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HEALTH WORKFORCE IN INDIA: WHY, WHERE AND HOW TO INVEST?

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Acronyms

ANM	auxiliary nurse midwife
BAMS	Bachelor of Ayurveda, Medicine and Surgery
BHMS	Bachelor of Homeopathic Medicine and Surgery
BSMS	Bachelor of Siddha Medicine and Surgery
BUMS	Bachelor of Unani Medicine and Surgery
CBHI	Central Bureau of Health Intelligence
CHC	community health centre
ComHEEG	High-Level Commission on Health Employment and Economic Growth
GoI	Government of India
HRH	human resources for health
MoH	Ministry of Health
MoHFW	Ministry of Health and Family Welfare
NCO	National Classification of Occupations
NHP	National Health Policy
NGO	nongovernmental organization
NHWA	National Health Workforce Account
NIC	National Industrial Classification
NITI Aayog	National Institute for Transforming India
NSSO	National Sample Survey Office
OECD	Organization for Economic Cooperation and Development
PHC	primary health centre
PHFI	Public Health Foundation of India
PLFS	Periodic Labour Force Survey
RMP	rural medical practitioner
SDGs	Sustainable Development Goals
WHO	World Health Organization

Executive summary

The High-Level Commission on Health Employment and Economic Growth emphasized multiple returns of investment in the human resource for health (HRH). Investments made in HRH not only strengthen the health system but also generate employment and contribute to economic growth (WHO 2016b). In India, such investments in HRH have the potential to enhance employment growth. They also increase the share of formal employment instead of informal employment and increase women labour force participation in addition to increase in accessibility to health workers by population, particularly those living in rural and remote areas.

Existing studies highlight acute shortage of health workers at all levels, which has also been reflected during the current pandemic crisis of COVID-19. World Health Organization. A recent 2020 WHO mid-term review of progress on Decade for health workforce strengthening in SEAR 2015-2024, mentions that India needs at least 1.8 million doctors, nurses and midwives to achieve the minimum threshold of 44.5 professional health workers per 10 000 population. India needs to invest in HRH for increasing the number of active health workforce and to improve the skill-mix ratio (nurses-doctors, allied-doctors etc.).

This study presents an updated estimate on the size and composition of stock of health professionals and active health workforce in the country. Using the information available from the National Health Workforce Account (NHWA) on the stock of health professionals and Periodic Labour Force Survey (PLFS) conducted by the National Sample Survey Office (NSSO 2017–18) on active health workforce, the study estimated a total stock of 5.7 million health workers which included allopathic doctors (1.1 million), dentists (0.27 million), nurses (2.3 million), pharmacists (1.2 million) and traditional medical practitioners (AYUSH 0.79 million). However, the active health workforce size is estimated (from the NSSO 2017-18) to be much lower (3.04 million) with allopathic doctors and nurses estimated as 0.78 million and 1.36 million respectively.

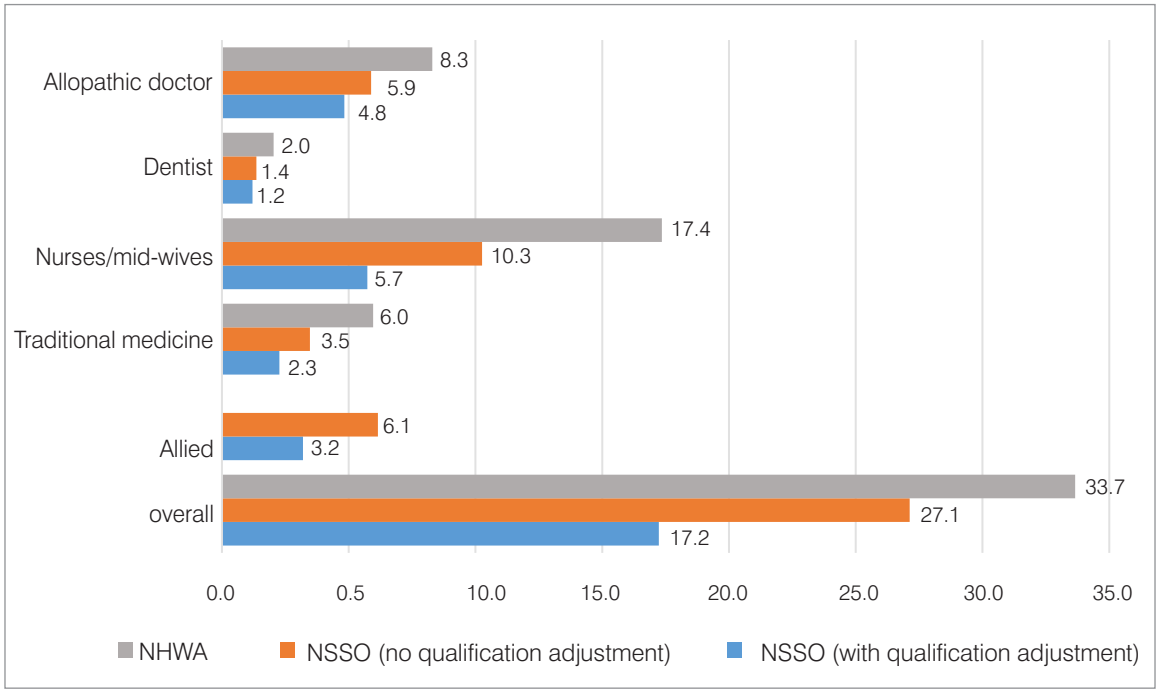
The prime reasons for differences between the two include outmigration of health professionals, economically inactive health professionals and lack of regular updates of NHWA database. Thus for real and accurate estimation, the two datasets that are available must be triangulated for a real and clear idea about the health workforce.

The study highlighted that while many inadequately qualified health workers report themselves as health workers, a large proportion of adequately qualified health workers holding a degree/diploma in medicine are not currently working in labour markets.

Density of health workforce is compared in terms of number of different types of health workforce per 10 000 persons and is an important indicator of availability and accessibility of HRH. The NHWA data, in general reflects higher density as compared with the NSSO based

estimates for almost all the categories of health workforce as it provides information on stock data. However, NSSO based estimates provide information on the active health workforce in the Indian health system. At the all-India level, stock density of doctor and nurses/midwives is 8.3 and 17.4 respectively per 10 000 persons. If the total stock of dentists and traditional medicine practitioners is added, a total stock density in the country would be estimated as 33.7 per 10 000 persons. However, active health workers' density (as estimated from NSSO) of doctor and nurses-midwives (without adjusting for adequate qualification) is estimated to be 5.9 and 10.3 respectively. The numbers further drop to 4.8 and 5.7 respectively after adjusting for adequate qualifications. If all kinds of health professionals are considered (including dentists, traditional medicine practitioners and allied health workforce), the total worker density per 10 000 persons is estimated to be 27.1 without adjusting for qualifications and 17.2 after adjusting for qualifications (Fig. 1).

Fig. 1. Number of health professionals/workers per 10 000 persons, 2018



Sources: NHWA 2018 and NSSO 2017–18

Among the states, Kerala reported the highest density of doctor workforce (20.96) whereas Delhi had the highest density of nurses and midwives. Considering doctor and nurse workforce together, Kerala, Delhi and Tamil Nadu are on the top while the states of Bihar, Jharkhand and Odisha appear at the bottom.

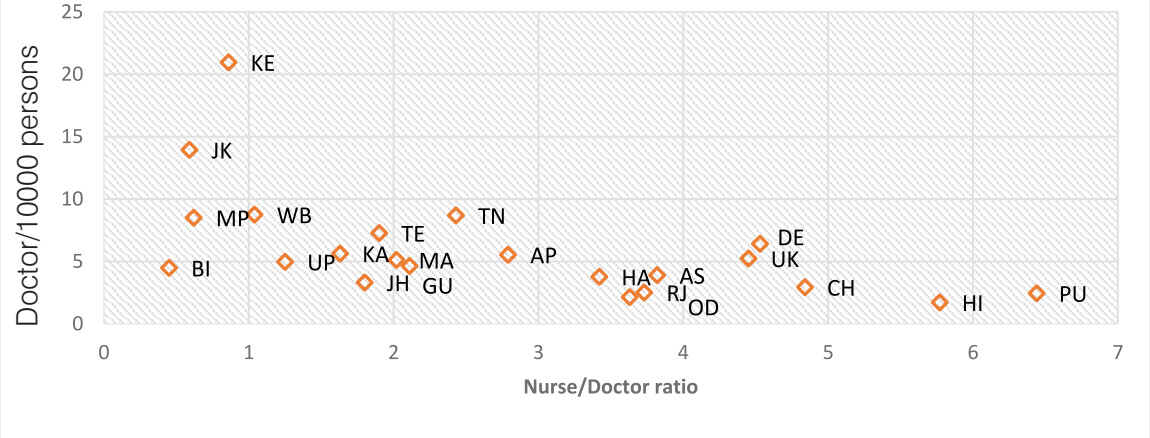
An improved service delivery requires the right skill-mix of these workers (WHO 2016b; WHO 2017). The High-Level Commission on Health Employment and Economic Growth (WHO 2016b) notes that "optimizing the skill-mix by reorganizing scopes of practice can improve access to services and reduce waiting time, producing a high patient satisfaction rate".

The right balance in the skill-mix ratio for health workers provides optimum health-care conditions. Contrasting the skill-mix ratio with the density of doctors at state levels, an inefficient skill-mix is found to exist between doctor and nurse and doctor and allied health professional in most states in India.

