ISSN: 2393-8048
International Advance Journal of Engineering, Science and Management (IAJESM)
Multidisciplinary, Multilingual, Indexed, Double Blind, Open Access, Peer-Reviewed, Refereed-International Journal.
SJIF Impact Factor =8.152, January-June 2025, Submitted in January 2025

Human Resources in Healthcare and its outcomes across states of India

Ashis Das, Research Scholar, Department of Management, NIILM University
Email: - ashisagt@gmail.com
Dr Deepak Tiwari, Professor, Department of Management, NIILM University

ABSTRACT

Health results are greatly influenced by human resources, especially medical professionals and trained healthcare workers. However, in lower-middle-income nations like India, the lack of human resources in healthcare services is a reality and has thus raised concerns. The current effort, which is based on census data, analyzes the distribution, size, and makeup of the human resources that are available in the Indian healthcare system. Along with examining the relationship between health worker density and health outcomes across Indian states, it also looks at the relationship between educational development and the availability of health professionals. Even though the country's health worker density has significantly improved, especially between 2001 and 2011, it still falls short of the World Health Organization's (WHO) need-based minimum standard of 4.45 health professionals per 1,000 population. According to the exploratory verification, there is a large and significant positive correlation between health outcomes and the density of health personnel.

Keywords: Healthcare, human resource for healthcare, India, workforce in healthcare, health professionals

INTRODUCTION

Health outcomes in every nation on the planet are greatly influenced by human resources for healthcare (HRH), which includes medical professionals and skilled health workers (from physicians and nurses to all other paramedics) (see WHO, 2006; 2016a; 2016b). For desired health results, there must be a sufficient supply of such human resources (Anand & Bärnighausen, 2004; Hazarika, 2013; Motkuri & Naik, 2010; also, WHO, 2006; 2016a; 2016b). However, there is a serious lack of human resources in healthcare services, which has raised concerns, especially in developing nations like India (Hazarika, 2013; Motkuri et al., 2017; Rao et al., 2009; 2011).

It is not merely the shortage but also the composition (by various cadres) and its distribution across geographical entities that make matters worse (Motkuri & Naik, 2010; Rao, 2013; see Dussault, 1999).

According to a recent assessment by the World Health Organization (WHO), there is an estimated 17.4 million healthcare professionals worldwide who are in need of HRH (WHO, 2016a). This deficit is made up of more than 9 million nurses and midwives and 2.6 million doctors (see WHO, 2016a). It is also noted that the countries in the African and Southeast Asian regions have the most needs-based shortages. Unquestionably, India makes a substantial contribution to the estimated global shortfall of human resources in the healthcare industry. This is true even though India has made significant strides in terms of health outcomes and inputs since gaining its independence. But the country's progress is still continuing to fall short of desirable health outcomes because of persistent inadequacy and short fall in the required input domains including HRH especially the skilled healthcare professionals consisting doctors (physicians, surgeons and specialists) and nurses and midwives. Therefore, concerted efforts are needed to address challenges related to shortages and distributional aspects of human resources in the healthcare sector.[1]

The foundation for supplying HRH with the necessary capacity continues to be the education and training of skilled and technical labour. This has broad ramifications for the entire educational system in general and medical education in particular. Therefore, the infrastructure of education must keep pace with the growing need for competent health workers and qualified health professionals. In this context, the WHO study correctly notes that ongoing shortages of

HRH are caused by chronic underinvestment in health worker education and training as well as a misalignment of educational initiatives with population needs and health systems (WHO, 2016a). At various points in time, health-specific expert committees2 in India have offered suggestions for enhancing the system (Thomas, 2017).

Notwithstanding certain advancements during that time, policy initiatives were unsuccessful in addressing the need for HRH and revitalizing the nation's medical education system. The National Medical Commission (NMC) was recently proposed by the Indian government to replace the Medical Council of India (MCI) in an attempt to revitalize the system for efficient operation. It remains to be seen if this proposed law will be successful and whether it will have an impact on the nation's healthcare system.

Against this backdrop, the present exercise is a situation analysis of size, composition and distribution of human resources available in the entire system of the healthcare services sector in India. The present study contributes to the existing system of knowledge in terms of trend analysis of the overall workforce engaged in the healthcare services sector in India. It also explores the relationship between educational development and health workers availability alongside the association between density of health workers and health outcomes across states of India. In this regard, the present article is organized as follows. The data sources for the workforce analysis in the healthcare industry are outlined in the second part. The fourth section's cadre-wise analysis of health workers is based on the National Classification of Occupations (NCO) in the census, whereas the third section analyzes the situation of health workers at the national and state levels using the National Industrial Classification (NIC) of workers in census data. The fifth section describes an exploratory study of the association between infant mortality rate (IMR) as an outcome variable in a bi-variate regression analysis and the density of health workers as a health input. Concluding remarks come last.

METHOD AND SOURCE

The current study focuses on the skilled health workers and the total human resources working in the healthcare industry. Allopathic physicians, surgeons, dentists, and other specialists, practitioners of AYUSH (an acronym for Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy), nurses, midwives, pharmacists, diagnostic technicians, and those with medical (or pharmacy) degrees or diplomas, as well as those with a variety of non-medical educational backgrounds, including health assistants, community health workers (CHWs), accredited social health activists (ASHAs), unlicensed private medical practitioners (PMP), and traditional healers, make up the workforce in the healthcare industry.[3] Also, there is a non-medical cadre of health management and supporting workers ranging from managerial and financial professionals, along with other administrative, accounting personnel to clerical staff engaged in the sector. Broadly, health workers may be categorized as medical health workers including paramedics and non-medical workers engaged in the healthcare sector. As mentioned above, the latter consists of various types of non- medical workers.[4] They are categorized as workforce in the healthcare sector as they engaged in the sector.

The sources of information on health workforce in India are as follows. The count of registrations made with professional bodies and respective authorities such as national and state level medical councils or the similar bodies and that are published in Government of India's reports on health information or health statistics such as *Health Information of India* or *Rural Health Statistics*. In the absence of a live register consisting of actively working health professionals, the Government of India's reported information based on such enduring registrations with professional bodies and authorities is considered to be inflated in regard to the number of health professionals actively working in India (Motkuri et al., 2017; Rao et al., 2016; see Motkuri & Naik, 2010). The issues concerned with such data are: multiplicity and duplication of registrations, no mechanism of delisting those who are not serving actively and those who are not available for providing their services in India owing to factors such as

migration, disability, aging and death (Motkuri et al., 2017). Migration of health professionals and other skilled workers trained in India and working abroad is not uncommon for India[5] (Percot, 2006; see Ravi, 2017; Sinha, 2007). Some of the other factors are eventual and common.

