir	0.0
520	Punch	Jammu & Kashmir	0.0
520	Chatra	Jharkhand	0.0
520	Kodarma	Jharkhand	0.0
520	Pakaur	Jharkhand	0.0
520	Garhwa	Jharkhand	0.0
520	Lohardaga	Jharkhand	0.0
520	Giridih	Jharkhand	0.0
520	Dhar	Madhya Pradesh	0.0
520	Dindori	Madhya Pradesh	0.0
520	Tamenglong	Manipur	0.0
520	Ukhrul	Manipur	0.0
520	South Garo Hills	Meghalaya	0.0
520	East Garo Hills	Meghalaya	0.0
520	Lawngtlai	Mizoram	0.0
520	Mon	Nagaland	0.0
520	Malkangiri	Orissa	0.0
520	Bundi	Rajasthan	0.0

LOWEST 73 DISTRICTS (CONTINUED)			
Rank	District	State	Density per lakh pop'n
520	Jaisalmer	Rajasthan	0.0
520	West	Sikkim	0.0
520	Dhalai	Tripura	0.0
520	Baghpat	Uttar Pradesh	0.0
520	Mahoba	Uttar Pradesh	0.0
520	Auraiya	Uttar Pradesh	0.0
520	Kannauj	Uttar Pradesh	0.0
520	Farrukhabad	Uttar Pradesh	0.0
520	Hathras	Uttar Pradesh	0.0
520	Banda	Uttar Pradesh	0.0
520	Lalitpur	Uttar Pradesh	0.0
520	Deoria	Uttar Pradesh	0.0
520	Fatehpur	Uttar Pradesh	0.0
520	Unnao	Uttar Pradesh	0.0
520	Kaushambi	Uttar Pradesh	0.0
520	Etah	Uttar Pradesh	0.0
520	Sitapur	Uttar Pradesh	0.0
520	Ambedkar Nagar	Uttar Pradesh	0.0
520	Kanpur Dehat	Uttar Pradesh	0.0
520	Ghazipur	Uttar Pradesh	0.0
520	Mahrajganj	Uttar Pradesh	0.0
520	Shrawasti	Uttar Pradesh	0.0
520	Bageshwar	Uttarakhand	0.0
520	Pithoragarh	Uttarakhand	0.0
520	Rudraprayag	Uttarakhand	0.0
520	Dakshin Dinajpur	West Bengal	0.0
520	Uttar Dinajpur	West Bengal	0.0

HIGHEST 17 DISTRICTS			
17	Kozhikode	Kerala	42.2
16	North	Delhi	51.4
15	Thiruvananthapuram	Kerala	52.0
14	Karaikal	Pondicherry	53.3
13	Central	Delhi	62.8
12	Chandigarh	Chandigarh	64.6
11	Wayanad	Kerala	67.4
10	Kollam	Kerala	69.8
9	Pondicherry	Pondicherry	72.3
8	Nicobars	Andaman & Nicobar Is.	73.7
7	New Delhi	Delhi	78.2
6	Alappuzha	Kerala	87.8
5	Thrissur	Kerala	88.4
4	Idukki	Kerala	109.5
3	Ernakulam	Kerala	135.9
2	Pathanamthitta	Kerala	144.8
1	Kottayam	Kerala	220.2

4.4 Other health worker categories: pharmacists, AYUSH doctors and dentists

Finally, we consider the health worker categories of pharmacists, AYUSH doctors, and dental practitioners – but leave out the heterogeneous category of ancillary health professionals and the small category of traditional and faith healers. Unlike ancillary health professionals, pharmacists are a relatively homogeneous category and are sometimes seen as substitutes for doctors. The category of AYUSH doctors consists of practitioners of three distinct systems of medicine, and all are counted as physicians. We include dental practitioners because their extremely low availability per capita leaves very large groups of the national population unserved, as shown below.

In distribution (A) for pharmacists, the districts with the highest densities were Leh (Ladakh) in Jammu and Kashmir (152.7 per lakh population), Lahul and Spiti in Himachal Pradesh (150.5), and Kargil in Jammu and Kashmir (121.5). Indeed, eight of Jammu and Kashmir's 14 districts and six of Himachal Pradesh's 12 districts were among the highest 30 districts in distribution (A) for pharmacists – see Table 4.4-(A). This is consistent with the states of Jammu and Kashmir and Himachal Pradesh having the highest *state* densities of pharmacists (49.9 and 52.6 per lakh population, respectively) – see Table 3.3.1. Of the lowest 30 districts in distribution (A) for pharmacists, six were found in Chhattisgarh (which had a low state density of pharmacists of 12.4 per lakh population – see Table 3.3.1), five in West Bengal, and four each in Orissa and Karnataka. See Table 4.4-(B) for the lowest 30 and highest 30 districts ranked by density of pharmacists with more than secondary schooling.

For AYUSH doctors in distribution (A), there were 18 districts with a zero density – 16 of which were in the north-eastern states – see Table 4.5-(A). The district with the highest density of AYUSH doctors in *each* of distributions (A), (B) and (C) was Pune in Maharashtra – see Tables 4.5-(A), 4.5-(B) and 4.5-(C). Among the highest 30 districts in distribution (A), there were 10 in Maharashtra, six in Kerala, and three each in West Bengal and Delhi.

For AYUSH doctors with more than secondary schooling (distribution (B)), there were 25 districts with zero density (Table 4.5-(B)); and for those with a medical qualification (C), there were 32 districts with zero density (Table 4.5-(C)). Among the highest 30 districts in distribution (B), Maharashtra had 15 and Kerala six – see Table 4.5-(B). In distribution (C) for AYUSH doctors, the top 10 districts were all from Maharashtra – see Table 4.5-(C).

Lastly, we consider the category of dental practitioners. The national density of dental practitioners (A) was just 2.4 per lakh population (see Tables 2.1 and 3.3.1). There were 420 districts out of 593 (or 71%) that had a density below the national mean of 2.4 (see Table 3.5.6), and 58 of those districts had *zero* density – see Table 4.6-(A). Distribution (A) for dental practitioners yielded a Gini coefficient of 0.5604 (Table 3.5.6).

In moving from distribution (A) to (B) to (C) for dental practitioners, the number of districts below the corresponding national mean density rose from 420 to 430 to 445, respectively (see Table 3.5.6). In this move from (A) to (B) to (C), the number of districts with *no* dentists also rose sharply: 58 districts had no dentists at all (A); 88 districts had no dentists with more than secondary schooling (B); and 175 districts had no dentists with a medical qualification (C) – see Tables 4.6-(A), 4.6-(B), and 4.6-(C). The increase in districts with *zero* density of dentists in going from distribution (A) to (B) to (C) contributed to the Gini rising from 0.5604 for distribution (A) to 0.6127 for distribution (B) and to 0.7003 for distribution (C) – see Table 3.5.6. In summary, the extremely low availability of dentists in the country left 30% of districts in the nation (175/593) *completely unserved* with a medically qualified dental practitioner.