For instance, in Bihar and Uttar Pradesh, the density of doctor and nurse-doctor ratio are both very low (Fig. 2). In Karnataka and Jharkhand nurse-doctor ratio is slightly better as compared to that in Bihar and Uttar Pradesh even though the density of doctors remains very low. In all these states along with maintaining high skill-mix, there is need to improve the availability of doctors. Similarly, in Madhya Pradesh and West Bengal, the density of doctors is fairly high but the nurse-doctor ratio is low. In these two states, improving the nurse-doctor ratio will lead to a better skill-mix situation. There are also states at the extreme end, i.e. very high doctor density but very low nurse-doctor ratio (Kerala, Jammu & Kashmir) and very high nurse-doctor ratio but very low density of doctors (Punjab, Himachal Pradesh, Chhattisgarh and Uttarakhand).

Fig. 2. States with varied density of doctors and nurse/doctor ratio

DE Delhi	HA Haryana	HI Himachal Pradesh	JK Jammu and Kashmir	PU Punjab
RJ Rajasthan	UK Uttarakhand	AS Assam	CH Chhattisgarh	MP Madhya Pradesh
BI Bihar	JH Jharkhand	WB West Bengal	OD Odisha	MA Maharashtra
GU Gujarat	UP Uttar Pradesh	AP Andhra Pradesh	KA Karnataka	KE Kerala
TN Tamil Nadu	TE Telangana			



Source: Estimates from NSSO 2017-18

Size of traditional medicine practitioners (AYUSH) in India is quite sizeable. Total number of active AYUSH practitioners is almost 60-70% of the total number of active allopathic doctors (NHWA 2018; NSSO 2017–18). However, number of nurses per doctor is less than two. This number is even lower and closer to one if BSc Nursing qualifications are considered. In most OECD countries, there are 3-4 nurses per doctor (OECD 2019). Although total stock of nurses in the country is approximately three times the number of doctors, a large proportion of nurses are not active in the labour market. The labour force based estimate (NSSO 2017–18) of doctors to nurse ratio is barely 1:1.3. A few states such as Delhi, Punjab, Himachal Pradesh, and Chhattisgarh have a high nurse doctor ratio but in these states the density of doctor per 10 000 persons is extremely low. There is need to balance densities of doctors and nurses, both for better availability of health professionals and skill-mix. Similarly, the doctor and allied health professionals' ratio is also very poor which needs attention.

As far as public-private division of health workforce is concerned, bulk of the doctors' employment remains in the private sector while nurses are almost equally distributed across

the public and private sector. Public sector seems to be the sole employer of traditional medical practitioners. This lopsided distribution of health workers not only creates a shortage of trained health workforce in many states and rural areas but also leads to an unequal skill-mix across different types of health workers in different settings.

The public sector is challenged by a high rate of vacancy of sanctioned positions. The Rural Health Statistics highlights this issue. While the shortage is most pronounced for specialists posted at Community Health Centres (CHC), India faces shortages across states for various positions. A review of the serially published reports of the Rural Health Statistics shows a slow but definite growth in the number of health providers at the overall country level. The vacancies are attributed to diverse reasons that range from barriers in recruitment, litigations against recruitment processes and premature exits from the system, especially in contractual positions.

Increase in the number of health workforce and the right balance in the skill mix requires a supply of health professionals at an increased rate. The supply side of health professionals is an important parametre in reaching the goals for minimal optimum density of the health workforce. An analysis of the health workforce projections provides the estimated density of skilled health professionals (doctors, nurses and midwives) per 10 000 population. Considering the current rates of growth are sustained, the required density of health workforce will still not be met as the rise in the number of health professionals will be balanced by a rise in the country's population. At the present level of growth on the supply side, the skill-mix ratio of doctor : nurse is unlikely to alter by 2030. A near 200% growth on the supply side for nurses will improve the doctor : nurse ratio to 1:1.5 by 2030. This will require a further rapid scale-up of nursing programmes.

The High Level Expert Group report for the Planning Commission in 2012 had suggested a ratio of 1:2:1 for doctor: nurse: ANM for India. For achieving this target by 2020, simultaneous efforts would be needed on the demand side of the market as well. The roles for nurses and the functions that are performed by them will need closer attention.

Recommendations

India needs to invest in HRH for increasing the number of active health workers and also improve the skill-mix ratio which requires investment in professional colleges and technical education. India needs to encourage qualified health professionals to join labour markets and ensure additional trainings and skill building for those who are already working but are inadequately qualified health workers. In addition to increased availability of and accessibility to quality health workers by population in general, enhanced investment in HRH will lead to strengthening of the health system for dealing with pandemic situations like COVID-19 and any other epidemic/s. It will lead to economic growth, increased women participation in the labour market, formalization of the labour market and overall economic wellbeing.

Important recommendations for the Government would be to assure an adequate and adroit workforce that emphasizes expansion of the supply side of the health workforce. This must be prioritized across geographical regions with a shortage of health workforce. Since such deficient geographies report a shortage of several categories of health workforce, a systematic effort for co-locating multiple teaching institutions such as medicine, nursing, dentistry etc. should be encouraged.

I. Introduction

Human resources for health (HRH) are identified as one of the core building blocks of a health system. (WHO 2006) The WHO Global Strategy on Human Resources for Health highlighted that investment in HRH can deliver a triple return of improved health outcomes, global health security and economic growth (Scheil-Adlung et al. 2015; WHO 2016a; WHO 2016b).

The WHO Global Strategy document also notes that globally, investment in the health workforce is lower than what is needed for education and training of health workers on the one hand and on the other hand, ensuring accessibility of health workers by population in need of health-care. This reduces the sustainability of workforce and the health system (WHO 2016a). Inspite of the increased recognition of investment and a central role of the health workforce in attaining health outcomes, multiple HRH challenges continue to persist in health systems in different countries. Any strategy of an investment in HRH must therefore consider these challenges to make investments efficient and meaningful for population (Cometto and Campbell 2016; WHO 2016a; WHO 2016b). The present study identifies some of these HRH challenges in India and identifies areas of investments in HRH in India.

Global agenda of investment in the health workforce

Global agenda of investment in health, including the health workforce, is articulated by the High-Level Commission on Health Employment and Economic Growth (henceforth referred to as "ComHEEG") established by the United Nations Secretary General in 2016. The ComHEEG recognizes that health workers and health employment reside at the heart of the sustainable development goal (SDG) agenda. Herein, an expanded, transformed and sustainable health workforce improves health outcomes, wellbeing, equity and social cohesion will foster inclusive economic growth.

The Commission recognized that although there is an urgency for building resilient health systems and the role of the health workforce is critical, a projected shortage of 18 million health workers exists to achieve and sustain the SDGs, primarily in low and lower-middle income countries (LMIC). The ComHEEG report (WHO 2016b) notes that investments in the health system have multiplier effects that enhance employment and inclusive economic growth. The returns on investment in health are estimated to be 9 to 1. Targeted investment in health systems, including in the health workforce, promote economic growth through a range of pathways such as economic output, social protection and cohesion, innovation and health security.

The report of the Commission highlighted that a dynamic health labour market fosters education and jobs, especially for women and young people. The commitment for investment in HRH at the global level is driven through the ComHEEG's 10 recommendations and five immediate actions for creating a sustainable health and social workforce (see Box: 1).

HRH in a true sense is often defined in terms of the health workforce i.e. "all people engaged in actions whose primary intent is to enhance health" (WHO 2006). However, more recently WHO further defined health workforce in terms of four dimensions, namely:

i) availability, ii) accessibility, iii) acceptability and iv) quality (WHO 2016a; WHO 2017a).

This exemplifies the fact that the size and composition of active health workforce in a country will be different from a total stock of professionals with adequate qualification to work in health service delivery. Nonetheless, the effective HRH governance considers all, namely stock, skill-mix, distribution, productivity and quality of the workforce in relation to population needs (Campbell et al. 2013; WHO 2017a).

Box 1:

Recommendations of the High-Level Commission to transform the health workforce for SDGs

The High-Level Commission on Health, Employment and Growth makes ten recommendations that would strengthen health and social protection systems as well as broader initiatives to implement the 2030 Agenda for Sustainable Development and to meet the targets of the SDGs. The recommendations include the following:

1. Stimulate investments in creating decent health sector jobs;
2. Maximize women's economic participation and foster their empowerment;
3. Scale up transformative, high-quality education and lifelong learning;
4. Reform service models; concentrate on hospital care and focus instead on prevention and efficient provision of high-quality, affordable, integrated, community-based, people-centered primary and ambulatory care;
5. Harness the power of cost-effective information and communication technologies;
6. Ensure investment in the International Health Regulations (2005) core capacities;
7. Raise adequate funding from domestic and international sources;
8. Promote intersectoral collaboration at national, regional and international levels;
9. Advance international recognition of health workers' qualifications to optimize skills use; and
10. Undertake robust research and analysis of health labour markets.

Source: WHO 2016b

A WHO report on National Health Workforce Account provides an "input-throughput-output" framework and assesses education sector, labour markets and distributional dimensions of health professionals to understand policy implications of the supply of health workforce in a country (WHO 2017a). Increasingly, there is greater recognition on the role of staff-mix or skill-mix, i.e. achieving a specific mix of different types of personnel, with an increasing interest in evidence about the value and contributions of different staff-mixes to patient, personnel, and organizational outcomes (WHO 2016a; WHO 2017b; OECD 2019). Few recent studies by Koopmans et al (2018) and European Union (2019) with respect to European countries suggest that more diverse staff and skill-mix, in combination with positive contextual conditions, can result in improved quality of care, quality of life, and job satisfaction.