Alternatively, there are two other main sources: the Census of India and the National Sample Survey Office (NSSO) sample surveys particularly that of quinquennial employment and unemployment surveys (EUSs). Unlike the registrations-based accumulated number reported by Government of India in its health statistics reports, these two sources provide information on the number of health workers actively serving in any part of country. Both the Census and NSSO sample survey classify the workforce by the industry and occupation that they are engaged in. For the purpose of workers' classification these sources adopt the NIC and NCO. They are timely updated and harmonized with the global or international systems of such classifications.[6] The 1991 Census classification of workers was based on NIC of 1987, that of 2001 Census was NIC of 1998 and that of recent 2011 Census was NIC of 2009. The Division 93 of NIC–87, 85 of NIC–98 and 86 of NIC–2009 represent the workforce engaged in healthcare activities. The Census operations from 1971 to 2001 had adopted NCO of 1968 for the classification of workers by their occupation and the recent Census 2011 adopted NCO–2004, while the NCO–2015 is just framed and will be adopted for Census 2021.

The present analysis is based on information sourced from the Census of India. We have three census (1991, 2001 and 2011) data to elicit changes during the last two decades in respect of the workforce in the healthcare sector. As the Census for the year 1991 was not conducted in the state of Jammu and Kashmir, some adjustment for the national level aggregate of population and health workers is made. The analysis is largely based on the workforce classified as those engaged in the healthcare sector based on NIC and NCO system. The NIC-based workforce in the healthcare sector covers all cadres of workforce including the non-medical administrative staff engaged in the sector. Besides, the analysis of NCO-based classification of workers of Census for the years 2001 and 2011 is carried out and corroborated with previous studies.

The standardization of the health workers to population ratio indicates density that serves towards eligible comparison in this regard, as the overall number, change, and growth of the workforce engaged in healthcare activities does not reveal much about its availability and adequacy with regard to the population in need of their services. As a standardized metric, we have taken the number of health workers available per thousand population (HW/1000P) into consideration.[7]

There has long been no reference minimum requirement for the number of health staff per 1,000 people. Variability in the availability of health workers on standardized measures among geographical entities—that is, countries, regions, and sub-regions within countries—is the focus of the research and the policy. In order to attain specific fundamental health outcomes, the WHO recently established a reference minimum requirement of 4.45 competent health workers/professionals per 1,000 population (see WHO, 2016a). The WHO's benchmark (minimum) need for health professionals and skilled workers is used to estimate the health workforce shortfall.

WORKFORCE IN THE HEALTHCARE SECTOR IN INDIA: AVAILABILITY AND SHORTFALLS

This section looks at the entire workforce working in the healthcare industry, including both medical and non-medical personnel. In addition to other specialized individuals in the healthcare industry, it includes managers, financial professionals, and health professionals. As previously stated, it is predicated on the workers' industrial categorization (NIC) for 1991, 2001, and 2011.

ISSN: 2393-8048
International Advance Journal of Engineering, Science and Management (IAJESM)
Multidisciplinary, Multilingual, Indexed, Double Blind, Open Access, Peer-Reviewed, Refereed-International Journal.
SJIF Impact Factor =8.152, January-June 2025, Submitted in January 2025

Growth of Workforce in the Healthcare Sector

In India, there were 1.9 million people working in the healthcare industry overall in 1991; this number increased to 2.35 million in 2001 and then to 4.6 million in 2011 (see Table 1). There was only a 0.45 million increase in the healthcare sector's labour between 1991 and 2001, but the 2.25 million impressive addition or increase nearly quadrupled the sector's workforce between 2001 and 2011. When the population growth rate and the workforce growth rate in the healthcare sector are compared across states, it can be seen that, although the population growth rate has slowed over the past 20 years, the workforce growth rate in the healthcare sector has increased between 1991 and 2011 (see Table 1).

The rate of growth in workforce in the healthcare sector in India was almost similar to that of its population during the 1990s, but it was four times higher than that of the population during 2001–2011.

Health Workers per 1,000 Population: Density as a Measure of Availability and Adequacy

Standardizing the density as the number of available health professionals per 1,000 people showed that, for the three census years 1991, 2001, and 2011, the density was 2.25, 2.28, and 3.80 health workers, respectively. This pattern indicates a slight improvement in this standardized measure in the 1990s, which is most noteworthy in the past ten years. This might be the result of both a decrease in population growth rates during the 2001–2011 decade and an increase in the health staff.

Disproportionate Urban Concentration of Health Workers

In comparison to metropolitan areas, rural areas have a lower density of health personnel. Since the rate of increase in urban health professionals did not keep up with the rate of urban population growth during this time, the density of health workers in urban areas actually exhibited a slight decline between 1991 and 2001. Once more, between 2001 and 2011, there was a notable improvement in the number of rural health personnel and their density. However, it was unable to change the disadvantage of rural areas due to their lower density. In India, a significant share of the workforce working in the healthcare industry is disproportionately concentrated in urban areas. Urban areas sharing less than one-third of total population have more than half of the workforce engaged in healthcare (see Table 1). Conversely, rural areas with more than two-thirds of total population of the country have less than half of the workforce engaged in healthcare services. This is not withstanding a certain improvement in rural areas during the last decade.

Table 1: Workforce in the Healthcare Sector in India

Location	1991	2001	2011		1991	2001	2011		1991	2001	2011
1	2	3	4		5	6	7		8	9	10
(in Millions)					(in Nos)						
All	846.3	1028.6	1210.9		1.90	2.35	4.60		2.25	2.28	3.80
Rural	628.7	742.5	833.7		0.76	0.90	2.11		1.21	1.21	2.53
Urban	217.6	286.1	377.1		1.14	1.45	2.49		5.24	5.08	6.60
Urban to rural ratio											
0.346		0.385	0.452		1.498	1.621	1.178		4.327	4.207	2.604
Percent of rural to all											
74.3		72.2	68.9		40.0	38.2	45.9				
Rate of growth (CAGR) in %											
All	1.97		1.64		2.13		6.95				
Rural	1.68		1.17		1.64		8.95				
Urban	2.77		2.80		2.45		5.53				

Source: Authors' calculations based on Census of India.

Notes: CAGR—Compound annual growth rate.

All India figures for the year 1991 were adjusted to account for Jammu and Kashmir for which census was not conducted in that year.

