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# Composition and distribution of the health workforce in India: estimates based on data from the National Sample Survey

Krishna D Rao<sup>1</sup>, Renu Shahrawat<sup>2</sup>, Aarushi Bhatnagar<sup>3</sup>

## ABSTRACT

**Background:** The availability of reliable and comprehensive information on the health workforce is crucial for workforce planning. In India, routine information sources on the health workforce are incomplete and unreliable. This paper addresses this issue and provides a comprehensive picture of India's health workforce.

**Methods:** Data from the 68th round (July 2011 to June 2012) of the National Sample Survey on the *Employment and unemployment situation in India* were analysed to produce estimates of the health workforce in India. The estimates were based on self-reported occupations, categorized using a combination of both National Classification of Occupations (2004) and National Industrial Classification (2008) codes.

**Results:** Findings suggest that in 2011–2012, there were 2.5 million health workers (density of 20.9 workers per 10 000 population) in India. However, 56.4% of all health workers were unqualified, including 42.3% of allopathic doctors, 27.5% of dentists, 56.1% of Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy (AYUSH) practitioners, 58.4% of nurses and midwives and 69.2% of health associates. By cadre, there were 3.3 qualified allopathic doctors and 3.1 nurses and midwives per 10 000 population; this is around one quarter of the World Health Organization benchmark of 22.8 doctors, nurses and midwives per 10 000 population. Out of all qualified workers, 77.4% were located in urban areas, even though the urban population is only 31% of the total population of the country. This urban–rural difference was higher for allopathic doctors (density 11.4 times higher in urban areas) compared to nurses and midwives (5.5 times higher in urban areas).

**Conclusion:** The study highlights several areas of concern: overall low numbers of qualified health workers; a large presence of unqualified health workers, particularly in rural areas; and large urban–rural differences in the distribution of qualified health workers.

**Key words:** health-worker distribution, health workers in India, health workforce, human resources for health

<sup>1</sup>Department of International Health, Johns Hopkins University, Baltimore, MD, United States of America, <sup>2</sup>National Institute of Health and Family Welfare, New Delhi, India, <sup>3</sup>Public Health Foundation of India, New Delhi, India

### Address for correspondence:

Dr Renu Shahrawat, National Institute of Health and Family Welfare, Baba Gang Nath Marg, Munirka, New Delhi, 110067, India  
Email: [renushahrawat@hotmail.com](mailto:renushahrawat@hotmail.com)

## BACKGROUND

India's health workforce has expanded considerably in the past decade. The supply of qualified health workers has increased, owing to the substantial growth in training institutes for doctors, nurses and other health workers. Moreover, the National Rural Health Mission (now National Health Mission) has substantially augmented the workforce by adding 870 089 accredited social health activists (ASHAs) to serve as community health workers.<sup>1</sup> These developments

are significant, given the findings from earlier studies that India faces an overall deficit of health workers and that health workers are largely concentrated in urban areas of the country.<sup>2,3</sup> It is far from clear, however, to what extent the growth in the health workforce has reduced the overall deficit or inequity in geographical distribution of health workers.

Information on the health workforce remains weak in India, as the routine sources of information on the health workforce provide fragmented and unreliable data. Government sources

provide information on the public-sector health workforce in rural areas, but are silent on that for urban areas (at secondary and tertiary levels), as well as the private sector. Professional councils of doctors, nurses, pharmacists and Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy (AYUSH) providers routinely publish statistics of the number of registered members; however, the absence of live registers in these institutions casts doubt on the reliability of these estimates, since they do not account for health workers exiting the workforce due to migration, death or retirement. Moreover, determining the size of the health workforce is even more problematic, since professional councils typically require only a one-time registration by new graduates, and this is usually done in the state where they studied, and not where they currently practise. Finally, several other cadres of health workers, such as physiotherapists, laboratory technicians and midwives, do not have professional councils, and so their presence in the workforce is largely undocumented by routine information sources.