Investment case for health workforce in India

The investment case for HRH in India is exemplified by the fact that such investments have the potential of not only strengthening the health system but also having a positive effect on labour markets which in turn impact economic growth in multiple ways. Enhanced investment in HRH will generate employment not only for doctors and nurses but also for a large number of allied health professionals, associate health workers and subordinate and support staff.

A recent WHO report mentions that India needs at least 1.8 million doctors, nurses and midwives to achieve the minimum threshold of 44.5 professional health workers per 10 000 population (WHO 2020). Also, India's National Health Policy (NHP) 2017 recommends strengthening the existing medical education system and mooting for the development of a cadre of mid-level care providers (Ministry of Health and Family Welfare [MoHFW] 2017). Similarly, the NITI Aayog's Strategy for "New India@75" aims at generating 1.5 million jobs in the public health sector by 2022–23 (NITI Aayog 2018).

The current COVID-19 pandemic has further exposed the acute shortage of health workers in India's health system. On the one hand, Organization for Economic Cooperation and Development (OECD) countries benefit immensely by the presence of Indian origin and Indian trained doctors and nurses (OECD 2019) but in crisis situations such as the COVID-19, the country's health system is found to be struggling with low numbers of trained health personnel.

An enhanced investment in HRH also has potential to positively affect other important labour market outcomes in India such as share of formal employment and female labour force participation. Share of formal sector employment in health sector is significantly higher (more than 60%) in India as compared with other sectors (less than 20%). Similarly, female workers share approximately 50% of the total health sector workforce in India (WHO 2020). Given very low and declining female labour force participation rate LFPR), in general in India (LFPR among 15–59 age women being 25% in 2017–18) (Klasen and Pieters 2015; Andres et al. 2017; Desai et al. 2018), new employment opportunities in HRH have huge potential for improving the same.

Health-care services in India are offered by a varied range of professionals trained in different specialties of medicine and health-care. The supply side information (Central

Bureau of Health Intelligence [CBHI) 2019) on the availability of qualified health professionals indicate that these health professionals have varied levels of educational qualifications and are registered with different councils/agencies (Rao et al. 2011; Karan et al. 2019). Table 1 presents categories of health professionals directly engaged in service delivery along with their levels of educational qualification and their registering agencies.

Table 1: Types of health professionals, their educational qualification and registering agencies

Health workers	Educational qualification	Registering agencies
Allopathic doctors (physician and surgeon)	Graduates with a bachelor's degree in medicine/surgery or postgraduate diploma	Medical Council of India
Dental practitioners	Graduates with a bachelor's or postgraduate degree in dentistry	Dental Council of India
AYUSH practitioners	Graduates with a bachelor's or postgraduate degree in Ayurveda, Unani, Siddha, or Homoeopathy	Department of AYUSH/MoHFW
Nurses	Diploma in General Nursing and Midwifery (3·5 year course) or a 4-year bachelor's degree or a 2–3-year postgraduate degree	Indian Nursing Council
Auxiliary nurses and midwives	Diploma in auxiliary nurse midwifery (2-year course).	Ministry of Health and Family Welfare
Pharmacists	Diploma or bachelor's degree course in pharmacy	Pharmacy Council of India
Physiotherapists, diagnostics and others technicians	Diploma/certificate in medical allied fields	Indian Association of Physiotherapist and Ministry of Health and Family Welfare

Sources: Information from CBHI 2019 and Councils of health professionals

In addition to the health professionals as presented in Table 1, there are also community health workers who have 10 years of formal education and have completed a short training course. Health work force at the ground level also includes many informal medical practitioners, such as registered medical practitioners (RMPs) (including traditional birth attendants, faith healers, snakebite curers, bonesetters etc.) with or without any formal education or skills/training. The RMPs are often the first point of contact for treatment for a majority of the population living in rural and remote areas and they may be dispensing either allopathic or traditional drugs or both as the need arises.

A lot of research conducted in the recent past has noted areas of concern related to the Indian health workforce. For instance, studies have highlighted that there has been an acute shortage of doctors and nurses along with low levels of skill-mix. Studies in the past have also indicated that lack of adequate number of institutions providing education and training in nursing and international migration of nurses from India are the two most prominent reasons of shortage of trained nurses in India (Nair and Percot 2007; Garbayo and Maben 2009; Gill 2009, 2011). Moreover, studies have highlighted low quality of a large share of total number of nurses in India (Gill 2016). The National Health Policy (NHP) 2017 in this regard recommends improving regulation and quality management of nursing education in India (MoHW 2017).

Despite several studies on shortage of different categories of health workforce in India, very few studies have highlighted the need for skill-mix and task shifting and the required amount of investment needed in this area. Although improving the availability and accessibility of health workforce remains an important issue, skill-mixing of the health workforce can provide a solution to the shortage of one or other categories of health workers. Improving skill-mix itself demands investments in training and improving the quality of health workers through various means.

The present study is an attempt to identify such needs of improvement in availability and skill-mix of health workforce. The report presents updated information on the size and composition of the health workforce in India and makes projections for 2030. One of the main objectives of the study is to identify areas of investment in HRH so that a focused policy strategy can be finalized.

II. Methods

2.1. Data

The present study used data from two main sources, namely the National Health Workforce Accounts (NHWA) on India for 2018, the Global Health Workforce Statistics, World Health Organization (WHO), Geneva[1] and the (2) Periodic Labour Force Survey (PLFS) conducted from July 2017 – June 2019 by the National Sample Survey Office (NSSO), Central Statistical Organization, Government of India (NSSO 2017–18). In addition, information was also collected from CBHI (2019) and Rural Health Statistics (2019).

NHWA data

The NHWA for India provides information on different categories of stock of health workers at national and sub-national (state) levels. The latest information available is for the year 2018. The number of health professionals were extracted from NHWA for four different categories (Medical doctors, dentists, nurses and pharmacists) at the all-India and state levels for the year 2018 (NHWA 2018).

NSSO data

The second source of information on heath workforce was estimated by the nationally representative "Periodic Labour Force Survey" (PLFS) 2017–18, conducted by the NSSO, GoI (NSSO 2017–18). The sample size of PLFS 2017–18 is 102 113 households (56 108 rural and 46 005 urban) covering 433 339 individuals (246 809 rural and 186 503 urban). In addition to a large number of socio-economic parametres, the survey provides information on detailed activity status, reflecting sectors and types of employment, of each individual covered in the survey.

Along with a large number of labour market indicators, the survey collected information related to the nature of occupation of workers, categorized by the three-digit National Classifications of Occupation (NCO) 2004 and the five-digit National Industrial Classification (NIC) 2008, which help identify national-level as well as state-level representative sectoral composition of workers, including the workforce engaged in human health activities (see Technical Annexure). NSSO data also provides information on detailed activity status such as workers, unemployed and out-of-labour force, location of workers by state and rural and urban, general educational and technical educational qualifications, place of working by public and private sectors.

2.2. Methods of estimation of health workforce

Estimation of health workforce

Total stock of health professionals by types of health professionals (doctors, nurses and midwives, pharmacists and traditional medicine practitioners) is directly reported in the

[1]Available at: https://apps.who.int/gho/data/node.country.country-IND?lang=en

NHWA database. The team estimated comparable size, composition and distribution of health workforce from the NSSO 2017–18, using the worker population ratio disaggregated by NIC and NCO classification of workers and projected population as of January 2018. (See Technical Annexure for details on estimation methods).

Two sources (NHWA and NSSO data) identify comparable categories of health professionals. However, NSSO database does not provide NCO code for identifying pharmacists comparable to the NHWA. The pharmacist number presented in this report on the basis of NSSO data only refers to pharmacists engaged in retail trade.

Supply estimation

Institutions offering health programmes in 2019 were identified using keywords such as "health programmes", "nursing courses", "AYUSH", "MBBS", "BPharma" and "allied health programmes" in the Google search engine. The search was limited to programmes offered in India. Additionally, the websites of the All India Council of Technical Education (AICTE), University Grants Commission (UGC), universities and institutions were also searched. In addition, education supplements of leading newspapers and education-based websites, including shiksha.com, targetstudy.com, getmyuni.com and career.webindia123.com, were searched. The number of seats available were estimated through various health domains/ medical specialties. The information was collected through internet and education related websites.

The number of seats in various health professional programmes offered by medical colleges/institutes was forecasted for the period till 2030. A seat occupancy of 95% was assumed for medical doctors. It was also assumed that the 95% occupancy would be constant for the forecast time period (see Box A-II in Technical Annexure).

III. Results

3.1. Size and composition of the health workforce

To begin with the present estimates of HRH, categorized by doctors, dentists, nurses/midwives and pharmacists, at the all-India level use the two main sources of data (Table 2). Since workers self-reported occupations in the NSSO survey and health workers may or may not have adequate qualifications (as presented in Table 1), estimates on health workforce from NSSO were submitted with and without adjustment of adequate qualifications.[2]

NHWA reported a total stock of approximately 1.1 million allopathic doctors, 0.27 million dentists, 2.3 million nurses, 0.8 million traditional medicine professionals and 1.2 million pharmacists. Both the estimates from NSSO were invariably lower compared with the NHWA estimates for all the reported health worker categories. For instance, according to NSSO, the number of allopathic doctors and nurses/midwives, even before adjusting for the right qualifications was 0.70 million and 1.37 million respectively as against the total stock of 1.1 million allopathic doctors and 2.3 million nurses recorded in the NHWA.