Between 2001 and 2011, the health workforce in rural India grew at a pace of 8.95 percent, nearly eight times faster than the rural population's growth rate of 1.17%. The health workforce's growth rate (5.53%) in urban regions is only twice as fast as the population's (2.80%). The rate of population growth and the number of health personnel in the country's rural and urban areas have not differed considerably during the past ten years. Between 1991 and 2001, the growth rate of rural health workers was two-thirds that of urban health workers during the same time period. This trend was reversed between 2001 and 2011, when the number of urban health personnel increased at a rate 60% faster than that of rural ones.

When looking at decadal change in terms of absolute addition/increment (i.e., the number of people/workers added from the base to reference years), urban areas accounted for almost half of the total population added between 2001 and 2011 and just over one-third of the total population added between 1991 and 2001. During the 1990s, the majority of health workers (70%) of the total workforce involved in health activities were concentrated in urban areas. However, in the 2000s, this urban concentration seemed to be slightly lower, with the urban share being slightly less than half (46%) of the total increase.

The ratio of increment in the decade 2001–2011 to the previous decade (1991– 2001) is 0.8 in case of absolute increment of population but the increment of health workers in 2001–2011 was nine times higher than that of the increment in the previous decade (1991–2001). In urban areas, such ratio between the last and the previous decade is 1.3 times in case of population and 3.3 times in respect of health workforce.

Overall, the increase in the number of people working in the healthcare industry over the past ten years (2001–2011) is remarkable in comparison to the preceding decade. However, in this area, the rural disadvantage still exists. In this sense, the metropolitan area has a clear comparative advantage since its proportion of health workers above that of the population, which in turn surpasses the bare minimum needed. As a result, health staff must be geographically redistributed or redeployed between rural and urban locations.

Shortage of Health Workers: Reference to WHO's Minimum Requirement

Even the density of all employees (including non-medical staff) in the nation's healthcare sector is below the WHO's specified basic/threshold minimum of 4.45 health workers per 1,000 inhabitants. It would have needed approximately 3.73, 4.58, and 5.39 million trained professionals for its healthcare services in India in 1991, 2001, and 2011, respectively, given the country's size and the WHO threshold of 4.45 health workers per 1,000 inhabitants. In 1991, 2001, and 2011, there were 1.85 million, 2.23 million, and 0.79 million healthcare workers in India, respectively (see Motkuri et al., 2017). As we elaborate in the following sections, the shortfall would be even more if only skilled health professionals, that is, excluding the non-medical staff are considered. When this minimal need is applied separately to rural and urban areas, the former would far surpass it, while the latter would fall well short. When compared to the shortage portrayed nationally, it is evident that the rural areas are experiencing a much more severe lack. Therefore, there should be a focus on redistribution or redeployment of the health workforce in addition to compensating for the shortage.

Surge in Health Workforce during 2001–2011 Explained: ASHAs or Growth of the Private Sector?

The expansion of the private sector in healthcare services, the introduction of ASHAs, or other factors may be the cause of the spike in the doubling of the personnel working in the health sector. Actually, one of the key elements of the Government of India's National Rural Health Mission (NRHM), which was started in 2005, is involving ASHAs—at least one each village. Since then, many ASHA employees have been inducted and integrated into the rural healthcare system in an effort to implement NRHM in rural India. There are almost 6 lakh villages in the

countryside, and if the number of hamlets is included, the total would be much higher. As per the Government of India's report the total number of ASHAs engaged by all the states/union territories (UTs) increased from 7.06 lakh in 2009 to 8.90 lakh in 2013 (GOI, 2014). If we take an approximate of 8.0 lakh ASHAs for the year 2011, they account for little above one-third of the total health workers added (increment) between 2001 and 2011. Their contribution is relatively large in rural areas; it was around two-thirds of increment in rural health workforce during 2001–2011.

The private sector expanded in the majority of industries and service sectors, including healthcare, thanks to the economic reforms implemented in 1991 (Duggal et al., 2012). It took shape during the post-reform era, despite the fact that the Indian government has aggressively supported the formal private healthcare sector from the mid-1980s through direct and indirect incentives and regulatory measures (Duggal et al., 2012; also, Chakravarthi et al., 2017). The 1990s were only the beginning of the private healthcare sector's expansion, but since the turn of the twenty-first century, its influence has multiplied. Individual practitioners, small and medium-sized hospitals, and corporate commercial hospitals make up India's diverse private healthcare sector (Duggal et al., 2012; Chakravarthi et al., 2017). As can be seen, the healthcare sector's 2000s trend shows that large businesses are expanding more quickly than small and medium-sized businesses in this sector (see Hooda, 2015). For example, Apollo, one of the largest corporate healthcare organizations, started operating in the 1980s and has since grown both inside and outside of India. According to Apollo Hospitals' most recent annual report, its patients come from 120 different countries (see Apollo Hospitals, 2016). The growing demand inducing the healthcare industry and market has led multinational companies to enter into the Indian market and begin their operations (see Chakravarthi et al., 2017).

Therefore, the growing private healthcare industry in India is somewhat to blame for the impressive increase in the workforce involved in healthcare activities that was seen during the 2001–2011 decade. Numerous healthcare experts and other skilled health workers, as well as non-medical personnel, are employed by large corporate entities. Assessing the size and strength of the private healthcare industry, particularly with regard to its human resources, has not received much attention. According to Apollo Hospitals' most recent annual report, the organization's network of hospitals spread across the nation's cities has over 9,000 beds and about 60,000 committed healthcare professionals, including physicians and other personnel (see Apollo Hospitals, 2016). There are many such corporate and non-corporate multi-specialty hospitals in India, along with clinics and nursing homes. Most of these private healthcare institutions are largely concentrated in urban areas.

Interestingly, there is a spatial difference in how these two significant elements are taken into consideration when comparing the spike in the healthcare worker growth in rural and urban areas. The expansion of the private healthcare sector was a major factor in the rise of the urban health workforce during the last ten years (2001–2011), even if the hiring of ASHA employees was mostly responsible for the increase in the rural health workforce.

Regional Variations: Across Major States

Public health is a state topic under the Indian Constitution's federal system, but the union government is ultimately responsible for formulating national policy and allocating funds to states for its implementation. The governments of the many states have the majority of the burden, and their performance is influenced by differences in their policies, resources, and political goals. In this sense, state-level analysis is done to highlight inter-state variances. Thus, beyond confirming the national average, there is a great deal of regional variation in this view, with states differing greatly in terms of the rate of population and health worker growth as well as the number of health workers per 1,000 people (see Table 2).