Earlier studies have provided estimates of the Indian health workforce using non-routine sources such as census and household surveys. These data sources, collected at intervals of 5–10 years, derive information directly from individuals, thereby potentially overcoming many of the inadequacies of official sources. However, as these estimates are based on self-reports (i.e. a “doctor” is classified as a doctor based on a reported description of his/her occupation), they are susceptible to misclassification, and need to be adjusted for reported education qualifications. One recent study using data from the 2001 census of India estimated the density per 10 000 population of all health workers as 20.1 (4.7 qualified), allopathic doctors as 8.0 (2.6 qualified) and nurses and midwives as 6.1 (0.6 qualified).<sup>3</sup> Another study using both the 2001 census and the 61st round (2004–2005) of the National Sample Survey (NSS) reported the density per 10 000 population of all health workers as 19.5 (8.6 qualified), allopathic doctors as 8.0 (3.8 qualified) and nurses and midwives as 7.3 (2.3 qualified).<sup>2</sup> Several common patterns emerge from these studies. Both studies point out that India faces an overall shortage of health workers – the combined density of allopathic doctors, nurses and midwives is much below the World Health Organization (WHO) benchmark of 22.8 workers per 10 000 population for achieving 80% of deliveries attended by skilled personnel, in cross-country comparisons.<sup>4</sup> Importantly, both studies suggest that a substantial part of the health workforce consists of unqualified providers. Further, there is a critical imbalance in the distribution of the workforce across states, and between urban and rural areas. Further, the low doctor-to-nurse ratio suggests an inefficient skill-mix, since there are efficiency gains in having a larger number of nurses compared to doctors.

This paper presents a comprehensive picture of India’s health workforce, using a recent nationally representative household survey conducted in 2011–2012.<sup>5</sup> It offers national and state-level estimates of the size, composition and distribution of the workforce, and the representation of women in the workforce. As such, the workforce estimates presented here provide a recent picture of the Indian health workforce and allow determination of temporal trends by comparison with previous studies using similar data sources.

## METHODS

Data from the 68th round (July 2011 to June 2012) of the NSS, on the *Employment and unemployment situation in India* were analysed to produce estimates of the health workforce in India.<sup>5</sup> The NSS employed multistage stratified cluster sampling to cover 101 724 households and 456 999 persons in 7469 villages and 5268 urban blocks throughout the country. Data were collected, based on self-reported occupations, categorized using both National Classification of Occupations (NCO)<sup>6</sup> and National Industrial Classification (NIC) codes.<sup>7</sup> While the NCO codes allow classification based on actual occupations (such as doctors, nurses, ayurvedic doctors, medical assistants), NIC codes are categorized based on the industry where respondents are employed (hospitals, medical practices, diagnostic laboratories, etc.).

This study used a combination of both NCO (2004) and NIC (2008) codes to enumerate and group those who reported to be health professionals into the following categories:<sup>6,7</sup> allopathic doctors, nurses and midwives, dentists, AYUSH practitioners, health associates (paramedics or allied health professionals) and traditional practitioners (see Table 1). Allopathic doctors included those in medical practices, hospitals, diagnostic/pathological laboratories, and other agencies relating to health, as well as teaching professionals in medicine. Nurses and midwives were grouped as one category, as NCO codes did not provide distinct job descriptions for the two cadres. Health associates incorporated a broad range of paramedical staff, including medical assistants, laboratory assistants, sanitarians, nutritionists, optometrists and opticians, dental assistants, physiotherapists, pharmacists, speech therapists, and other medical and health technicians. All estimates were based on the usual principal activity of a person and pertained to the majority of time spent on an activity during the reference period of 365 days.

Since the occupations were based on self-reports, there was a possibility of unqualified health workers being included in the total estimates. To differentiate the qualified from unqualified providers, information on the technical education (degree, certificate/diploma) and general education of respondents was used (see Table 1). Allopathic doctors were classified as qualified if they had a minimum of higher secondary (10 + 2 years) education, along with either a technical degree or postgraduate diploma/certificate in medicine. Nurses and midwives were considered as qualified if they had higher secondary education combined with any technical education in medicine, or possessed a diploma/certificate. These estimates included nurses and midwives with qualifications in general nursing and midwifery and above. Auxiliary nurses and midwives (ANMs) were separately classified as qualified if they had a minimum of secondary education (10 years) and had received formal vocational training. Qualified ANMs were grouped together with qualified nurses and midwives, as qualified nurses and midwives. Health associates were considered qualified if they had higher secondary education plus any technical education in medicine or any diploma/certificate.

To estimate health-worker densities, the weighted totals of different categories of health workers were first calculated.