Estimates on dentists, pharmacists and traditional medical practitioners from NSSO were significantly lower as compared with those recorded in NHWA. The difference in estimates from the two sources was however highest for pharmacists mainly because only pharmacists engaged in the retail trade were identifiable in the NSSO data. The NSSO based estimates after adjusting for the mandated qualifications were further lower as approximately 20% of health workers who self-reported as allopathic doctors had no adequate qualification. Similarly, as high as 45% of health workers engaged as nurses and midwives reported inadequate qualifications.

Table 2. Size and composition of HRH in India as of 2018

HWF	NHWA (millions)	NSSO (millions)		NSSO estimate as % of NHWA	
		Total reported	Adequately qualified	Total reported	Adequately qualified
Allopathic doctors	1.1	0.78	0.64	70.9	58.2
Dentist	0.27	0.18	0.16	66.7	59.3
Nurse/midwives	2.30	1.36	0.76	59.1	33.0

[2]The qualification codes recorded in NSSO database under technical education includes degree in medicine, diploma below graduates and diplomas above graduate level. The degree in medicine is considered adequate qualification for doctors and dentists, and any diploma level education for nurses/midwives and pharmacists. Some necessary adjustments were made if doctors did not report any technical education but reported post-graduation and similarly if nurse/midwives did not report certificate and diploma under technical education category but reported diploma under general education category.

Pharmacists	1.19	0.24	0.12	20.2	10.1
Traditional medicine professionals/AYUSH	0.79	0.46	0.30	58.2	38.0
Overall	5.67	3.04	2.09	53.6	36.9

Sources: NHWA 2018 and NSSO 2017–18

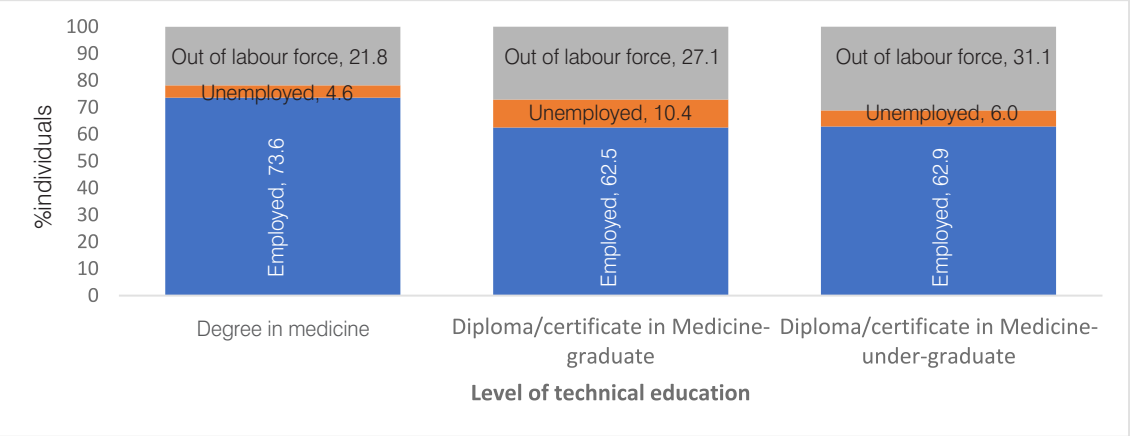
Several reasons were highlighted explaining the difference between the estimates of health professionals from the NHWA data and health workers as reported in the NSSO data (Rao et al. 2012, Karan et al. 2019). Most of these reasons were related to the fact that a large proportion of health professionals registered with different councils and associations were not part of the current health workforce in India. One such widely discussed reason was the migration of qualified health professionals from India to other developed countries (Mullan 2006; Kaushik et al 2008; Rao et al. 2011; OECD 2019). Although no comprehensive estimates on outmigration of health professionals from India was available , a recent study by OECD (OECD 2019) indicated that Indian doctors and nurses constituted up to 12-13% of all foreign trained physicians and up to approximately 6-7% of all foreign trained nurses in OECD countries.

In addition, there were reasons related to the veracity and updating of the NHWA data. For instance, the NHWA data collated from different professional councils, which did not maintain a live register and did not require renewing the registration. Also, the information they provided was fraught with non-adjustment of health professionals leaving the workforce on account of death, retirement and double counting of workers. This was largely because they had registered in more than one state (Rao et al. 2012; Karan et al. 2019).

However, one of the most important reasons of this differential estimate was that the NHWA provided total stock of health professionals but not all of them were active in labour markets. The NSSO data on the other hand provided estimates of health professionals active in labour markets as of date of the survey. It was quite possible that a part of medically qualified individuals was currently not a part of the workforce, either because they were currently unemployed but available for work or they do not want to join the labour markets (WHO 2017a).

The estimates from NSSO 2017–18 indicated that among the individuals holding the qualification of degree in medicine (graduate and above), 74% were actively working (employed) in the labour market as doctors or in other capacity while approximately 4% were currently unemployed and looking for jobs (Fig. 3). However, approximately 22% individuals with a degree in medicine reported themselves to be out of the labour force. Similarly, among the diploma holders, above or below graduate levels, only 63% reported currently employed. If these proportions are applied (% employed) over the NHWA stock data, the numbers would be close to what has been estimated from the NSSO. A more detailed information on distribution of qualified individuals not currently employed by gender, age-group and reasons of being out of the labour force is presented later in this report.

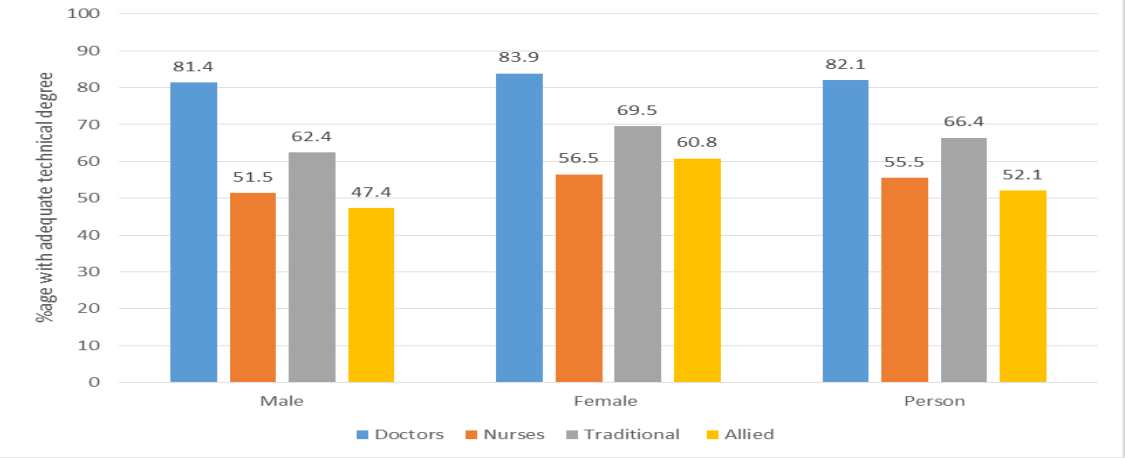
Fig. 3. Percentage distribution of individuals with various levels of technical education in medicine as employed, unemployed and out of labour force, 2018



Source: NSSO 2017–18

The NSSO based estimates of health workforce, however was not free from discrepancies. Estimates of health workforce from NSSO data was based on self-reported occupations and sectors of employment by individuals. It was possible that many individuals may have reported themselves as health-care workers without having adequate educational qualifications as recognized by different councils. Past studies indicated that approximately 40% individuals practicing allopathic medicine lacked adequate technical qualifications required for an allopathic doctor (Rao et al. 2016). Using the 2017–18 NSSO data it was estimated that this would approximately be 18% (Fig. 4). Similarly, as high as 45% of individuals reported themselves working as nurses/midwives with no technical education even up to the diploma level. This proportion was higher (66%) among traditional medicine practitioners (including AYUSH). The detailed state-wise estimates for doctors and nurses with adequate technical education is presented in Appendix Table A-I.

Fig. 4. Percentage of health-care workers reporting adequate* technical education



Note: Adequate is defined as degree in medicine for allopathic doctors; diploma above and below graduate level for other health workers.
Source: NSSO 2017–18

State-wise disaggregation of allopathic doctors and nurses reflected that as per NHWA data, approximately 39% allopathic doctors were concentrated in the three states of Maharashtra (16%), Tamil Nadu (12%) and Karnataka (11%) (Table 3). These were followed by Andhra Pradesh (9%), Uttar Pradesh (7%), West Bengal (6.5%) and Kerala (5%). These states taken together constituted up to approximately 70% total stock of allopathic doctors. However, in terms of active workforce, estimated from NSSO, Uttar Pradesh shared the largest proportion (15%) of all allopathic doctors followed by West Bengal (11%) and Kerala (10%). Uttar Pradesh and Tamil Nadu shared highest proportion of all nursing workers 10-11% each, followed by Maharashtra (9.5%) and Andhra Pradesh (6%) (Table 3). State-wise disaggregation of all health professionals is presented in Appendix Table A-II.