ISSN: 2393-8048
International Advance Journal of Engineering, Science and Management (IAJESM)
Multidisciplinary, Multilingual, Indexed, Double Blind, Open Access, Peer-Reviewed, Refereed-International Journal.
SJIF Impact Factor =8.152, January-June 2025, Submitted in January 2025

The disparity between population growth and health workforce size is also true for states, much like it is for the federal government. During the two decades between 1991 and 2011, the growth of the health workforce accelerated while the population growth rate slowed (see Table 2). Furthermore, in contrast to the 1990s, the health workforce grew at a significantly faster rate between 2001 and 2011 than the population, which is true for the majority of states. Throughout the 1990s, the health workforce grew at a rate of less than 4% in each state. With the exception of Kerala and New Delhi, it was even lower than in the majority of the states.
But during 2001–2011 some of the states namely, Assam, Himachal Pradesh, Jammu and Kashmir and Odisha witnessed a double-digit rate of growth in their healthcare workforce. Except the state of Chhattisgarh, all the remaining states registered a rate of growth in their health workforce in the range of 5 to 8 per cent. Reading the ratio of rate of growth in health workers to that of population returns a national average of 4.2. States which stand above the national average are: Kerala (13.7), Odisha (8.8), Himachal Pradesh (8.7), Assam (6.7) united Andhra Pradesh (6.5), Karnataka (5.1), Jammu and Kashmir (5.1), Tamil Nadu (4.9), West Bengal (4.8), Punjab (4.7) and Gujarat (4.5) which could be considered as states with advantage in capacity of health workforce. The rest of the states may be termed as disadvantaged in this regard.

Table 2: Density of Health Workers (per 1,000 Population) and Growth of Population and Health Workers between 1991 and 2011: Majors States in India

S. No.	State	1991–2001		2001–2011		Density of HW		
		Pop	HW	Pop	HW	1991	2001	2011
1	2	3	4	5	6	7	8	9
1	Andhra Pradesh	1.37	2.30	1.05	6.80	2.1	2.3	4.0
1a	(United) Andhra Pradesh	–	–	0.92	7.22	–	2.0	3.8
1b	(Residual) Telangana	–	–	1.23	5.12	–	2.7	4.2
2	Assam	1.75	1.27	1.59	10.71	1.8	1.8	4.2
3	Bihar	1.86	0.90	2.29	7.16	1.4	1.1	1.8
4	Chhattisgarh	–	–	2.06	4.22	–	1.8	2.3
5	Gujarat	2.06	1.89	1.78	7.97	2.3	2.2	4.1
6	Haryana	2.53	1.93	1.83	6.49	2.6	2.4	3.8
7	Himachal Pradesh	1.63	(–)1.20	1.22	10.62	3.1	2.4	5.7
8	Jammu & Kashmir	2.77	–	2.14	10.90	–	2.2	5.0
9	Jharkhand	–	–	2.04	7.59	–	1.4	2.4
10	Karnataka	1.63	1.91	1.46	7.45	2.3	2.4	4.3
11	Kerala	0.90	3.33	0.48	6.59	3.7	4.7	8.5
12	Madhya Pradesh	2.81	2.95	1.87	7.43	1.7	1.9	3.2
13	Maharashtra	2.07	2.90	1.49	5.52	3.3	3.6	5.3
14	Odisha	1.52	0.17	1.32	11.60	1.8	1.6	4.2
15	Punjab	1.85	1.86	1.31	6.11	3.0	3.0	4.7
16	Rajasthan	2.53	1.80	1.95	7.45	1.9	1.8	3.0
17	Tamil Nadu	1.11	1.36		1.46	7.22		2.4
18	Uttarakhand	–	–		1.74	6.77		–
19	Uttar Pradesh	2.30	1.93		1.86	6.67		1.6
20	West Bengal	1.65	2.14		1.31	6.25		2.6
21	NCT of Delhi	3.93	3.92		1.94	3.62		6.6
All India		**1.97**	**2.13**	**1.64**	**6.95**	**2.2**	**2.3**	**3.8**
CV (Major States excl. Delhi)						**26.7**	**36.3**	**35.9**

Source: Authors' calculations based on census data.

Notes: Figure represent rural and urban combined; For the state of Jammu and Kashmir in fact there was no Census conducted in 1991, but the estimated population figures are available with RGI and so we made a rough estimation based on that; The united Andhra Pradesh was bifurcated in the year 2014 into residual state of Andhra Pradesh and Telangana state. The separate state level averages for these two states for the years 2001 and 2011 were based on their district level information; CV—coefficient of variation (%).

When comparing population growth rates with health workforce growth rates, the 1991–2001 decade showed only slight variations across states, and the advancements made in health workforce density (available per 1,000 population) during this time period followed a similar pattern (see Table 2). The health workforce grew at a significantly faster rate than the population between 2001 and 2011, which caused the density of health workers in each state to increase significantly by 2011. By 2011, it was 1.5–2.5 times greater than it was in 2001. With differing rates of progress, this is true for the majority of Indian states.

As previously noted, the expansion of the commercial healthcare sector and the induction of ASHA employees during the implementation of the NRHM from 2005 are both contributing factors to the rise in the healthcare workforce. The contribution of ASHA employees and growth in the private sector differ from state to state, much as does the diversity in the rate of improvement among states.

Between 1991 and 2001, there was an increase in the variation (as indicated by CV) in density among states; however, by 2011, this variation had somewhat decreased. But over the course of the two decades, the gap between the lowest and highest densities grew.

HEALTH PROFESSIONALS AND SKILLED HEALTH WORKERS: NCO-BASED WORKFORCE

Here, we distinguish between health professionals and other skilled health workers in order to analyze the healthcare workforce. As previously stated, it is predicated on the 2001 and 2011 census data regarding the classification of occupation (NCO) of workers. It should be made clear that the number of NIC-based employees working in the healthcare sector may differ slightly from the number of NCO-based employees working in this field. The reason for the discrepancy is that non-medical employees working in the healthcare industry are not considered health workers by the NCO.