Table 4.4-(A). Pharmacists with any level of education: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
593	Uttar Dinajpur	West Bengal	1.2	30	Srinagar	Jammu & Kashmir	47.6
592	Koppal	Karnataka	1.3	29	Nainital	Uttarakhand	48.2
591	Baudh	Orissa	1.3	28	Pulwama	Jammu & Kashmir	49.0
590	Lawngtlai	Mizoram	1.4	27	Kota	Rajasthan	49.3
589	Chamarajanagar	Karnataka	2.0	26	North	Delhi	50.5
588	Dakshin Dinajpur	West Bengal	2.4	25	West	Delhi	50.8
587	The Dangs	Gujarat	2.7	24	Una	Himachal Pradesh	51.1
586	Janjgir - Champa	Chhattisgarh	2.7	23	Gwalior	Madhya Pradesh	51.5
585	Koch Bihar	West Bengal	3.0	22	Punch	Jammu & Kashmir	51.5
584	Senapati	Manipur	3.2	21	South	Delhi	53.7
583	West Khasi Hills	Meghalaya	3.4	20	Mandi	Himachal Pradesh	53.8
582	Maldah	West Bengal	3.6	19	Imphal West	Manipur	54.2
581	Viluppuram	Tamil Nadu	3.7	18	Bilaspur	Himachal Pradesh	54.3
580	Korba	Chhattisgarh	3.9	17	Mokokchung	Nagaland	55.6
579	Sonapur	Orissa	3.9	16	North West	Delhi	56.6
578	Ganganagar	Rajasthan	4.0	15	Nicobars	Andaman & Nicobar Is.	57.1
577	Kodagu	Karnataka	4.2	14	Ahmadabad	Gujarat	58.7
576	Murshidabad	West Bengal	4.3	13	Kohima	Nagaland	58.7
575	Tamenglong	Manipur	4.5	12	Hamirpur	Himachal Pradesh	58.9
574	Balrampur	Uttar Pradesh	4.5	11	Jammu	Jammu & Kashmir	60.1
573	Debagarh	Orissa	4.7	10	Mumbai	Maharashtra	62.5
572	West	Sikkim	4.9	9	Doda	Jammu & Kashmir	65.8
571	Malkangiri	Orissa	5.0	8	Dimapur	Nagaland	71.2
570	Raigarh	Chhattisgarh	5.0	7	Kathua	Jammu & Kashmir	75.4
569	Kanpur Dehat	Uttar Pradesh	5.3	6	Mahe	Pondicherry	78.7
568	Jashpur	Chhattisgarh	5.4	5	Shimla	Himachal Pradesh	79.4
567	Ariyalur	Tamil Nadu	5.8	4	Wokha	Nagaland	94.3
566	Bilaspur	Chhattisgarh	5.8	3	Kargil	Jammu & Kashmir	121.5
565	Haveri	Karnataka	5.8	2	Lahul & Spiti	Himachal Pradesh	150.5
564	Dantewada	Chhattisgarh	5.8	1	Leh (Ladakh)	Jammu & Kashmir	152.7

Table 4.4-(B). Pharmacists with more than secondary schooling: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
582	Lahul & Spiti	Himachal Pradesh	0.0	30	Lucknow	Uttar Pradesh	19.0
582	Kodagu	Karnataka	0.0	29	Kinnaur	Himachal Pradesh	19.1
582	Chandel	Manipur	0.0	28	Sangrur	Punjab	19.2
582	Senapati	Manipur	0.0	27	Uttarkashi	Uttarakhand	19.3
582	Tamenglong	Manipur	0.0	26	North	Delhi	19.3
582	South Garo Hills	Meghalaya	0.0	25	Srinagar	Jammu & Kashmir	20.0
582	West Khasi Hills	Meghalaya	0.0	24	Kollam	Kerala	20.4
582	Lawngtlai	Mizoram	0.0	23	Rohtak	Haryana	20.5
582	Saiha	Mizoram	0.0	22	Almora	Uttarakhand	21.1
582	Serchhip	Mizoram	0.0	21	West	Delhi	21.1
582	Baudh	Orissa	0.0	20	Ukhrul	Manipur	21.3
582	North	Sikkim	0.0	19	North West	Delhi	21.7
581	Koppal	Karnataka	0.3	18	Kozhikode	Kerala	22.1
580	West Garo Hills	Meghalaya	0.4	17	Alappuzha	Kerala	22.5
579	Uttar Dinajpur	West Bengal	0.5	16	Imphal East	Manipur	22.5
578	Dakshin Dinajpur	West Bengal	0.5	15	Patna	Bihar	22.5
577	South	Sikkim	0.8	14	Rupnagar	Punjab	23.5
576	East Garo Hills	Meghalaya	0.8	13	Chamoli	Uttarakhand	24.0
575	West	Sikkim	0.8	12	Pondicherry	Pondicherry	24.1
574	Ratnagiri	Maharashtra	0.8	11	Bilaspur	Himachal Pradesh	24.3
573	Pakaur	Jharkhand	0.9	10	Pathanamthitta	Kerala	24.4
572	Murshidabad	West Bengal	0.9	9	Wayanad	Kerala	25.7
571	Champhai	Mizoram	0.9	8	Thrissur	Kerala	26.0
570	Jamui	Bihar	1.0	7	Chandigarh	Chandigarh	26.9
569	Sant Ravidas Nagar Bhadohi	Uttar Pradesh	1.0	6	Mahe	Pondicherry	27.2
568	Koch Bihar	West Bengal	1.0	5	Imphal West	Manipur	27.7
567	Garhwa	Jharkhand	1.1	4	Ernakulam	Kerala	28.3
566	Dantewada	Chhattisgarh	1.1	3	Shimla	Himachal Pradesh	28.4
565	Ganganagar	Rajasthan	1.1	2	Kottayam	Kerala	29.4
564	Janjgir - Champa	Chhattisgarh	1.1	1	Nicobars	Andaman & Nicobar Is.	35.7