Table 3. Number and percentage distribution of allopathic doctors and nurse in states, 2018

	NHWA		NSSO estimates	
State	Doctors	Nurses	Doctors	Nurses
Andhra Pradesh	9.09	12.38	3.73	5.99
Assam	2.16	1.68	1.68	3.68
Bihar	3.67	0.6	6.18	1.61
Chhattisgarh	0.79	0.88	1.01	2.82
Delhi	1.93	2.4	1.94	5.06
Gujarat	6.05	5.73	3.87	4.67
Haryana	0.52	1.9	1.39	2.73
Himachal	0.28	1.09	0.16	0.53
J&K	1.36	0	2.29	0.77
Jharkhand	0.53	0.27	1.48	1.53
Karnataka	11.1	9.53	4.62	4.32
Kerala	5.36	10.22	9.71	4.77
Madhya Pradesh	3.45	5.28	8.9	3.15
Maharashtra	15.67	7.02	8.19	9.52
NE States*	0.39	1.34	1.76	2.77
Odisha	2.04	4.6	1.19	2.48
Punjab	4.37	3.33	0.94	3.47
Rajasthan	3.92	10.31	2.45	5.24
Tamil Nadu	12.24	11.73	7.8	10.87
Telangana	0.45	0.51	3.52	3.84
Uttar Pradesh	7.01	4.51	14.63	10.49
Uttarakhand	0.78	0.17	0.74	1.9
West Bengal	6.51	4.54	10.76	6.41
Union Territories	0	0	1.05	1.16

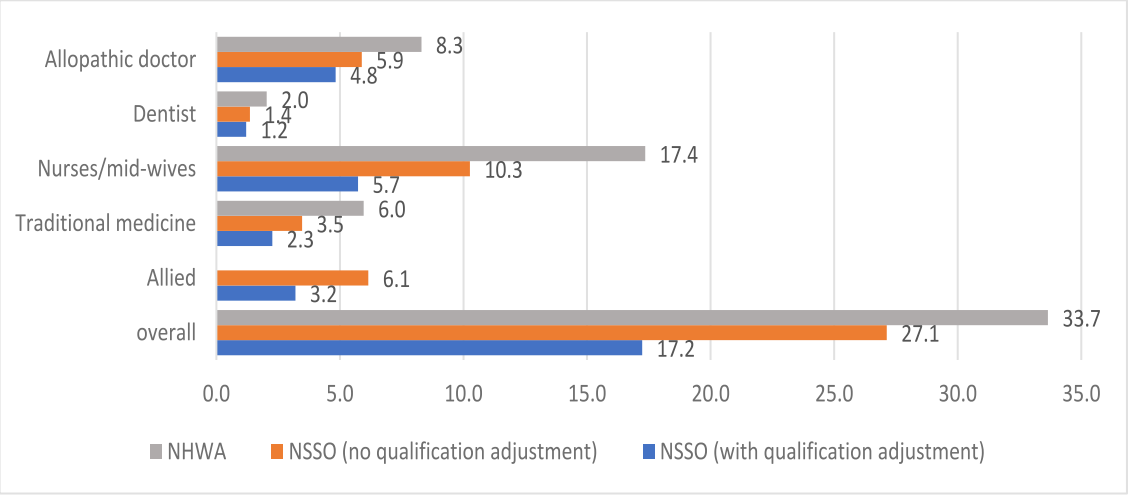
*Note: * Includes the Northeast states of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura*
Sources: NHWA 2018 and NSSO 2017–18

3.2. Density of doctors and nurses and skill-mix

Density of health workforce with respect to population is an important indicator of availability of health workforce for the population in a country. Density of health workforce is compared in terms of number of different types of health workforce per 10 000 persons. The density of different categories of stock of health professional and health workers per 10 000 persons at the all-India and state levels was estimated (Fig. 5 and Fig. 6).

At the all-India level, stock density of doctor and nurses/midwives was 8.3 and 17.4 respectively per 10 000 persons. If this total stock of dentists and traditional medicine practitioners is added, the total stock density in India would be estimated as 33.7 per 10 000 persons. However, active density of workers (as estimated from NSSO) of doctor and nurses/ midwives (without adjusting for adequate qualification) would be estimated to be 5.9 and 10.3 respectively. Accordingly, the numbers further dropped to 4.8 and 5.7 respectively after adjusting for adequate qualifications. If all kind of health professionals are considered (including dentists, traditional medicine practitioners and allied health workforce), the total worker density per 10 000 persons would be estimated to be 27.1 without adjusting for qualifications and 17.2 after adjusting for qualifications.

Fig. 5. Number of health professionals/workers per 10 000 persons, 2018

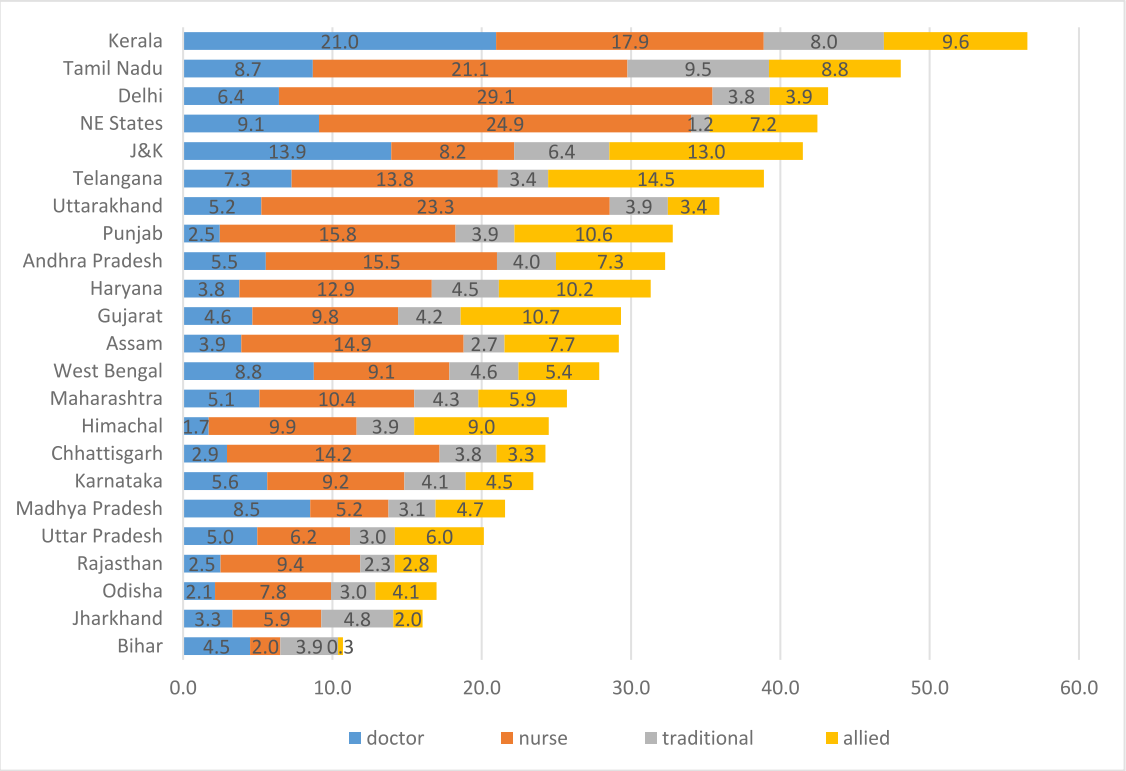


Sources: NHWA 2018 and NSSO 2017–18

The NHWA data, in general reflected higher density as compared with NSSO based estimates for almost all the categories of health workforce. However, the difference between the density of health professional stock and health workforce was more pronounced in case of nurses, mainly because a larger proportion of technically qualified nurses were out of the labour force as compared with other categories of health professionals. Women constituted an overwhelming proportion of the nurse's stock in India. Moreover, the overall labour force participation rate among women in India was abysmally low, at approximately 23% women of age 15 years and above who reported themselves in labour markets in the country. However, labour force participation rate among 15 years and above women with diploma in medicine (mandatory qualification for nurses and midwives) was significantly higher (more than 55%) as compared with not only all women of age 15 years and above (23%) but also women with diploma in non-medical disciplines (47%).

Among the states, Kerala reported the highest density of doctor workforce (20.96) whereas Delhi had the highest density of nurse and midwives workforce. Considering doctor and nurse workforce together, Kerala, Delhi and Tamil Nadu were on top of the list with density of doctors and nurses taken together being 39, 35, and 30 per 10 000 respectively. At the bottom of the list were the states of Bihar, Jharkhand and Odisha with doctor-nurse density being as low as 7, 9 and 10 per 10 000 respectively (Fig. 6). A more detailed information on density of health workers as well as stock of health professionals at state levels was presented in Appendix Table A-III.

Fig. 6. Density of health workers/professionals in states, 2018



Note: Estimates are not adjusted with adequate qualifications of respective health workers
Source: Estimates from NSSO 2017-18

Although there was no standard skill-mix ratio of different health workers, most OECD countries reported approximately 3-4 nurses per physician (OECD 2019). Indian High Level Expert Group (HLEG) recommendation for the nurse-doctor ratio in India stood at 3:1 (Public Health Foundation of India [PHFI] 2011). Moreover, there was also a need to strike a balance (right skill-mix) between doctors and allied health workers (PHFI 2011).