**Table 1. Classification of health workers and their qualifications**

Type	Health-worker categories included	Qualifications of qualified workers
Allopathic doctors	<ul style="list-style-type: none"> <li>Physicians in: medical practice, hospitals, diagnostic/pathological laboratories, industries and service-related activities (water transportation and public services), regulatory agencies relating to health</li> <li>College/university/higher education teaching professionals in: medical practice, hospitals</li> </ul>	10 + 2 years' education plus a technical degree or postgraduate diploma/certificate in medicine
Nurses and midwives	<ul style="list-style-type: none"> <li>Nursing professionals</li> <li>Nursing and midwifery associates (general/industrial/other nurses, midwives/lady health visitors, midwifery attendants, midwifery associate professionals)</li> </ul>	<p>Nurses: 10 + 2 years' education plus any technical education in medicine or a diploma/certificate</p> <p>Auxiliary nurses and midwives: 10 years' education plus a formal vocational training</p>
Dentists	<ul style="list-style-type: none"> <li>Dentists, excluding those working in hospitals</li> </ul>	10 + 2 years' education plus a technical degree or postgraduate diploma/certificate in medicine
AYUSH practitioners	<ul style="list-style-type: none"> <li>Practitioners of Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy, excluding those working in hospitals</li> </ul>	10 + 2 years' education plus a technical degree or postgraduate diploma/certificate in medicine
Health associates	<ul style="list-style-type: none"> <li>Modern health-associate professionals (medical assistants, laboratory assistants, sanitarians, nutritionists, optometrists and opticians, dental assistants, physiotherapists, pharmacists, speech therapists, other medical and health technicians)</li> <li>Life-science and health-associate professionals in: hospital, medical practice</li> <li>Optical and electronic equipment operators in: hospitals, diagnostic/pathological laboratories</li> <li>Non-nursing health professionals who were not allopathic doctors, dentists or AYUSH practitioners</li> </ul>	10 + 2 years' education plus any technical education in medicine or diploma/certificate
Traditional practitioners	<ul style="list-style-type: none"> <li>Practitioners of traditional medicine, faith healers</li> </ul>	

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy.

Because the totals are based on a probability sample, they are subject to sampling errors. This paper reports both the density point estimates of the totals and their 95% confidence intervals. These estimates were divided by the relevant population (state or country) and multiplied by 10 000 to get estimates of the health-worker density per 10 000 population.

## RESULTS

The number of health workers in the different categories (qualified and unqualified) sampled in the NSS 68th round is shown in Table 2. The estimates of national health-worker totals used are the weighted estimates of the samples shown in Table 2. The majority of the sample comprised allopathic doctors and nurses and midwives. Importantly, Table 2 indicates that a small number of health workers were sampled by the NSS, with particularly small sample sizes for some categories, notably dentists (36) and traditional practitioners (14).

## Size, composition and qualifications of the health workforce

The NSS estimates suggest that during 2011–2012 there were 2.53 million health workers in India, which translates into a density of 20.9 health workers per 10 000 population (see Table 3).<sup>5</sup> The estimated densities by cadre were as follows: allopathic doctors, 5.8; nurses and midwives, 7.6; dentists, 0.4; AYUSH practitioners, 1.3; health associates, 5.8; and traditional practitioners, 0.1 (see Table 3).

After adjusting for qualification, the density of health workers declined from 20.9 to 9.1 per 10 000 population. The estimated densities of qualified workers by cadre were as follows: allopathic doctors, 3.3; nurses and midwives, 3.1; dentists, 0.3; AYUSH practitioners, 0.6; health associates, 1.8; and traditional practitioners, 0.0. The largest decline in density after adjusting for qualification was observed in nurses and midwives (7.6 to 3.1 per 10 000 population) and health associates (5.8 to 1.8 per 10 000 population) (see Table 3).

**Table 2. Sample sizes of qualified and unqualified health workers from the 68th round of the National Sample Survey, 2011–2012<sup>5</sup>**

Health workers	Urban, number qualified (unqualified)	Rural, number qualified (unqualified)	Total, number qualified (unqualified)
Allopathic doctors	164 (99)	57 (112)	221 (211)
Nurses and midwives	155 (167)	118 (124)	273 (291)
Dentists	17 (12)	2 (5)	19 (17)
AYUSH practitioners	31 (30)	18 (37)	49 (67)
Health associates (includes pharmacists)	102 (173)	59 (143)	161 (316)
Traditional practitioners	0 (5)	0 (9)	0 (14)

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy.