Table 4.5-(A). AYUSH doctors with any level of education: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
576	Upper Siang	Arunachal Pradesh	0.0	30	Chandigarh	Chandigarh	37.8
576	The Dangs	Gujarat	0.0	29	Thiruvananthapuram	Kerala	37.8
576	Tamenglong	Manipur	0.0	28	Hardwar	Uttarakhand	37.9
576	Chandel	Manipur	0.0	27	Buldana	Maharashtra	38.0
576	Bishnupur	Manipur	0.0	26	North East	Delhi	38.5
576	Ukhrul	Manipur	0.0	25	Hugli	West Bengal	39.6
576	Churachandpur	Manipur	0.0	24	Satara	Maharashtra	39.8
576	East Garo Hills	Meghalaya	0.0	23	Thane	Maharashtra	40.0
576	Ri Bhoi	Meghalaya	0.0	22	Panchkula	Haryana	40.1
576	South Garo Hills	Meghalaya	0.0	21	Nagpur	Maharashtra	40.7
576	Mamit	Mizoram	0.0	20	Nadia	West Bengal	40.9
576	Lawngtlai	Mizoram	0.0	19	Kollam	Kerala	42.1
576	Serchhip	Mizoram	0.0	18	Una	Himachal Pradesh	42.2
576	Mon	Nagaland	0.0	17	Ahmadnagar	Maharashtra	42.2
576	Zunheboto	Nagaland	0.0	16	East	Delhi	42.8
576	Yanam	Pondicherry	0.0	15	Hamirpur	Himachal Pradesh	43.1
576	West	Sikkim	0.0	14	North 24 Parganas	West Bengal	44.1
576	North	Sikkim	0.0	13	Kurukshetra	Haryana	44.5
575	Tuensang	Nagaland	0.2	12	Sangli	Maharashtra	45.2
574	Mokokchung	Nagaland	0.4	11	Nashik	Maharashtra	45.2
573	Lunglei	Mizoram	0.7	10	Mumbai (Suburban)	Maharashtra	45.4
572	South	Sikkim	0.8	9	Mahe	Pondicherry	46.2
571	Chamarajanagar	Karnataka	0.8	8	Central	Delhi	48.0
570	West Siang	Arunachal Pradesh	1.0	7	Pathanamthitta	Kerala	48.0
569	Lower Subansiri	Arunachal Pradesh	1.0	6	Kolhapur	Maharashtra	48.8
568	Jaintia Hills	Meghalaya	1.3	5	Kottayam	Kerala	48.9
567	West Kameng	Arunachal Pradesh	1.3	4	North Tripura	Tripura	49.2
566	Kolasib	Mizoram	1.5	3	Ernakulam	Kerala	51.1
565	Saiha	Mizoram	1.6	2	Alappuzha	Kerala	52.4
564	Kargil	Jammu & Kashmir	1.7	1	Pune	Maharashtra	54.8

Table 4.5-(B). AYUSH doctors with more than secondary schooling: ranking of districts by density – lowest 30 and highest 30 districts

LOWEST 30 DISTRICTS				HIGHEST 30 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
569	Nicobars	Andaman & Nicobar Is.	0.0	30	West	Delhi	30.5
569	Upper Siang	Arunachal Pradesh	0.0	29	Thiruvananthapuram	Kerala	30.8
569	North Cachar Hills	Assam	0.0	28	Ratnagiri	Maharashtra	31.5
569	The Dangs	Gujarat	0.0	27	Panchkula	Haryana	31.6
569	Tamenglong	Manipur	0.0	26	Pathanamthitta	Kerala	31.8
569	Chandel	Manipur	0.0	25	Kurukshetra	Haryana	32.0
569	Bishnupur	Manipur	0.0	24	Surat	Gujarat	32.2
569	Ukhrul	Manipur	0.0	23	Mumbai	Maharashtra	32.7
569	Churachandpur	Manipur	0.0	22	Chandigarh	Chandigarh	33.2
569	Senapati	Manipur	0.0	21	Aurangabad	Maharashtra	33.2
569	East Garo Hills	Meghalaya	0.0	20	Sindhudurg	Maharashtra	33.4
569	Ri Bhoi	Meghalaya	0.0	19	Una	Himachal Pradesh	33.5
569	South Garo Hills	Meghalaya	0.0	18	Kottayam	Kerala	33.9
569	Jaintia Hills	Meghalaya	0.0	17	Alappuzha	Kerala	35.2
569	Mamit	Mizoram	0.0	16	Kollam	Kerala	35.3
569	Lawngtlai	Mizoram	0.0	15	Amravati	Maharashtra	35.3
569	Serchhip	Mizoram	0.0	14	Buldana	Maharashtra	35.3
569	Champhai	Mizoram	0.0	13	Hamirpur	Himachal Pradesh	35.9
569	Mon	Nagaland	0.0	12	East	Delhi	35.9
569	Zunheboto	Nagaland	0.0	11	Thane	Maharashtra	36.9
569	Tuensang	Nagaland	0.0	10	Nagpur	Maharashtra	37.4
569	Mokokchung	Nagaland	0.0	9	Satara	Maharashtra	38.5
569	Yanam	Pondicherry	0.0	8	Ernakulam	Kerala	38.7
569	West	Sikkim	0.0	7	Central	Delhi	39.6
569	North	Sikkim	0.0	6	Ahmadnagar	Maharashtra	41.1
568	Shrawasti	Uttar Pradesh	0.7	5	Mumbai (Suburban)	Maharashtra	41.2
567	Lohit	Arunachal Pradesh	0.7	4	Nashik	Maharashtra	43.4
566	Lunglei	Mizoram	0.7	3	Sangli	Maharashtra	43.9
565	South	Sikkim	0.8	2	Kolhapur	Maharashtra	46.2
564	Changlang	Arunachal Pradesh	0.8	1	Pune	Maharashtra	53.2

Table 4.5-(C). AYUSH doctors with a medical qualification: ranking of districts by density – lowest 32 and highest 28 districts