The stock data of NHWA suggested nurse to doctor ratio (number of nurse/midwives per doctor) to be 2.1:1 at the all-India level, with large-scale variations across states from 10.7:1 in Himachal Pradesh and 9.9:1 in Haryana on the higher side to as low as 0.4:1 in Bihar and 0.6:1 in Uttarakhand. The nurse to doctor ratio on the basis of the NSSO data, however, was estimated to be 1.7:1 with Punjab (6.4:1) and Delhi (4.5:1) on the higher side and states of Bihar, Jammu & Kashmir and Madhya Pradesh having less than one nurse per doctor. Even in Kerala, where stock of nurse number was very high, the worker nurse to doctor ratio was less than one nurse per doctor (Table 4). A comparison of the nurse/doctor ratios between

NHWA and NSSO data indicated that both the sources reflected higher ratios in the same states expect for Kerala and Madhya Pradesh where NSSO estimates (0.9:1 and 0.6:1 respectively) were far lower in comparison with NHWA ratios (5.2:1 and 4.1:1 respectively) and in Uttarakhand where NSSO based estimate (4.5:1) were higher to the NHWA number (0.6:1).

Table 4: Skill-mix of health workers in different states, 2018

	Nurse/Doctor		Traditional medicine including AYUSH / doctor		Allied professional/ doctor
	NSSO	NHWA	NSSO	NHWA	NSSO
Andhra Pradesh	2.8	3.7	0.7	0.2	1.3
Assam	3.8	2.1	0.7	0.1	2
Bihar	0.5	0.4	0.9	3.4	0.1
Chhattisgarh	4.8	3.0	1.3	0.6	1.1
Delhi	4.5	3.4	0.6	0.6	0.6
Gujarat	2.1	2.6	0.9	0.7	2.3
Haryana	3.4	9.9	1.2	2.5	2.7
Himachal Pradesh	5.8	10.7	2.3	3.8	5.3
J&K	0.6	0.0	0.5	0.4	0.9
Jharkhand	1.8	1.4	1.5	0.1	0.6
Karnataka	1.6	2.3	0.7	0.4	0.8
Kerala	0.9	5.2	0.4	0.7	0.5
Madhya Pradesh	0.6	4.1	0.4	1.8	0.6
Maharashtra	2	1.2	0.8	0.9	1.2
Odisha	3.6	6.1	1.4	0.6	1.9
Punjab	6.4	2.1	1.6	0.3	4.3
Rajasthan	3.7	7.1	0.9	0.4	1.1
Tamil Nadu	2.4	2.6	1.1	0.1	1.0
Telangana	1.9	3.1	0.5	4.2	2.0
Uttar Pradesh	1.3	1.7	0.6	1.1	1.2
Uttarakhand	4.5	0.6	0.7	0.5	0.7
West Bengal	1.0	1.9	0.5	0.6	0.6
India	1.7	2.1	0.7	0.7	1

Sources: NHWA 2018 and NSSO 2017–18

In addition to the doctor-nurse ratio, Table 4 presented two different skill-mix indicators namely:

i) doctor to allied health professional ratio; and

ii) doctor to traditional medicine practitioners (including AYUSH).

While the doctor to allied health professional ratio may represent availability of technical support health professionals in the health system, the doctor to traditional medicine

practitioners reflected a sharing of patient burden between allopathic doctors and traditional medical practitioners. Traditional medicine practitioners to doctor ratio was estimated to be 0.7:1 at the all-India level, both from NHWA and NSSO data.

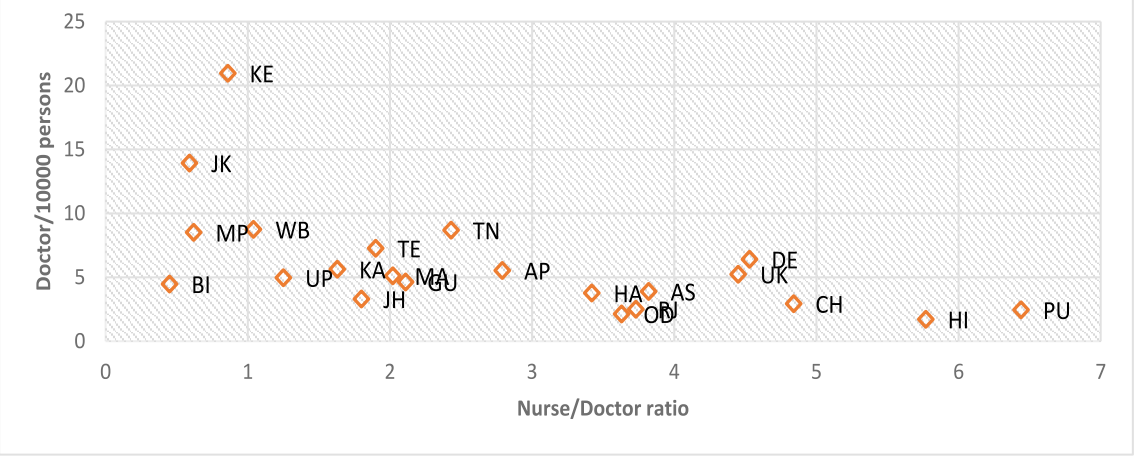
Although, there were large variations in this ratio across states, estimates from the two sources again reflected similarity in most of the states. However, a few states like Bihar, Chhattisgarh, Jharkhand, Odisha, Punjab and Tamil Nadu reported higher traditional practitioners per doctor based on NSSO as compared with that from NHWA. There was a possibility that the presence of unregistered traditional health workers, such as birth attendants, faith healers, bone setters, snakebite curers etc., was higher in these states who were not captured in the NHWA data.

Number of allied health professionals per allopathic doctor at the all-India level was estimated to be one, again with large variations across states ranging from more than five allied personnel per allopathic doctor in Himachal Pradesh to as low as one-tenth (0.1) allied health professionals per doctor. Number of traditional medicine practitioner is per allopathic doctor is about 0.7 with ratios being more than one in a few states: Chhattisgarh, Haryana, Himachal Pradesh, Jharkhand, Odisha, Punjab and Tamil Nadu.

Contrasting the skill-mix ratio with the density of doctors at the state levels clearly helps identifying the situation of availability of health workforce as well as emerging skill-mix requirements in different states. For instance, in the states of Bihar and Uttar Pradesh, the density of doctor and nurse-doctor ratio both are very low (Fig. 7). In Karnataka and Jharkhand nurse-doctor ratio is slightly better to that in Bihar and Uttar Pradesh but density of doctors remains very low.

In all these states, along with maintaining high skill-mix, there is need improve the availability of doctors. Similarly, in the states of Madhya Pradesh and West Bengal, the density of doctors is fairly high but the nurse-doctor ratio is very low. In these two states, improving the nurse-doctor ratio will lead to a better skill-mix situation. There are also states at the extreme end, like having very high doctor density but low nurse-doctor ratio (Kerala, Jammu & Kashmir) and very high nurse-doctor ratio but low density of doctors (Punjab, Himachal Pradesh, Chhattisgarh and Uttarakhand).

Fig. 7. States with varied density of doctors and nurse-doctor ratio



Source: Estimates from NSSO 2017–18

• DE Delhi • HA Haryana • HI Himachal Pradesh • JK Jammu and Kashmir • PU Punjab
• RJ Rajasthan • UK Uttarakhand • AS Assam • CH Chhattisgarh • MP Madhya Pradesh
• UP Uttar Pradesh • BI Bihar • JH Jharkhand • WB West Bengal • OD Odisha • MA Maharashtra
• GU Gujarat • AP Andhra Pradesh • KA Karnataka • KE Kerala • TN Tamil Nadu • TE Telangana

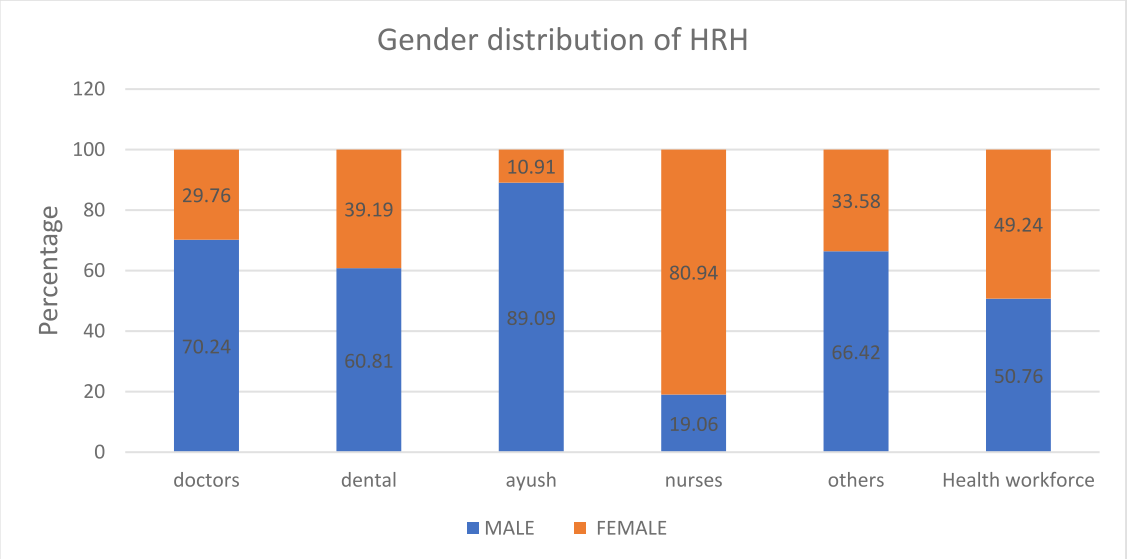
3.3. Distribution of health workforce by gender and age

The overall numerical distribution of the total health workforce by gender is almost even. However, if the distribution in separate components of health workforce is considered, what emerges is a clear numerical dominance of males in doctors, dental and AYUSH categories while females remain predominant in the nurses category (Fig. 8).