**Table 3. Health-worker density and female participation in the health workforce, from the 68th round of the National Sample Survey, 2011–2012<sup>5</sup>**

Health workers	Density per 10 000 population		Female (%)
	Total (95% CI)	Qualified (95% CI)	
Allopathic doctors	5.8 (4.5–7.1)	3.3 (2.1–4.6)	27.7
Nurses and midwives	7.6 (6.4–8.9)	3.1 (2.4–4.0)	88.8
Dentists	0.4 (0.2–0.6)	0.3 (0.1–0.4)	42.2
AYUSH practitioners	1.3 (0.9–1.7)	0.6 (0.3–0.8)	17.2
Health associates	5.8 (4.8–6.8)	1.8 (1.3–2.3)	20.4
Traditional practitioners	0.1 (0.0–0.2)	0.0	—
All	20.9 (18.9–23.0)	9.1 (7.6–10.7)	47.2

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy; CI: confidence interval.

There were 1.3 nurse-midwives per allopathic doctor, which, after correcting for qualifications, reduced to 0.9.

The education adjustments highlight the large presence of unqualified providers in India's health workforce. Overall, there are 1.4 million unqualified health workers in India, representing 56.4% of the health workforce. The weighted estimates of unqualified (i.e. did not possess the necessary qualification for their cadre) health workers by cadre are as follows: 42.3% of allopathic doctors, 58.4% of nurses and midwives, 27.5% of dentists, 56.1% of AYUSH practitioners, and 69.2% of health associates.

The presence of unqualified health workers is higher in rural (71.2%) compared to urban (48.8%) areas. The weighted estimates for unqualified health workers in rural India were: 69.1% of allopathic doctors, 68.2% of nurses and midwives, 62.9% of dentists, 74.3% of AYUSH practitioners, and 75.8% of health associates. In urban areas, the weighted estimates of unqualified health workers were: 31.4% of allopathic doctors, 52.6% of nurses and midwives, 25.5% of dentists, 44.1% of AYUSH practitioners, and 65.5% of health associates.

Qualified female health workers constitute almost half of the qualified health workforce (see Table 3). Among different categories of health workers, qualified nurses and midwives were dominated by women (88.9%). This was followed by dentists (42.2%), allopathic doctors (27.7%), AYUSH practitioners (17.2%) and health associates (20.4%) (see Table 3).

### Distribution of health workers

As expected, the distribution of qualified health workers was skewed towards urban areas; 77.4% of all qualified workers were in urban areas, even though the urban population accounted for only 31% of the total population. The density of qualified health workers was 22.7 per 10 000 population in urban areas, as compared to 3.0 per 10 000 population in rural areas. This urban dominance was seen across all health-worker categories (see Table 4). The maldistribution was higher for allopathic doctors (density 11.4 times higher in urban areas), as compared to nurses and midwives (5.5 times higher in urban areas). Almost all the dentists were in urban areas. The density

**Table 4. Density of qualified health workers in urban and rural areas, from the 68th round of the National Sample Survey, 2011–2012<sup>5</sup>**

Health workers	Mean (95% CI) density per 10 000 population		
	All	Rural	Urban
Allopathic doctors	3.4 (2.1–4.6)	0.8 (0.3–1.2)	9.1 (5.3–12.8)
Nurses and midwives	3.2 (2.4–4.0)	1.3 (0.9–1.7)	7.2 (4.8–9.6)
Dentists	0.3 (0.1–0.5)	0.0 (0.0–0.0)	0.9 (0.3–1.4)
AYUSH practitioners	0.6 (0.3–0.8)	0.2 (0.1–0.3)	1.4 (0.6–2.2)
Health associates	1.8 (1.3–2.3)	0.7 (0.4–1.0)	4.1 (2.7–5.5)

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy; CI: confidence interval.

of AYUSH practitioners was 7.0 times, and health associates was 5.9 times higher in urban compared to rural areas (see Table 4).

In both rural and urban areas, around 70% of the health workers were privately employed in the nongovernment sector (rural, 67.0%; urban, 74.0%). More than 80% of allopathic doctors in urban (87.1%) and rural (83.5%) areas were engaged in private employment. Similarly, more than 90% of dentists (rural, 96.7%; urban, 91.9%) and AYUSH practitioners (rural, 95.5%; urban, 93.9%), and around 70% of health associates in both rural (68.3%) and urban (75.5%) areas were working in the nongovernment sector. However, among nurses and midwives, 48.8% of those in rural and 59.8% of those in urban areas were privately engaged.