LOWEST 32 DISTRICTS				HIGHEST 28 DISTRICTS			
Rank	District	State	Density per lakh pop'n	Rank	District	State	Density per lakh pop'n
562	Nicobars	Andaman & Nicobar Is.	0.0	28	Kottayam	Kerala	27.3
562	Upper Siang	Arunachal Pradesh	0.0	27	Kurukshetra	Haryana	27.6
562	Tawang	Arunachal Pradesh	0.0	26	Ratnagiri	Maharashtra	27.9
562	North Cachar Hills	Assam	0.0	25	East	Delhi	28.0
562	Banka	Bihar	0.0	24	Panchkula	Haryana	28.2
562	The Dangs	Gujarat	0.0	23	Una	Himachal Pradesh	28.6
562	Kargil	Jammu & Kashmir	0.0	22	Alappuzha	Kerala	28.8
562	Leh (Ladakh)	Jammu & Kashmir	0.0	21	Mumbai	Maharashtra	28.8
562	Kodarma	Jharkhand	0.0	20	Nandurbar	Maharashtra	29.0
562	Tamenglong	Manipur	0.0	19	Chandigarh	Chandigarh	29.1
562	Chandel	Manipur	0.0	18	Dhule	Maharashtra	29.5
562	Bishnupur	Manipur	0.0	17	Hamirpur	Himachal Pradesh	29.6
562	Ukhrul	Manipur	0.0	16	Sindhudurg	Maharashtra	29.7
562	Churachandpur	Manipur	0.0	15	Kollam	Kerala	30.1
562	Senapati	Manipur	0.0	14	Aurangabad	Maharashtra	31.5
562	East Garo Hills	Meghalaya	0.0	13	Ernakulam	Kerala	31.6
562	Ri Bhoi	Meghalaya	0.0	12	Buldana	Maharashtra	32.6
562	South Garo Hills	Meghalaya	0.0	11	Central	Delhi	33.7
562	Jaintia Hills	Meghalaya	0.0	10	Thane	Maharashtra	33.9
562	West Khasi Hills	Meghalaya	0.0	9	Amravati	Maharashtra	34.1
562	Mamit	Mizoram	0.0	8	Nagpur	Maharashtra	34.4
562	Lawngtlai	Mizoram	0.0	7	Satara	Maharashtra	36.7
562	Serchhip	Mizoram	0.0	6	Mumbai (Suburban)	Maharashtra	36.9
562	Champhai	Mizoram	0.0	5	Ahmadnagar	Maharashtra	39.7
562	Lunglei	Mizoram	0.0	4	Sangli	Maharashtra	41.1
562	Mon	Nagaland	0.0	3	Nashik	Maharashtra	41.6
562	Zunheboto	Nagaland	0.0	2	Kolhapur	Maharashtra	44.3
562	Tuensang	Nagaland	0.0	1	Pune	Maharashtra	51.2
562	Mokokchung	Nagaland	0.0				
562	Yanam	Pondicherry	0.0				
562	West	Sikkim	0.0				
562	North	Sikkim	0.0				

Table 4.6-(A). Dental practitioners with any level of education: ranking of districts by density – lowest 60 and highest 30 districts

LOWEST 60 DISTRICTS			
Rank	District	State	Density per lakh pop'n
536	Upper Subansiri	Arunachal Pradesh	0.0
536	Lower Subansiri	Arunachal Pradesh	0.0
536	Upper Siang	Arunachal Pradesh	0.0
536	North Cachar Hills	Assam	0.0
536	Goalpara	Assam	0.0
536	Marigaon	Assam	0.0
536	Jamui	Bihar	0.0
536	Banka	Bihar	0.0
536	Sheohar	Bihar	0.0
536	Katihar	Bihar	0.0
536	Lakhisarai	Bihar	0.0
536	Saharsa	Bihar	0.0
536	Sheikhpura	Bihar	0.0
536	Kanker	Chhattisgarh	0.0
536	Mahasamund	Chhattisgarh	0.0
536	Dhamtari	Chhattisgarh	0.0
536	The Dangs	Gujarat	0.0
536	Narmada	Gujarat	0.0
536	Lahul & Spiti	Himachal Pradesh	0.0
536	Kinnaur	Himachal Pradesh	0.0
536	Kargil	Jammu & Kashmir	0.0
536	Pakaur	Jharkhand	0.0
536	Garhwa	Jharkhand	0.0
536	Giridih	Jharkhand	0.0
536	Sahibganj	Jharkhand	0.0
536	Lohardaga	Jharkhand	0.0
536	Umaria	Madhya Pradesh	0.0
536	Dindori	Madhya Pradesh	0.0
536	Vidisha	Madhya Pradesh	0.0
536	Balaghat	Madhya Pradesh	0.0
536	Morena	Madhya Pradesh	0.0
536	Betul	Madhya Pradesh	0.0
536	Tikamgarh	Madhya Pradesh	0.0
536	Datia	Madhya Pradesh	0.0
536	Harda	Madhya Pradesh	0.0
536	Sheopur	Madhya Pradesh	0.0
536	Senapati	Manipur	0.0
536	Tamenglong	Manipur	0.0
536	Chandel	Manipur	0.0
536	Bishnupur	Manipur	0.0
536	Ukhrul	Manipur	0.0
536	West Khasi Hills	Meghalaya	0.0
536	East Garo Hills	Meghalaya	0.0
536	Ri Bhoi	Meghalaya	0.0
536	Mamit	Mizoram	0.0
536	Tuensang	Nagaland	0.0

LOWEST 60 DISTRICTS (CONTINUED)			
Rank	District	State	Density per lakh pop'n
536	Mon	Nagaland	0.0
536	Wokha	Nagaland	0.0
536	Sonapur	Orissa	0.0
536	Nuapada	Orissa	0.0
536	Debagarh	Orissa	0.0
536	Yanam	Pondicherry	0.0
536	Jaisalmer	Rajasthan	0.0
536	Dungarpur	Rajasthan	0.0
536	Dhalai	Tripura	0.0
536	Shrawasti	Uttar Pradesh	0.0
536	Rudraprayag	Uttarakhand	0.0
536	Almora	Uttarakhand	0.0
535	Medak	Andhra Pradesh	0.1
534	Bhagalpur	Bihar	0.1

HIGHEST 30 DISTRICTS			
30	Chennai	Tamil Nadu	9.1
29	Hamirpur	Himachal Pradesh	9.2
28	Pathanamthitta	Kerala	9.2
27	Shimla	Himachal Pradesh	9.6
26	North West	Delhi	9.6
25	Daman	Daman & Diu	9.7
24	South	Delhi	9.9
23	Kottayam	Kerala	10.1
22	Leh (Ladakh)	Jammu & Kashmir	10.2
21	Thiruvananthapuram	Kerala	10.3
20	Aizawl	Mizoram	11.4
19	Mumbai (Suburban)	Maharashtra	11.4
18	Pondicherry	Pondicherry	11.4
17	Ernakulam	Kerala	11.9
16	Dakshina Kannada	Karnataka	12.5
15	Thoothukkudi	Tamil Nadu	12.8
14	North Goa	Goa	13.1
13	Bangalore	Karnataka	13.1
12	North East	Delhi	13.3
11	North	Delhi	13.9
10	East	Delhi	14.3
9	Mumbai	Maharashtra	14.5
8	New Delhi	Delhi	14.5
7	Lakshadweep	Lakshadweep	14.8
6	West	Delhi	15.3
5	Mahe	Pondicherry	16.3
4	South Goa	Goa	17.5
3	Panchkula	Haryana	17.7
2	Chandigarh	Chandigarh	21.0
1	Central	Delhi	39.30

Table 4.6-(B). Dental practitioners with more than secondary schooling: ranking of districts by density – lowest 88 and highest 2 districts