Alternative Evidence

Based on occupational classification (NCO) data from the 2001 Census, which was conducted at the state and district levels, Anand and Fan (2016) conducted an insightful in-depth study and found that there were 2.1 million health workers in India, of whom 0.82 million (or 39.6%) were doctors, 0.63 million (or 30.5%) were nurses and midwives, and 0.024 million (or 1.2%) were dentists. Of all physicians, 22.8 percent belonged to the AYUSH group and 77.2 percent were allopathic. Approximately 28.8% of the entire health workforce was made up of traditional and religion healers, pharmacists, and ancillary health professionals. According to Anand and Fan (2016), the national health worker density was 79.7 doctors per lakh population, 61.3 nurses and midwives per lakh population, and just 2.4 dentists per lakh population. Only 27.8% of the population lived in rural areas, while 59.2% of all health workers were situated in urban areas, resulting in an urban–rural ratio of 1.45. According to Anand and Fan (2016), the study also found that the ratio of urban to rural density was 9.9 for dentists, 3.8 for doctors, and 4.0 for nurses and midwives.

According to the same survey, the majority of healthcare professionals in the Indian healthcare system are shockingly underqualified. In 2001, it was found that less than half (48.6%) of all health worker cadres had completed secondary school or higher. Furthermore, a startling fact was that, in 2001, less than a quarter (23.3%) of all health workers in India had medical credentials, such as a medical diploma or degree (Rao et al., 2016). It is concerning that around one-third of those who were listed as allopathic doctors had less than a secondary education.

According to medical qualifications, just 42% of allopathic physicians had this kind of training. Only 9.9% of nurses and midwives had medical professional degrees, while around two-thirds (67%) had completed secondary school (Rao et al., 2016). It shows that a significant percentage of the staff in the Indian healthcare sector is underqualified.

The following inter-state discrepancies were highlighted by the study (Anand & Fan, 2016). The gap between the highest and lowest density of all health personnel across states was six times (see Anand & Fan, 2016). In several states, there was a high concentration of certain types of health personnel. For example, 30.6 percent of all homeopathic physicians practiced in West Bengal, 37.5 percent of all Unani physicians practiced in Uttar Pradesh, and 24.0 percent of Ayurvedic physicians practiced in Maharashtra. Kerala accounted for 38.4% of the nation's total number of medically qualified nurses. The percentage of AYUSH physicians was significantly higher in other states, including Kerala (38.1%), Odisha (40.5%), and Tripura (41.7%) (Anand & Fan, 2016). The percentage of nurses in the health workforce and the percentage of doctors in each state were shown to be negatively correlated in Anand and Fan's (2016) study. Additionally, the study discovered a positive but weak correlation between a state's per capita GDP and the density of all health personnel in that state9. According to the study, wealthier states appear to be able to pay for more dentists and physicians per capita.[11]

Additionally, a recent study by Rao et al. (2016) assessed the density of skilled health workers and health professionals using data from the NSSO 68th round EUS in 2011–2012, accounting for occupational classification of workers (NCO). Only competent health workers who matched the survey respondents' occupation and educational background were taken into consideration for this investigation. The density per 10,000 inhabitants was measured in this investigation. The estimates provided by this study make it clear that the density of all cadres of certified health workers and professionals combined for the 2011–2012 period seems to be lower than that for 2001.

In actuality, trend comparison is problematic due to the estimates derived from two distinct sources (NSSO and Census) and methodologies that are strictly non-comparable. While the study by Rao et al. (2016) based on NSSO's survey of 2011–2012 offered their estimates of qualified health professionals, the Census 2001 presented both qualified and unqualified health professionals as well as other health workers.

In India, there were 1.4 million unqualified healthcare professionals, or 56.4% of the country's total estimated health workforce for 2011–2012, according to a study by Rao et al. (2016). According to Rao et al. (2016), the percentage of untrained individuals in different health professional cadres is as follows: 42.3% of allopathic physicians, 58.4% of nurses and midwives, 27.5% of dentists, 56.1% of AYUSH practitioners, and 69.2% of health associates. Furthermore, the percentage of such untrained medical personnel is very high in rural areas (71.2%) and shockingly high in urban areas (48.8%) as well (Rao et al., 2016). Indeed, prevalence of unqualified and largely unlicensed PMPs attending to certain basic healthcare services is not a rare phenomenon in rural India and there are lakhs of such unqualified doctors in many cases at least one per village (see Narayana, 2004; 2006).

NCO-based Shortage of Health Professionals/Workers

Given the availability of such workforce based on NCO, it is evident that India lacks a least of 4.45 qualified health workers/professionals per 1,000 people, which is the WHO threshold (norm), as was previously noted. According to estimates, there was a "2.51 million in 2001 and 1.59 million in 2011" lack of these qualified healthcare professionals. In 2011, the NCO-based estimate of the skilled health worker shortfall was found to be twice as large as the NIC-based estimate of 0.79 million. Since the NIC is made up of non-medical employees, it is more acceptable to base the shortage on NCO.

The lack of trained workers (medical personnel) increased between 2001 and 2011 as a result of the healthcare sector's strong rise in non-medical staff compared to medical professionals.

ISSN: 2393-8048
International Advance Journal of Engineering, Science and Management (IAJESM)
Multidisciplinary, Multilingual, Indexed, Double Blind, Open Access, Peer-Reviewed, Refereed-International Journal.
SJIF Impact Factor =8.152, January-June 2025, Submitted in January 2025

Furthermore, the WHO standard states that there should be "one doctor and 2.5 nurses per 1000 population," but in 2011, India had a "deficit of 0.21 million doctors and more than 2.0 million nurses" (not including the midwifery category, which includes ASHA workers). Furthermore, the concerning aspect is to the sizeable percentage of medical personnel who lack proper training among the competent health workers. If we simply look at trained professional health workers, it exacerbates the lack of competent health workers.

Ratio of Nurses and Midwives to Doctors

There appears to be an optimal nurse-to-doctor ratio that should not be less than one, i.e., there should be more than one nurse for every doctor in the health workforce (Rao et al., 2016). In 2001, it was less than one at the national level, but it improved over the next ten years, reaching 2.1 in 2011. States, however, differ greatly in this ratio. With the exception of Odisha (2.4), Kerala (1.9), Assam (1.4), Tamil Nadu (1.16), and Jharkhand (1.13), the majority of states had a lower nurse-to-doctor density in 2001 than the doctor-to-doctor ratio, which is undesirable.