The state-wise distribution reported majority of doctors as males whereas females in the health workforce were predominantly nurses and midwives. Proportion of female in doctors' workforce was higher in states like Delhi, Himachal, Uttarakhand and Kerala compared to that in other states. Total number of female allopathic doctors was almost 170% higher to male doctors in Himachal Pradesh and Uttarakhand. Similarly, in Kerala the number of female doctors was 85% higher to male doctors. In Delhi, number of female doctors was marginally higher (13%) to male doctors. However, in many states like Assam, Bihar, Chhattisgarh, Madhya Pradesh, Haryana, Rajasthan etc. the number of female doctors was extremely low and varied between 10% to 25% of the total number of male doctors. Similarly, the proportion of male in nurse and midwives is marginally higher in states of Madhya Pradesh and Jharkhand compared to that in other states. However, Bihar reported significantly higher proportion of male nurses (70%) compared to other states.

The complete gender distribution of the HRH across major states is provided in the appendix Table A-IV.

Fig. 8. Gender distribution of HRH in India-2018

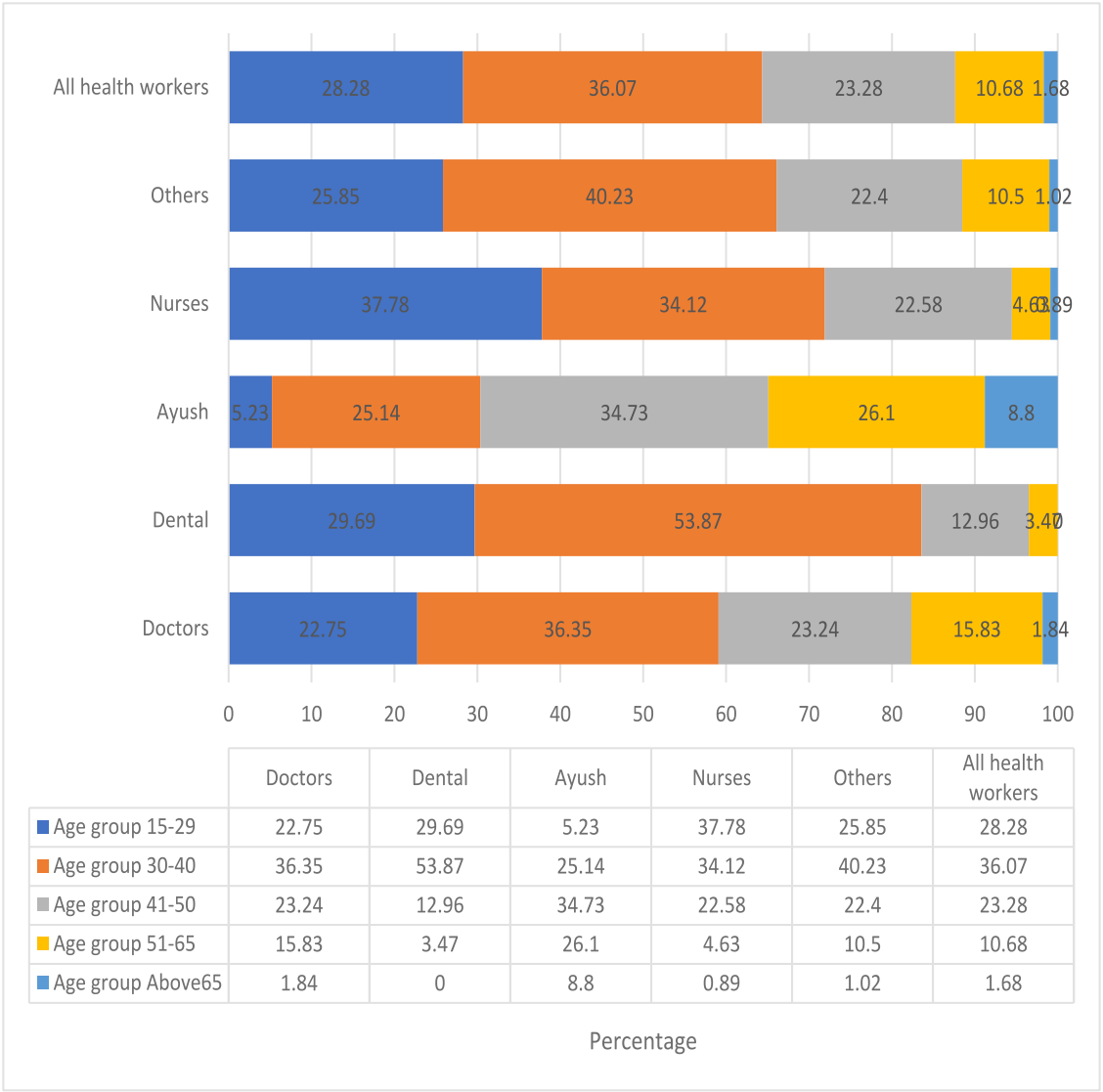


Source: Estimates from NSSO 2017–18

Considering the age distribution of the health workforce, approximately two-thirds of all health workforce are below age 40 years while more than 25% are in the younger age group of below 30 years. Nurses and dentists reflect higher concentration at 38% and 30% respectively as compared to the still younger age group of 15-29 years, as compared with doctors (23%) and other health workers. (Fig. 9)

Accordingly, doctors have higher concentration in the older age group of 50 years and above (18%) as compared with just 4% dentists and 6% nurses in the same age group. Doctors in Punjab and Andhra Pradesh aged above 50 years were much higher (46 % and 38 % respectively) than the national average of 18%. Similarly, for nursing professionals, the states of Haryana, Madhya Pradesh and Bihar showed higher percentages of above 50, as compared to the national average. The detailed tables are provided in the appendix Tables A-V & A-VI.

Fig. 9. Age distribution of health workforce in India-2018



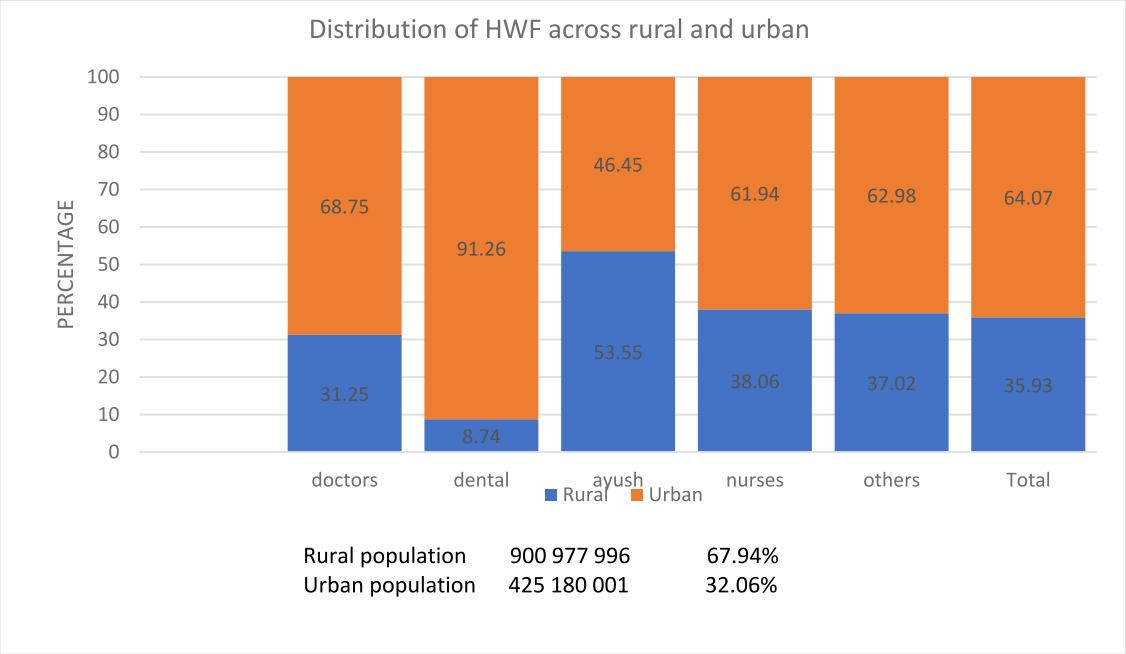
	Doctors	Dental	Ayush	Nurses	Others	All health workers
Age group 15-29	22.75	29.69	5.23	37.78	25.85	28.28
Age group 30-40	36.35	53.87	25.14	34.12	40.23	36.07
Age group 41-50	23.24	12.96	34.73	22.58	22.4	23.28
Age group 51-65	15.83	3.47	26.1	4.63	10.5	10.68
Age group Above65	1.84	0	8.8	0.89	1.02	1.68

Source: Estimates from NSSO 2017–18

3.4. Distribution across rural–urban and public–private

The uneven distribution of health workers is reflected across rural–urban settings. Although rural India constituted approximately 68% of the total population in 2018, only 36% of all health workers were found in rural areas (Fig.10). This proportion was much lower for the dental work force. The proportions of doctor and nurses in rural areas are 31% and 38%, respectively. Amongst the states, Punjab, Gujarat and Maharashtra have the lowest percentage of doctors in rural area (0%, 2% and 8% respectively). Similarly, for nurses, Gujarat, Bihar and Odisha (11%, 27% and 28% respectively) have lower percentage of nurses in rural settings as compared to the national average (appendix Table A-VII).