LOWEST 88 DISTRICTS			
Rank	District	State	Density per lakh pop'n
506	Upper Subansiri	Arunachal Pradesh	0.0
506	Lower Subansiri	Arunachal Pradesh	0.0
506	Upper Siang	Arunachal Pradesh	0.0
506	Tirap	Arunachal Pradesh	0.0
506	Changlang	Arunachal Pradesh	0.0
506	North Cachar Hills	Assam	0.0
506	Goalpara	Assam	0.0
506	Marigaon	Assam	0.0
506	Tinsukia	Assam	0.0
506	Kokrajhar	Assam	0.0
506	Karimganj	Assam	0.0
506	Sibsagar	Assam	0.0
506	Karbi Anglong	Assam	0.0
506	Jamui	Bihar	0.0
506	Banka	Bihar	0.0
506	Sheohar	Bihar	0.0
506	Katihar	Bihar	0.0
506	Lakhisarai	Bihar	0.0
506	Saharsa	Bihar	0.0
506	Sheikhpura	Bihar	0.0
506	Siwan	Bihar	0.0
506	Aurangabad	Bihar	0.0
506	Nalanda	Bihar	0.0
506	Khagaria	Bihar	0.0
506	Kanker	Chhattisgarh	0.0
506	Mahasamund	Chhattisgarh	0.0
506	Dhamtari	Chhattisgarh	0.0
506	Janjgir - Champa	Chhattisgarh	0.0
506	The Dangs	Gujarat	0.0
506	Narmada	Gujarat	0.0
506	Lahul & Spiti	Himachal Pradesh	0.0
506	Kinnaur	Himachal Pradesh	0.0
506	Kargil	Jammu & Kashmir	0.0
506	Pakaur	Jharkhand	0.0
506	Garhwa	Jharkhand	0.0
506	Giridih	Jharkhand	0.0
506	Sahibganj	Jharkhand	0.0
506	Lohardaga	Jharkhand	0.0
506	Godda	Jharkhand	0.0
506	Dumka	Jharkhand	0.0
506	Umaria	Madhya Pradesh	0.0
506	Dindori	Madhya Pradesh	0.0
506	Vidisha	Madhya Pradesh	0.0
506	Balaghat	Madhya Pradesh	0.0
506	Morena	Madhya Pradesh	0.0
506	Betul	Madhya Pradesh	0.0

LOWEST 88 DISTRICTS (CONTINUED)			
Rank	District	State	Density per lakh pop'n
506	Tikamgarh	Madhya Pradesh	0.0
506	Datia	Madhya Pradesh	0.0
506	Harda	Madhya Pradesh	0.0
506	Sheopur	Madhya Pradesh	0.0
506	Sehore	Madhya Pradesh	0.0
506	Senapati	Manipur	0.0
506	Tamenglong	Manipur	0.0
506	Chandel	Manipur	0.0
506	Bishnupur	Manipur	0.0
506	Ukhrul	Manipur	0.0
506	Thoubal	Manipur	0.0
506	Churachandpur	Manipur	0.0
506	West Khasi Hills	Meghalaya	0.0
506	East Garo Hills	Meghalaya	0.0
506	Ri Bhoi	Meghalaya	0.0
506	Mamit	Mizoram	0.0
506	Saiha	Mizoram	0.0
506	Tuensang	Nagaland	0.0
506	Mon	Nagaland	0.0
506	Wokha	Nagaland	0.0
506	Sonapur	Orissa	0.0
506	Nuapada	Orissa	0.0
506	Debagarh	Orissa	0.0
506	Sambalpur	Orissa	0.0
506	Rayagada	Orissa	0.0
506	Gajapati	Orissa	0.0
506	Yanam	Pondicherry	0.0
506	Jaisalmer	Rajasthan	0.0
506	Dungarpur	Rajasthan	0.0
506	Jalor	Rajasthan	0.0
506	Dhaulpur	Rajasthan	0.0
506	Rajsamand	Rajasthan	0.0
506	Karauli	Rajasthan	0.0
506	West	Sikkim	0.0
506	Perambalur	Tamil Nadu	0.0
506	Dhalai	Tripura	0.0
506	Shrawasti	Uttar Pradesh	0.0
506	Jalaun	Uttar Pradesh	0.0
506	Mahrajganj	Uttar Pradesh	0.0
506	Sant Ravidas Nagar Bhadohi	Uttar Pradesh	0.0
506	Rudraprayag	Uttarakhand	0.0
506	Almora	Uttarakhand	0.0

HIGHEST 2 DISTRICTS			
2	Chandigarh	Chandigarh	15.0
1	Panchkula	Haryana	15.8

Table 4.6-(C). Dental practitioners with a medical qualification: ranking of districts by density – lowest 175 and highest 5 districts (over two pages)

LOWEST 175 DISTRICTS			
Rank	District	State	Density per lakh pop'n
419	Medak	Andhra Pradesh	0.0
419	Upper Subansiri	Arunachal Pradesh	0.0
419	Lower Subansiri	Arunachal Pradesh	0.0
419	Upper Siang	Arunachal Pradesh	0.0
419	Tirap	Arunachal Pradesh	0.0
419	Changlang	Arunachal Pradesh	0.0
419	North Cachar Hills	Assam	0.0
419	Goalpara	Assam	0.0
419	Marigaon	Assam	0.0
419	Tinsukia	Assam	0.0
419	Kokrajhar	Assam	0.0
419	Karimganj	Assam	0.0
419	Sibsagar	Assam	0.0
419	Karbi Anglong	Assam	0.0
419	Cachar	Assam	0.0
419	Nalbari	Assam	0.0
419	Dhubri	Assam	0.0
419	Hailakandi	Assam	0.0
419	Jamui	Bihar	0.0
419	Banka	Bihar	0.0
419	Sheohar	Bihar	0.0
419	Katihar	Bihar	0.0
419	Lakhisarai	Bihar	0.0
419	Saharsa	Bihar	0.0
419	Sheikhpura	Bihar	0.0
419	Siwan	Bihar	0.0
419	Aurangabad	Bihar	0.0
419	Nalanda	Bihar	0.0
419	Khagaria	Bihar	0.0
419	Bhagalpur	Bihar	0.0
419	Araria	Bihar	0.0
419	Supaul	Bihar	0.0
419	Pashchim Champaran	Bihar	0.0
419	Jehanabad	Bihar	0.0
419	Vaishali	Bihar	0.0
419	Kishanganj	Bihar	0.0
419	Munger	Bihar	0.0
419	Buxar	Bihar	0.0
419	Saran	Bihar	0.0
419	Begusarai	Bihar	0.0
419	Kaimur (Bhabua)	Bihar	0.0
419	Samastipur	Bihar	0.0
419	Kanker	Chhattisgarh	0.0
419	Mahasamund	Chhattisgarh	0.0
419	Dhamtari	Chhattisgarh	0.0
419	Janjgir - Champa	Chhattisgarh	0.0
419	Rajnandgaon	Chhattisgarh	0.0
419	Korba	Chhattisgarh	0.0