There was wide variation in the density of qualified health workers across states (see Table 5). North-eastern and north-central states had a lower density of qualified health workers compared to the national average. Similarly, the densities of qualified allopathic doctors and nurses and midwives varied across states, though they did not necessarily follow the same distribution pattern as for qualified health workers. Kerala (31.6 per 10 000) had the highest density of qualified health workers in India, which was 20 times higher than for Bihar (1.5 per 10 000), the state with the lowest density. The highest density of qualified allopathic doctors was in Maharashtra (8.7 per 10 000); in comparison, states like Bihar (0.3 per 10 000) and Himachal Pradesh (0.1 per 10 000) had among the lowest densities of qualified doctors. The density of qualified nurses and midwives was highest in Kerala (18.5 per 10 000) and lowest in the states of Uttar Pradesh (0.5 per 10 000), Bihar (0.4 per 10 000) and Tripura (0.3 per 10 000).

## DISCUSSION

This study used a recent nationally representative household survey, the 68th round of the NSS conducted in 2011–2012, to enumerate the size, composition and distribution of India's health workforce. Workforce estimates based on this survey suggest that the density of all health workers is 20.9 (9.1 qualified), allopathic doctors 5.8 (3.3 qualified), nurses and midwives 7.6 (3.1 qualified) and AYUSH

practitioners 1.3 (0.6 qualified) per 10 000 population. The overall estimates of health-worker density are similar to those based on the 2001 census.<sup>2,3</sup> The combined density of qualified allopathic doctors and nurses and midwives of 6.4 per 10 000 population is considerably below the WHO benchmark of 22.8 workers per 10 000 population for achieving 80% of deliveries attended by skilled personnel, in cross-country comparisons.<sup>4</sup> This suggests that there is a shortage of qualified providers of clinical care in India. There is considerable variation across states in the availability of qualified health workers, with those in north-central and north-eastern India having lower densities as compared to the national average. Kerala is the only state in India to achieve the WHO benchmark. This highlights that shortage of providers of clinical care is a feature of almost every Indian state. The results also confirm the skewed distribution of the workforce favouring urban areas, a phenomenon that is present in most countries.<sup>4,8</sup>

Earlier studies have offered estimates of the health workforce based on census and sample surveys. A study using the 2001 census estimated the density of all health workers as 20.1 (4.7 qualified), allopathic doctors as 8.0 (2.6 qualified) and nurses and midwives as 6.1 (0.6 qualified) per 10 000 population.<sup>3</sup> Another study, which used the 2001 census data adjusted to 2004 levels, reported the density of overall health workers as 19.5 (8.6 qualified), allopathic doctors as 8.0 (3.8 qualified) and nurses and midwives as 7.3 (2.3 qualified) per 10 000 population.<sup>2</sup> Comparing unadjusted estimates from these and the present study indicates how the workforce has changed between 2001 and 2012. Qualification-adjusted estimates are difficult to compare, owing to the different educational criteria used. Comparing the unadjusted estimates of health-worker density between 2001 and 2012 indicates that the overall health-worker density increased from around 20.0 per 10 000 population to 20.9 per 10 000 between 2001 and 2012. Further, the density decreased for allopathic doctors (8.0 to 5.8) and increased for nurses and midwives (6.1 to 7.6).

The large presence of unqualified health workers in the workforce is both remarkable and alarming. The weighted estimates of this study indicate that up to 42.3% of allopathic doctors operating in India do not have the requisite qualification. Remarkably, the weighted estimates revealed that the majority (69.1%) of allopathic doctors in rural India, where most of India's population

**Table 5. State-wise density of qualified health workers from the 68th round of the National Sample Survey, 2011–2012<sup>5</sup>**