Due to various circumstances, most states achieved a higher density of nurses than doctors, showing a ratio of more than one nurse per doctor, notwithstanding the notable improvement that was observed in the 2000s. The states of Assam (6.7), Odisha (4.9), Himachal Pradesh (3.7), Rajasthan (3.5), and Kerala (3.3) had the highest percentage in 2011. In 2011, the nurse-to-doctor ratio in three states—Chhattisgarh, Delhi, and Haryana—remains below one. Additionally, a bi-variate regression analysis of the ratio of nurses and midwives to the density of doctors in rural and urban areas across Indian states and union territories for the years 2001 and 2011 reveals a monotonic but non-linear (reciprocal) relationship (see Figure 1). According to the relationship, the ratio of nurses and midwives to doctor density is low in areas with a high doctor density and vice versa. It is in line with the findings of Anand and Fan's (2016) study, which found that the availability of doctors and nurses across India's various states is suggestively substituted.

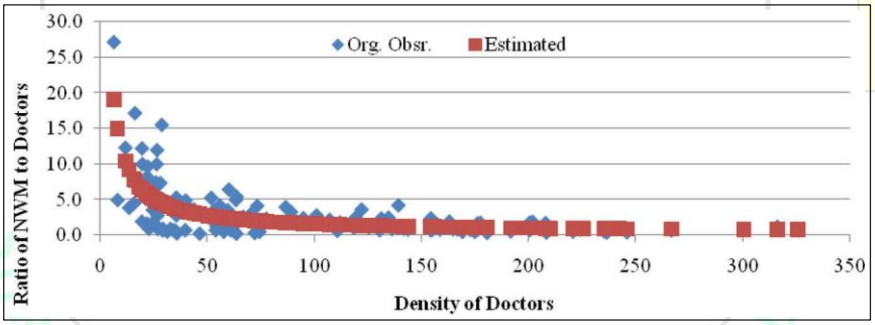


Figure 1: The Relationship between Ratio of Density of Nurse and Midwives to That of Doctors and Density of Doctors

Source: Authors' estimates.

Notes: NMW—nurses and midwives; Observations (140) consist of state- and UT-level rural and urban values separately for the year 2001 and 2011; Org. Obsr—original observations.

Educational Levels and Health Workers Density

The aforementioned analysis makes it abundantly evident that there is a shortage in both the number and makeup of the health workforce, which is primarily dependent on its production and generation. This may be connected to the region's overall educational development, which guarantees a supply of skilled and competent health professionals. Thus, we confirm that the density of health personnel in India's states is correlated with educational advancement. Since the education system and development are essential to the training and production of qualified health professionals and other skilled health workers, the latter are crucial in providing such health workers. The percentage of adults (15 years and older) with a higher secondary (HS) or

higher education level is the measure designed to indicate educational growth. It would have been ideal if state-wise enrolment or number of seats available for degree and diploma courses and training related to medical, clinical or any healthcare related subjects were considered for this purpose. In the absence of a readily available indicator of the kind, proxy for the same is considered for the purpose of present analysis. An exploratory linear bivariate regression of health worker density (dependent variable) against the educational development (independent variable) indicates that there is a significantly positive association between the two (see Figure 2).

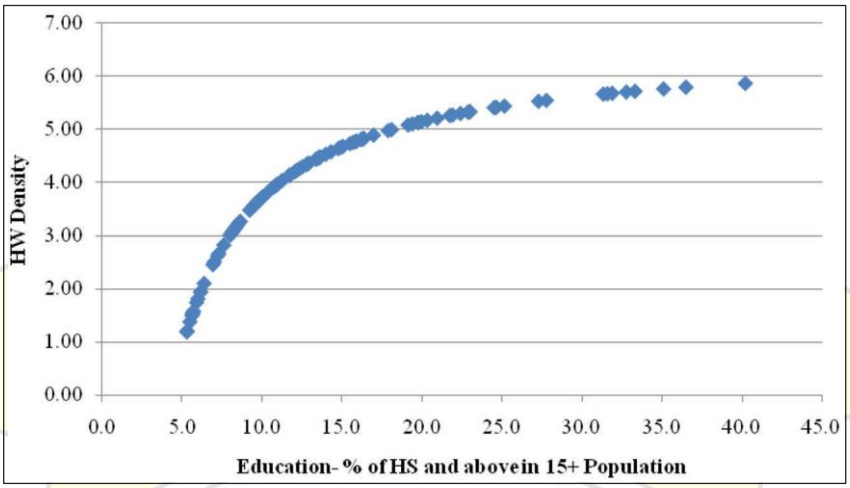


Figure 2. Educational Development and Health Workers Density across States and UTs in India

Source: Authors' estimation based on Census of India information.

Note: Observations are of all states and UTs for the years 1991, 2001 and 2011.

It displays a non-linear monotonic connection with an asymptote of the density of health workers following a particular educational development threshold. Thus, it may be argued that in order to meet the desired density of health workers, a certain level of educational development is required in order to guarantee the production and supply of a skilled workforce for the healthcare industry.

AVAILABILITY OF WORKFORCE IN HEALTHCARE SERVICES AND HEALTH OUTCOMES

Given the health workforce's current state of deficiency, it is important to confirm the extent to which this contributes to the variation in health outcomes among the states. Health workers per 1,000 population and IMR are the input and outcome variables taken into consideration, respectively. IMR was chosen as a health outcome measure for the analysis for the following reasons. According to the frameworks of demographics, epidemiology, and health transition, mortality plays a crucial role in population and health dynamics (Caldwell, 1976; Kirk, 1996). Changes in age-independent mortality factors are linked to a significant portion of the mortality transition that improves life expectancy as seen in several nations (Gavrilov & Gavrilova, 1991).

Changes in the patterns of illness occurrence and causes of death, particularly the management of infectious diseases, are related to the epidemiological transition framework (Omran, 1971). In order to promote long and healthy lives by preventing premature deaths and guaranteeing a life free from morbidity and disability, the recent health transition framework looks beyond measuring mortality and causes of death and instead focuses on sociocultural practices and health behaviors as well as the operation of healthcare systems (Caldwell, 1993; Frenk et al., 1991).

Child mortality (of those under five) is the primary contributing element in a situation of high mortality, as seen in poor nations and India. It accounts for about 60% of all fatalities of

individuals of all ages, especially those brought on by infectious parasite diseases. Children's health and disease patterns are stated to undergo significant changes throughout the epidemiological transition as their vulnerability to pandemic-related mortality decreases, improving their chances of survival (Omran, 1971). Acute respiratory infections (ARI), which include pneumonia, diarrhoea, measles, and tetanus, are among the primary diseases or disease categories that cause the majority of child mortality, accounting for 70% of all child deaths.

However, it is important to remember that a child's survival is dependent on their birth circumstances, including prenatal care, institutional delivery, postnatal care, vaccinations, and the management of childhood illnesses. Healthcare systems are essential in this sense, particularly when it comes to the health of mothers and children. Along with the availability of medical facilities, the availability of qualified medical professionals—such as physicians—as well as other human resources, such as nurses and paramedics, is crucial and crucial in healthcare systems.