LOWEST 175 DISTRICTS (CONTINUED)			
Rank	District	State	Density per lakh pop'n
419	The Dangs	Gujarat	0.0
419	Narmada	Gujarat	0.0
419	Lahul & Spiti	Himachal Pradesh	0.0
419	Kinnaur	Himachal Pradesh	0.0
419	Kargil	Jammu & Kashmir	0.0
419	Badgam	Jammu & Kashmir	0.0
419	Doda	Jammu & Kashmir	0.0
419	Pakaur	Jharkhand	0.0
419	Garhwa	Jharkhand	0.0
419	Giridih	Jharkhand	0.0
419	Sahibganj	Jharkhand	0.0
419	Lohardaga	Jharkhand	0.0
419	Godda	Jharkhand	0.0
419	Dumka	Jharkhand	0.0
419	Pashchimi Singhbhum	Jharkhand	0.0
419	Gumla	Jharkhand	0.0
419	Deoghar	Jharkhand	0.0
419	Chatra	Jharkhand	0.0
419	Koppal	Karnataka	0.0
419	Gadag	Karnataka	0.0
419	Chamarajanagar	Karnataka	0.0
419	Bidar	Karnataka	0.0
419	Umaria	Madhya Pradesh	0.0
419	Dindori	Madhya Pradesh	0.0
419	Vidisha	Madhya Pradesh	0.0
419	Balaghat	Madhya Pradesh	0.0
419	Morena	Madhya Pradesh	0.0
419	Betul	Madhya Pradesh	0.0
419	Tikamgarh	Madhya Pradesh	0.0
419	Datia	Madhya Pradesh	0.0
419	Harda	Madhya Pradesh	0.0
419	Sheopur	Madhya Pradesh	0.0
419	Sehore	Madhya Pradesh	0.0
419	Bhind	Madhya Pradesh	0.0
419	Jhabua	Madhya Pradesh	0.0
419	Shajapur	Madhya Pradesh	0.0
419	Rajgarh	Madhya Pradesh	0.0
419	Raisen	Madhya Pradesh	0.0
419	Shivpuri	Madhya Pradesh	0.0
419	Chhatarpur	Madhya Pradesh	0.0
419	Senapati	Manipur	0.0
419	Tamenglong	Manipur	0.0
419	Chandel	Manipur	0.0
419	Bishnupur	Manipur	0.0
419	Ukhrul	Manipur	0.0
419	Thoubal	Manipur	0.0
419	Churachandpur	Manipur	0.0

Table 4.6-(C). Dental practitioners with a medical qualification: ranking of districts by density – lowest 175 and highest 5 districts (continued)

LOWEST 175 DISTRICTS (CONTINUED)			
Rank	District	State	Density per lakh pop'n
419	West Khasi Hills	Meghalaya	0.0
419	East Garo Hills	Meghalaya	0.0
419	Ri Bhoi	Meghalaya	0.0
419	Mamit	Mizoram	0.0
419	Saiha	Mizoram	0.0
419	Tuensang	Nagaland	0.0
419	Mon	Nagaland	0.0
419	Wokha	Nagaland	0.0
419	Sonapur	Orissa	0.0
419	Nuapada	Orissa	0.0
419	Debagarh	Orissa	0.0
419	Sambalpur	Orissa	0.0
419	Rayagada	Orissa	0.0
419	Gajapati	Orissa	0.0
419	Balangir	Orissa	0.0
419	Kalahandi	Orissa	0.0
419	Kendrapara	Orissa	0.0
419	Koraput	Orissa	0.0
419	Jajapur	Orissa	0.0
419	Malkangiri	Orissa	0.0
419	Anugul	Orissa	0.0
419	Dhenkanal	Orissa	0.0
419	Jharsuguda	Orissa	0.0
419	Nayagarh	Orissa	0.0
419	Yanam	Pondicherry	0.0
419	Jaisalmer	Rajasthan	0.0
419	Dungarpur	Rajasthan	0.0
419	Jalor	Rajasthan	0.0
419	Dhaulpur	Rajasthan	0.0
419	Rajsamand	Rajasthan	0.0
419	Karauli	Rajasthan	0.0
419	Jhalawar	Rajasthan	0.0
419	Sawai Madhopur	Rajasthan	0.0
419	Bharatpur	Rajasthan	0.0
419	Tonk	Rajasthan	0.0
419	Banswara	Rajasthan	0.0
419	Nagaur	Rajasthan	0.0
419	West	Sikkim	0.0
419	Perambalur	Tamil Nadu	0.0
419	Ariyalur	Tamil Nadu	0.0
419	Thiruvarur	Tamil Nadu	0.0
419	Nagapattinam	Tamil Nadu	0.0
419	Dhalai	Tripura	0.0

LOWEST 175 DISTRICTS (CONTINUED)			
Rank	District	State	Density per lakh pop'n
419	Shrawasti	Uttar Pradesh	0.0
419	Jalaun	Uttar Pradesh	0.0
419	Mahrajganj	Uttar Pradesh	0.0
419	Sant Ravidas Nagar Bhadohi	Uttar Pradesh	0.0
419	Sultanpur	Uttar Pradesh	0.0
419	Ghazipur	Uttar Pradesh	0.0
419	Unnao	Uttar Pradesh	0.0
419	Faizabad	Uttar Pradesh	0.0
419	Mathura	Uttar Pradesh	0.0
419	Azamgarh	Uttar Pradesh	0.0
419	Balrampur	Uttar Pradesh	0.0
419	Kheri	Uttar Pradesh	0.0
419	Jyotiba Phule Nagar	Uttar Pradesh	0.0
419	Sonbhadra	Uttar Pradesh	0.0
419	Kaushambi	Uttar Pradesh	0.0
419	Hardoi	Uttar Pradesh	0.0
419	Jhansi	Uttar Pradesh	0.0
419	Banda	Uttar Pradesh	0.0
419	Jaunpur	Uttar Pradesh	0.0
419	Basti	Uttar Pradesh	0.0
419	Baghpat	Uttar Pradesh	0.0
419	Ambedkar Nagar	Uttar Pradesh	0.0
419	Sant Kabir Nagar	Uttar Pradesh	0.0
419	Lalitpur	Uttar Pradesh	0.0
419	Pratapgarh	Uttar Pradesh	0.0
419	Hathras	Uttar Pradesh	0.0
419	Pilibhit	Uttar Pradesh	0.0
419	Auraiya	Uttar Pradesh	0.0
419	Mahoba	Uttar Pradesh	0.0
419	Fatehpur	Uttar Pradesh	0.0
419	Kannauj	Uttar Pradesh	0.0
419	Chitrakoot	Uttar Pradesh	0.0
419	Rudraprayag	Uttarakhand	0.0
419	Almora	Uttarakhand	0.0
419	Garhwal	Uttarakhand	0.0
419	Pithoragarh	Uttarakhand	0.0
419	Bageshwar	Uttarakhand	0.0

HIGHEST 5 DISTRICTS			
5	Ernakulam	Kerala	10.0
4	Leh (Ladakh)	Jammu & Kashmir	10.2
3	South Goa	Goa	12.4
2	Chandigarh	Chandigarh	12.8
1	Panchkula	Haryana	14.5

5. Concluding remarks

This study is based on data collected in the 2001 Indian census, from which 593 district data files were specially extracted for us on health workers cross-classified by education level and medical qualification, in addition to demographic and geographical variables such as gender, urban–rural stratum (within each district), and so on. The value of using these census data is that for the first time we have information on the educational qualifications of practicing health professionals, including allopathic doctors, ayurvedic doctors, homeopathic doctors, nurses and pharmacists – at the level of district in India. Hence, for example, we can assess how many people claiming to be practicing doctors in a district actually have medical degrees or qualifications.