State	Density of qualified health workers per 10 000 population		
	Allopathic doctors	Nurses and midwives	All health workers
Bihar	0.3	0.4	1.5
Himachal Pradesh	0.1	1.1	2.2
Assam	<sup>a</sup>	2.0	2.2
Jharkhand	0.7	1.6	2.3
Orissa	1.3	1.0	3.1
Rajasthan	0.4	2.6	3.4
Tripura	3.7	0.3	4.0
Arunachal Pradesh	2.0	2.4	4.9
Madhya Pradesh	0.3	1.7	5.1
West Bengal	3.5	0.8	5.4
Meghalaya	2.1	2.7	6.9
Goa	5.8	0.7	7.6
Uttar Pradesh	6.2	0.5	7.8
Manipur	1.0	4.2	7.8
Andhra Pradesh	2.3	1.9	8.3
Sikkim	<sup>a</sup>	4.5	8.3
Jammu and Kashmir	2.3	1.8	9.1
Karnataka	5.2	1.3	9.2
Chhattisgarh	3.6	2.3	9.8
Nagaland	1.9	1.3	10.5
Lakshadweep	6.2	4.9	11.1
Tamil Nadu	1.6	6.3	12.5
Punjab	2.2	6.8	12.6
Mizoram	0.5	10.6	14.8
Uttarakhand	6.8	4.7	15.2
Andaman and Nicobar Islands	<sup>a</sup>	11.8	16.5
Gujarat	1.4	13.1	16.6
Maharashtra	8.7	4.2	16.8
Haryana	3.3	5.1	17.1
Delhi	7.5	1.4	17.9
Kerala	3.2	18.5	31.6
<b>Whole of India</b>	<b>3.4</b>	<b>3.2</b>	<b>9.1</b>

<sup>a</sup>Inadequate sample size.

resides, were unqualified. Estimates from the 2001 census suggest that between 37% and 57% of the allopathic doctors at that time did not have a medical qualification.<sup>2,3</sup> These findings indicate that a large number of people in India, particularly in rural areas, receive health care from unqualified providers, whose quality of care is likely to be harmful to their patients' health. Several studies in India have also documented the role of unqualified or informal providers in providing health services to both rural and poor-urban populations in different parts of the country.<sup>9–11</sup> Studies have also found the quality of care provided by these providers to be inadequate.<sup>12,13</sup> The question of how to engage with informal providers is a complex challenge. On one hand, they do provide health care to populations that do not have access to qualified providers, while on the other hand, their lack of proper training will always be a source of concern.

The findings of the present study suggest that the majority of health workers in India work in the nongovernment sector. Given that more than 70% of outpatient visits and 60% of hospital admissions take place in the private sector,<sup>14</sup> these results are not surprising. An interesting exception to the above finding, however, is the proportional presence of nurses and midwives in the government and nongovernment sectors in both urban and rural areas. This suggests that while doctors have a strong preference for working in nongovernment and urban facilities, it could be easier to fill a larger number of positions for nurses/midwives in rural government facilities. Nurses are often the most predominant category of the so-called “front-line” health workforce and are capable of providing a wide range of basic curative and preventive services at lower costs than doctors. Strengthening the nursing cadre, in terms of both size and competencies, has also been found to improve the quality of health care in other low-resource settings.<sup>15</sup> This is also crucial in the Indian context, given that the present study finds that the skill-mix of the workforce, particularly the doctor-to-nurse ratio close to one, is suboptimal.

The use of non-routine sources of information on the workforce, such as sample surveys and censuses, can provide a comprehensive picture of India's health workforce. Moreover, they enable several of the fragmentation and other challenges present in routine sources of information on the workforce to be overcome. There are, however, several areas in which the quality of these non-routine sources can be strengthened. First, self-reported occupations were coded only up to the initial three digits of the 2004 NCO codes; this resulted in loss of valuable information on the finer distinction of all health-worker categories. However, this shortcoming was partially overcome by combining codes from the 2004 NCO and 2008 NIC. In addition, 2004 NCO codes do not distinguish clearly between nursing and midwifery cadres, resulting in both being combined as one category even though, particularly in the Indian context, their job profiles and qualifications are very different. Finally, the NCO classification does not have a code for community health workers and hence these estimates do not take account of the additional 846 309 ASHAs recruited through the National Rural Health Mission up to 2011–2012.<sup>16</sup> Although sample surveys are nationally representative, sample sizes at the state level are too small to calculate robust state-specific estimates. Moreover, these data cannot be further disaggregated to the district level, where

most of the planning and management decisions for primary health care are taken.

Areas with poorer health outcomes and service-delivery indicators typically have a lower density of health workers. The low health-worker density in rural areas, particularly of qualified doctors, could be a reason for low uptake of health services in these areas. Globally, and in India, several strategies have been tried to increase the presence of qualified health workers in rural areas, by offering either higher salaries or non-monetary incentives tied to further educational opportunities to those posted in rural areas.<sup>17</sup> Studies conducted among graduating medical and nursing students in India have also found that substantial salary increases, combined with adequate facility infrastructure and good living conditions, are likely to result in acceptance of rural jobs.<sup>18,19</sup> These strategies need to be further studied within the context of every individual state and integrated into human-resource planning and management.

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