Given the foregoing context, the current exercise attempts a bi-variate analysis as a starting point without adjusting for any additional independent variables. It should be mentioned that the state-level analysis in the previous section only included the major Indian states; however, the regression analysis takes into account observations from all 35 entities, including union territories. Table 3 presents the results of the study of five distinct bi-variate regression equations involving the same dependent variable (i.e., IMR) on five distinct independent variables.

For the current bi-variate investigation of the link between the density of health workers and the chosen health outcome, namely IMR, a reciprocal form of the regression equation is taken into consideration. The equation with the reciprocal term of density (as the independent variable) fits better according to the fundamentals of econometrics, suggesting a monotonic non-linear relationship as opposed to its linear version (see Figures 4 and 5). In fact, for the reciprocal form of the regression equation, the diagnosis of residuals distribution checking the randomness is more advantageous than for the linear equation.

Table 3: Bi-Variate Regression Results: State Level Association between Density of Skilled Workforce in the Healthcare Sector and Health Outcomes (i.e., IMR)

	Eq. No. Independent Variables	Constant	B	P	R2	df	Obsr
1	2	3	4	5	6	7	8
1	NIC based HW/1000P—all health	20.20	50.72	0.00	0.58	138	140
	workers	(1.61)	(3.71)				
2	NCO based HW/1000P—all health	38.80	21.10	0.00	0.47	138	140
	workers	(3.49)	(1.84)				
3	NCO based HW/1000P—all	23.78	22.71	0.00	0.42	138	140
	doctors & nurses and midwives	(2.38)	(1.88)				
4	NCO based HW/1000P—allopathic	2.38	30.56	0.00	0.13	138	140
	doctors	(0.52)	(2.04)				
5	NCO based HW/1000P—nurses	7.55	27.63	0.00	0.38	138	140
	and midwives (including ANMs)	(0.82)	(1.62)				

Source: Authors' estimation based on Census and SRS data.

Notes: Figures in parenthesis are values of standard errors (SE); Observations are separate rural and urban values of all the 35 Indian states and UTs for the two census years 2001 and 2011; ANMs— auxiliary nurse-midwives.

ISSN: 2393-8048
International Advance Journal of Engineering, Science and Management (IAJESM)
Multidisciplinary, Multilingual, Indexed, Double Blind, Open Access, Peer-Reviewed, Refereed-International Journal.
SJIF Impact Factor =8.152, January-June 2025, Submitted in January 2025

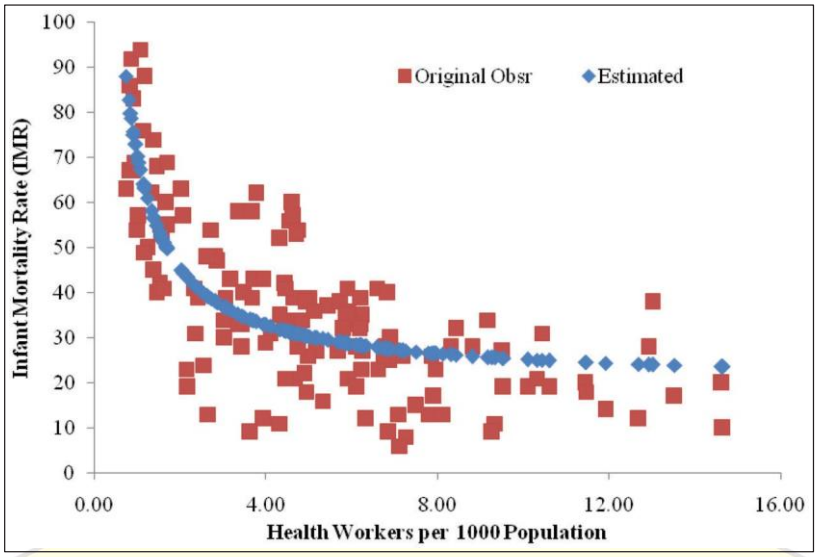


Figure 3: NIC-based Health Workers and IMR across States and UTs in India for the Years 2001 and 2011

Source: Authors' estimation based on Census and SRS data.

Note: Observations are state level rural and urban values separately for the years 2001 and 2011.

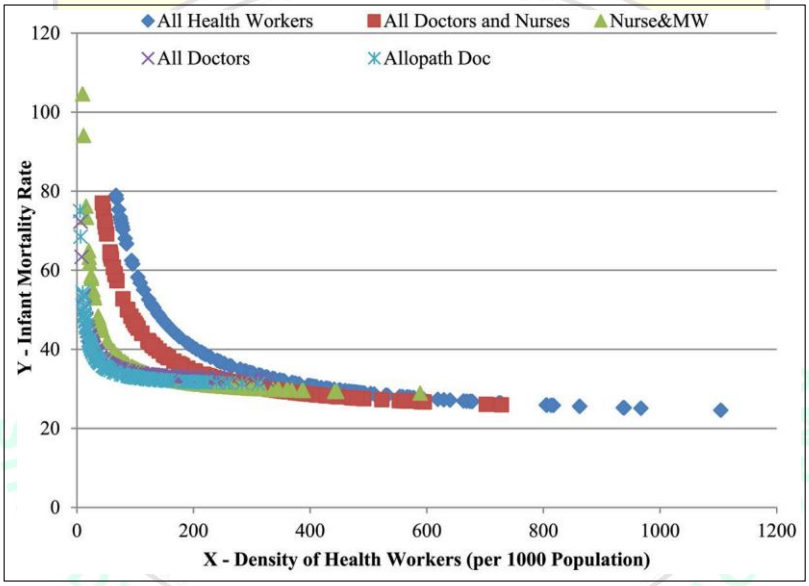


Figure 4: NCO-based Health Professionals and IMR across States and UTs in India for the Years 2001 and 2011

Source: Authors' estimation based on Census and SRS data.

Note: Observations (140) consists of state and UT level rural and urban values separately for the year 2001 and 2011.

The bi-variate regression analysis with five separate equations conducted in this exercise informs us the significantly strong and positive relationship/ association between density of health workers and the health outcome. Otherwise, a negative relationship observed between IMR and density of health workers indicates a positive relationship between such density of workforce and health outcomes because IMR is a negative outcome indicator that needs to be lowered (lesser the IMR better the health outcome in terms of higher infant survival rate). The explanatory power of the independent variable varied from 0.58 in con- sideration of density of NIC-based health workforce of all cadres to 0.21 with consideration of NCO-based health workforce of only allopathic doctors.