These census data provide a very comprehensive and unique picture of health workers in each district (or semi-district if the rural and urban part of a district are considered separately). By contrast, other data sources – including household surveys – are much less comprehensive. Typical data sources on healthcare personnel relate either to those employed in the public health system, which leaves out the very substantial numbers of private practitioners – or to data from professional registries, which are incomplete or inaccurate owing to non-coverage of certain professions or because they do not reflect retirement, death or migration in the professions covered. Moreover, unlike the census data, *none* of these sources provide a district-level profile of the health workforce.

With access to the detailed census data, we have analysed the Indian health workforce in terms of its occupational and gender composition, its educational attainment, and its geographical distribution. Some of our main findings regarding the health workforce in 2001 are summarized below.

- At the national level, the density of all doctors (allopathic, ayurvedic, homeopathic and unani) was 79.7 doctors per lakh population, and of nurses and midwives 61.3 per lakh population. The comparable figures for China in 2005 were 130 for doctors, and 96 for nurses, per lakh population.[12] In both countries, the densities were higher in urban than in rural areas, but in India the urban density of doctors was 4 times higher than in rural areas, whereas in China it was only twice as high as in rural areas. In short, India had significantly fewer doctors per person compared to China, and their distribution between urban and rural areas was much more unequal.

- Many individuals claiming to be doctors in India do not have the requisite professional qualifications. Almost one third (31.4%) of those who called themselves allopathic doctors in 2001 were educated up to only secondary school level, and as many as 57.3% did *not* have a medical qualification. Expectedly, lack of medical qualification is disproportionately concentrated in rural areas. Whereas 58.4% of allopathic doctors in urban areas had a medical qualification, only 18.8% of those in rural areas had such a qualification.

- Female health workers were *more* educated and medically qualified than male health workers in every category (except ancillary health professionals). For example, in the category of allopathic doctors, 86.3% of females compared to 65.0% of males had more than secondary schooling, and 67.2% of females compared to 37.7% of males had a medical qualification.

- The density of health workers varied substantially across states and across districts. There was a 6-fold interstate differential between the highest and lowest density of all health workers; for health workers with more than secondary schooling this differential was 10-fold, and for health workers with a medical qualification it was 20-fold. However, the variation at the district level was much greater. For example, the density of allopathic doctors with any level of education in the lowest 30 districts was a little over 9.4 per lakh of population, whereas in the highest 30 districts it was 159 per lakh of population, i.e. a multiple of 17-to-1. For allopathic doctors with more than secondary schooling, the corresponding multiple was 22-to-1, and for allopathic doctors with a medical qualification this multiple was 44-to-1.

12 See Sudhir Anand, *Measuring health workforce inequalities: methods and application to China and India*, Human Resources for Health Observer, 5. Geneva: World Health Organization, 2010.

- The national density of dentists was extremely low at 2.4 per lakh population, which was made even worse by the severe maldistribution of dentists across districts. Of 593 districts in the country, 58 districts had no dentists *at all*; 88 districts had no dentists with more than secondary schooling; and 175 districts had no dentists with a medical qualification. The interdistrict Gini coefficient for dentists with a medical qualification was 0.7003.

The data described in this study are for the year 2001 and the situation should have improved over the past decade and a half. But the lack of qualified human resources, especially in rural areas, constitutes a major constraint in India's ability to improve health outcomes. To advance health outcomes, India needs to step up the capacity to produce and deploy medically trained personnel rapidly – in both rural and urban areas.

Our study provides a baseline profile of the health workforce in India in 2001, by (semi-) district, level of education, and other pertinent variables. This baseline at the country, state and district levels will allow progress to be monitored at each of these levels – through later censuses, or ad hoc state and district level surveys. The baseline information in this study is also relevant for policymakers and health programmes implemented at these levels. State governments can identify districts that are poorly served by health workers. Citizens in a district can point to the ranking of their district to advocate for more health workers – e.g. Tamenglong in Manipur with the lowest district density (zero) of allopathic doctors with a medical qualification.

When the comparable 2011 census of India data become available, a similar study to ours should be repeated. While some improvement in health worker availability can be expected over the period, it will be interesting to see how general the improvement is across districts – in terms of health worker densities, education levels, and distribution.

To the best of our knowledge, few countries have generated detailed information at such a disaggregated level or conducted comparable analyses. Apart from providing a detailed investigation of the Indian health workforce in 2001, our study could serve as a template for similar analyses in other countries. That would allow comparison across countries of not just the density of doctors, nurses and other healthcare professionals, but also their relative levels of education, training and medical qualification – including their urban-rural and geographical distribution. We hope that our present study on India provides a template and a baseline, respectively, for similar studies in other countries and over time in India.

Annex 1. Description of NCO four-digit codes

NCO CODE	DESCRIPTION
2221	*Physicians and Surgeons, Allopathic,* diagnose human ailments and treat them allopathically by medicines and surgical operations and specialise in treatment of diseases of particular types or disorders of particular parts of human body. This category includes Physician, General, Surgeon, General, Anatomist, Medical, Anaesthetist, Psychiatrist, Neurologist, Dermatologist, Allergy Specialist, Ear, Nose and Throat Specialist, Cardiologist, Radiologist, Tuberculosis Specialist, Ophthalmologist, Urologist, Venereologist, Obstetrician, Gynaecologist, Paediatrician, Orthopaedist, and Other Allopathic Surgeons and Medical Specialists.
2222	*Physicians and Surgeons, Ayurvedic,* conduct medical examinations, making diagnosis, prescribing and giving other forms of medical treatment based on Ayurvedic system of medicine.
2223	*Physicians and Surgeons, Homeopathic,* conduct medical examination making diagnosis, prescribing and giving other forms of medical treatment based on Homeopathic system of medicine. This category includes homeopathic physicians and bio-chemic physicians.
2224	*Physicians and Surgeons, Unani,* conduct medical examination making diagnosis, prescribing and giving other forms of medical treatment based on Unani system of medicine.
2225	*Dental Specialists* conduct research, improve or develop concepts, theories and operational methods, and apply medical knowledge in the field of dentistry. This category includes Dentist, Oral and Maxillofacial Surgeon, Orthodontist, Periodontist, Prosthodontist, Paediatric Dentist, and Other Dental Specialists.
3225	*Dental Assistants* carry out advisory, diagnostic, preventive and curative dental tasks, more limited in scope and complexity than those carried out by Dentists, and they assist Dentists by preparing and taking care of instruments and other equipment, preparing materials and helping patients prepare for examination and treatment.
2230	*Nursing Professionals* provide professional, general or specialised nursing care for sick, injured and infirm for treatment of physical and mental disorders; give nursing care and advice; assist physicians and perform other nursing tasks and community health service in hospitals, clinics, sanatoria, schools, factories, medical establishments, private homes and elsewhere. This category includes Specialist Nurses and Other Professional Nurses.
3231	*Nursing Associate Professionals* provide nursing care for the sick, injured, and others in need of such care, and, in the absence of medical doctors or professional nurses, deal with emergencies. This category includes General Nurse, Nurse, Industrial Nurse, Nursing Attendant and Other Nurses.
3232	*Midwifery Associate Professionals* deliver or assist doctors or midwifery professionals in the delivery of babies, provide antenatal and post natal care and instruct parents in baby care. This category includes Midwife, Midwifery Attendant, Lady Health Visitor, and Other Midwifery Associate Professionals.
3228	*Pharmaceutical Assistants* dispense and prepare medicaments, lotions and mixtures under the guidance of pharmacists, in pharmacies, hospitals and dispensaries. This category includes Pharmacist, Pharmaceutical Laboratory Assistant, and Other Pharmaceutical Assistants.
2229	*Health Professionals (Except Nursing), n.e.c.,* covers health professionals (except nursing) not classified elsewhere in the three-digit code 222, Health Professionals (except nursing). This category includes Health Officer, Administrator, Hospital, Naturopath, Osteopathic Physician, Sidha Physician, and Other Physicians and Surgeons.
3221	*Medical Assistants* carry out advisory, diagnostic, preventive and creative and curative medical tasks, more limited in scope and complexity than those carried out by medical doctors. They work independently or with the guidance and supervision of medical doctors in institutions or in the field as part of the public health service, and may work mainly with diseases and disorders common in their region, or mainly apply specific types of treatment. This category includes Laboratory Assistant, Clinical, Vaccinator, Inoculator, Dresser, and Other Medical Assistants.
3222	*Sanitarians* provide technical assistance and advice on measures to restore or improve sanitary conditions, and supervise their implementation. This category includes Sanitary Inspector, Sanitary Darogha, and Other Sanitarians.
3223	*Dieticians and Nutritionists* conduct research and improve or develop concepts and operational methods concerning the preparation and application of diets for general and therapeutic purposes. This category includes General Nutritionist, General Dietician, Animal Nutritionist, and Other Dieticians and Nutritionists.
3224	*Optometrists and Opticians* prescribe and fit glasses and contact lenses and advise on their use or the use of other visual aids, as well as on proper lighting for work and reading. This category includes General Optician, Contact-Lens Optician, and Other Optometrists and Opticians.
3226	*Physiotherapists and Related Associate Professionals* treat disorders of bones, muscles and parts of the circulatory or the nervous system by manipulative methods, and ultrasound, heating, laser or similar techniques, or apply physiotherapy and related therapies as part of the treatment for the physically disabled, mentally ill or unbalanced. This category includes Physiotherapist, Occupational Therapist, Masseur, Chiropodist, and Physiotherapists and Related Associate Professionals.
3229	*Modern Health Associate Professionals (Except Nursing), n.e.c.,* covers modern health associate professionals (except nursing) not classified elsewhere in the three-digit code 322, Modern Health Associate Professionals (except nursing). For instance, in this four-digit code those occupations should be classified who practice, plan and carry out therapeutic activities to help the mentally unbalanced, ill, or physically handicapped, deal with speech impediments, provide eye exercises as remedial treatments, or deal with orientation problems of the blind. This category includes Speech Pathologist, Voice Pathologist, Orthotist and Prosthetist, Orientation and Mobility Instructor and Other Medical and Health Technicians.
3241	*Traditional Medicine Practitioners* treat human mental and physical sickness by herbs, medicinal plants and other techniques traditionally used in the community, and believed to cure and heal by assisting or stimulating nature, and advise on methods to preserve or improve health and well being.
3242	*Faith Healers* endeavour to cure human mental and physical illness by mental influence and suggestion, power of faith and spiritual advice.

Note: "n.e.c." means not elsewhere classified.

Annex 2. List of medical qualifications

This annex contains a list of diploma/certificate or degree used to identify a person with a medical qualification in this study.

Diploma/Certificate in Technical and Non-Technical Subjects

Ayurvedic System of Medicine (Diploma/Certificate)
Medicine Other System (Diploma/Certificate)
Unani System of Medicine (Diploma/Certificate)
Medical (Diploma/Certificate)
DMS (Diploma/Certificate)
FCPS (Diploma/Certificate)
Surgery (Diploma/Certificate)
LMP (Diploma/Certificate)
LMS (Diploma/Certificate)
LSMF (Diploma/Certificate)
Nursing (Diploma/Certificate)
Pharmacy Course (Diploma/Certificate)
Hansen's Disease (Postgraduate)
Nutrition and Health Education (Hindi and English) (Diploma)
Maternal and Child Health (Hindi and English) (Diploma)

Graduate Degree

B.Pharm.
Dental Surgery (Degree)
Ayurvedic System of Medicine (Degree)
Medicine Other System (Degree)
Unani System of Medicine (Degree)
M.B.B.S.
Nursing (equal to degree/P.G. Degree)
Homeopathic Medicine and Surgery
Medicine Homeopathic (Degree)
Surgery Homeopathic (Degree)
Audiology of Speech Therapy (B.Sc.)
B.Sc. (Audiology of Speech Therapy)

Postgraduate Degree

D.C.H.
D.M.
Anaesthesiology
Cardiology
D.O.M.S.
Ophthalmology and Medical Surgery
Orthopaedics
F.R.C.S.
I.M.S.
M.D.
M.S.
M.R.C.O.G.
M.R.C.P.
M.Pharm.
Dental Surgery (Master Degree)
M.D.S.
Ph.D. (Medical)
Medical Entomology (M.Sc.)
D.H.S.
D.M.R.D.
D.H.M.S.

Note: This list of medical diplomas/certificates and degrees to identify a person with a medical qualification was selected by the Planning Commission in consultation with the Office of the Registrar General of India.

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