CONCLUSION

Based on census data and the relationship between health worker density, educational attainment, and the chosen health result (i.e., IMR), the article looked at the expansion and sufficiency of the workforce working in India's healthcare industry over the last 20 years. According to the data, the density of health workers in India and in different states improved between 1991 and 2011, especially in the most recent ten years (2001–2011). It's interesting to note that as compared to their urban colleagues, health workers in rural areas had faster development. Despite this expansion, there are only one-third as many health professionals in rural areas as in urban ones. The country is not meeting the WHO's need-based minimum criterion of 4.45 health workers per 1,000 population, which is concerning despite the notable improvement in health worker density, especially between 2001 and 2011. The country's education system in general and medical education in particular are intertwined with the scarcity of professional health workers in the healthcare industry, both in terms of quantity and quality. How the proposed NMC would revitalize the healthcare system with its inherent abnormalities is still up in the air.

According to the exploratory verification, educational development and health workforce density are substantially positively correlated. It displays a non-linear monotonic connection with an asymptote of the density of health workers following a particular educational development threshold. Additionally, there is a strong and positive correlation between health outcomes and the density of health personnel. Given the shortage of health workers, it is necessary to gradually increase the number of health workers while paying careful attention to their redistribution in order to account for regional variations.

REFERENCES

1. Anand, S., & Bärnighausen, T. (2004). Human resources and health outcomes: Cross-country econometric study. *The Lancet*, *364*(9445), 1603–1609.
2. Anand, S., & Fan, V. (2016). The health workforce in India: Human resources for health observer series no. 16. World Health Organization. https://www.who.int/hrh/resources/16058health_workforce_India.pdf
3. Apollo Hospitals. (2016). *Annual report 2015-16: Valuing life*. Author.
4. Caldwell, J. C. (1976). Toward a restatement of demographic transition theory. *Population Development Review*, *2*(3–4), 321–366.
5. Caldwell, J. C. (1993). Health transition: the cultural, social and behavioural determinants of health in the Third World. *Social Science Medicine*, *36*(2), 125–135.
6. Chakravarthi, I., Roy, B., Mukhopadhyay I., & Barria, S. (2017). Investing in health: Healthcare industry in India. *Economic and Political Weekly*, *52*(45), 50–56.
7. Duggal, R., Kurien, O. C., Bhate-Deosthali, P., & Wagle, S. (2012). Political economy of healthcare in India. *Health for the Millions*, *38*(4), 1–60.
8. Dussault, G. (1999). *Human resources development: The challenge of health sector reform*. The World Bank.
9. Frenk, J., Bobadilla, J. L., Stern, C., Frejka, T., & Lozano, R. (1991). Elements for a theory of the health transition. *Health Transition Review*, *1*(1), 21–38.
10. Gavrilov, L. A., & Gavrilova, N. S. (1991). *The biology of life span: A quantitative approach*. Harwood Academic Publisher.
11. GOI. (2014). *Achievements and new initiatives: Five years (2009–14)*. Ministry of Health and Family Welfare, Government of India.
12. Hazarika, I. (2013). Health workforce in India: Assessment of availability, production and distribution. *WHO South-East Asia Journal of Public Health*, *2*(2), 106–112.
13. Hooda, S. K. (2015). *Private sector in healthcare delivery market in India* (Working Paper No. 185). Institute for Studies in Industrial Development (ISID), New Delhi.

14. Kirk, D. (1996). Demographic transition theory. *Population Studies*, *50*(3), 361–387. Motkuri, V., & Naik, V. S. (2010, August). Workforce in Indian health care sector. *The*
15. *Asian Economic Review*, *52*(2).
16. Motkuri, V., Vardhan, T. S., & Ahmad, S. (2017). *Quantity and quality of human resources in health care: Shortage of health workers in India* (MPRA Paper No 84332). https://mpra.ub.uni-muenchen.de/84332/1/MPRA_paper_84332.pdf
17. Narayana, J. P. (2004). *Ensuring a healthy future*. Loksutta.
18. Narayana, K. V. (2006). *The unqualified medical practitioners: Methods of practice and nexus with the qualified doctors* (Working Paper No. 70) Centre for Economic and Social Studies, Hyderabad.
19. Omran, A. R. (1971). The epidemiologic transition: A theory of the epidemiology of population change. *Milbank Mem Fund Q, 49*(4), 509–538.
20. Percot, M. (2006). Indian nurses in the gulf: Two generations of female migration. *South Asia Research*, *26*(1), 41–62.
21. Rao, K. D. (2013). *Situation analysis of the health workforce in India* (Human resources background paper 1). Public Health Foundation of India (PHFI).
22. Rao, K. D., Bhatnagar, A., & Berman, P. (2009). India's health workforce: Size, composition and distribution. In J. La Forgia & K. Rao (Eds.), *India health beat*. World Bank and Public Health Foundation of India.
23. Rao, K. D., Shahrawat, R., & Bhatnagar, A. (2016, September). Composition and distribution of the health workforce in India: Estimates based on data from the National Sample Survey. *WHO South-East Asia Journal of Public Health*, *5*(2), 133–140.
24. Rao, M., Rao, K. D., Kumar, A. S., Chatterjee, M., & Sundararaman, T. (2011, 11 January).
25. Human resources for health in India. *The Lancet*, *377* (9765), 587–598.
26. Ravi, S. (2017, 19 September). Restructuring the Medical Council of India to elimi- nate corruption (Op-ed.). *LiveMint*. http://www.livemint.com/Opinion/t2Q58kLDVNiagMILIMXB4O/Restructuring-the-Medical-Council-of-India-to-eliminate-corr.html
27. Sinha, K. (2007, 12 September). Nurse exodus leaves India short. *Times of India.*
28. Thomas, G. (2017, 7 September). A case for universal medical care: The opposition to NEET is a smokescreen to hide inequalities and exploitation (Op-ed). *The Hindu*.
29. World Health Organization (WHO). (2006). *The world health report 2006: Working together for health*. Author.
30. WHO. (2016a). *Global strategy on human resources for health: Workforce 2030*. Author.
31. WHO. (2016b). *Health workforce requirements for universal health coverage and the sustainable development goals* (Background paper no. 1 to the global strategy on human resources for health). *Human Resources for Health Observer 17*(1). https://www.who.int/hrh/resources/health-observer17/en/