Fig. 10. Distribution of HWF in India 2018 across rural and urban

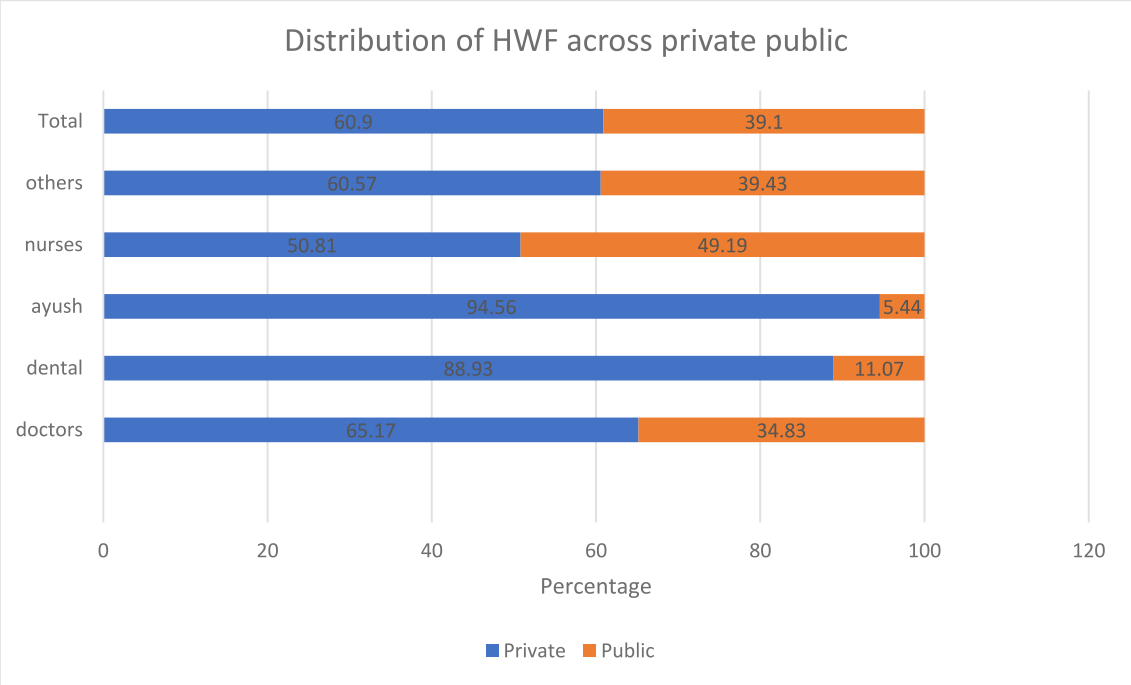


Source: NSSO 2017–18

Further, bulk of the total health workforce is employed in the private sector (Fig. 11). NSSO Report on health and morbidity in India ("Social consumption in India: Health" [NSSO 2017-18a]) reflects that approximately 60% of inpatient care and 70% of outpatient care in India is provided by the private sector. The proportions employed in the private sector are doctors (65%), dentists (89%), AYUSH (95%) and other health workers (61%). These are to a great extent commensurate to the proportion of service delivery. It is only in the case of nurses and midwives that approximately half of them are employed in public sector institutions (Fig. 8). Further, the private health sector in India consists of a wide range of service providers, ranging from 'for-profit' hospitals, 'not-for-profit' (NGO, charitable institutions, trusts and so on) institutions and private individual practitioners. Health workers are employed at all these levels of care in the private sector.

Amongst the states in terms of percentage of doctors in the private sector, Chhattisgarh followed by J&K and Delhi reported the lowest percentages (14%, 21% and 24% respectively.) while in terms of nurses, Himachal Pradesh, J&K and Chhattisgarh reported the lowest percentages in the private sector (14%, 14% and 19% respectively).(Appendix Table A-VIII

Fig. 11. Distribution of HWF in India 2018 across private public settings



Source: Estimates from NSSO 2017–18

3.5. Characteristics of persons with technical education but out of labour force

The study looked at the gender and age profile of persons who have technical education in medicine but are neither in employment (health workforce or otherwise) nor reported as unemployed (referred to as 'out of labour force'). This helped identifying an available and idle pool of health professionals who could be integrated in the health system rapidly with adequate policy measures. This would also improve the employment growth in the country.

Table 5 revealed that females share an overwhelming proportion of persons with technical education in medicine but were out of the labour force. More than 37% females, as against 15% males, with technical education in medicine were out of the labour force. Proportion of persons with technical education in medicine but out of labour force was higher in the younger and elderly age groups. However, approximately 21% females who were not in the labour force and had technical education in medicine were in the age group of 30-40 years (Fig. 12). More detailed levels of technical education reflected that even with a degree level of education in medicine, more than 33% of females, as against approximately 13% males, were out of the labour force. Similarly, approximately 35% females with graduate level diploma education in medicine and as high as 43% females with under-graduate level diploma education in medicine were out of the labour force. These proportions were significantly lower for males.

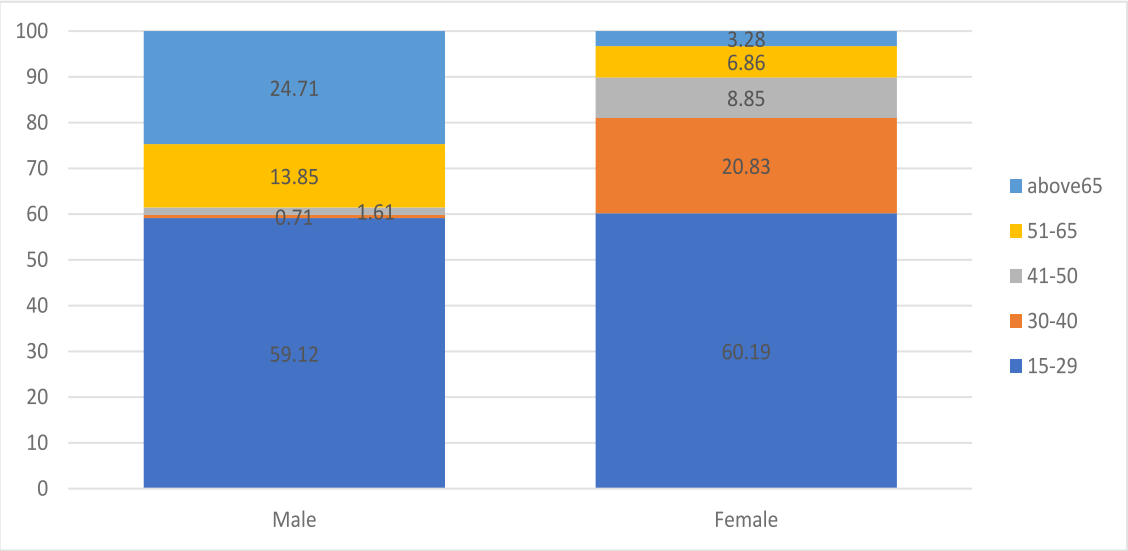
Table 5. Percentage distribution of persons with technical education in medicine by employment, unemployment and out of labour force

Gender	Employed	Unemployed	Out of labour force
Male	79.83	4.89	15.28
Female	54.6	7.87	37.53
Overall	66.79	6.43	26.78
Age group			
15-29	45.31	13.93	40.76
30-40	84.28	2.57	13.14
41-50	87.13	0.18	12.69
51-65	77.75	1.13	21.12
above65	37.06	0	62.94
Total (age>=15)	66.79	6.43	26.78

Source: NSSO 2017–18

A further disaggregation of out of labour force individuals with any technical degree in medicine by age groups separately for males and females indicates that younger age group of 15-29 years constitutes approximately 60% of out of labour force both for males and females. However, more than 20% of females who were out of labour force fell in the 30-40 year age group with additional 9% in the 41-50 year age group. Also, 14% and 25% males with adequate technical degree reported themselves out of labour force.

Fig. 12. Percentage distribution of male and female with technical education in medicine and out of labour force by age groups



Source: Estimates from NSSO 2017–18

It was further explored what activities these adult individuals were engaged in while reporting themselves out of labour force. Disaggregation of all out of labour force individuals with technical degree in medicine, separately for males and females indicated that while 38% males were pursuing further studies, as high as 60% females were engaged in domestic activities (Table 6). Approximately 35% males and 37% females with degree level education in medicine were pursuing further education. However, a most striking fact that emerged from this analysis was that approximately 54% women with degree level education in medicine who were out of labour force reported themselves engaged in household work as against joining labour market.

Table 6. Percentage distribution of persons out of labour with technical education in medicine at the all-India level, 2018

	Male			Female			Persons		
Degree in medicine	Student	Household work	Others*	Student	Household work	Others*	Student	Household work	Others*
Degree in medicine	34.57	0	65.43	36.85	53.63	9.52	36.17	37.54	26.3
Diploma/certificate in medicine undergraduate	52.65	10.55	36.8	28.24	62.6	9.16	33.08	52.29	14.63
Diploma/certificate in medicine graduate level	26.06	0	73.94	32.13	64.22	3.65	29.65	38.02	32.32
All	37.94	3.6	58.46	31.46	60.28	8.26	33.25	44.65	22.1

*Note: * others include rentiers, pensioners, remittance recipients, not able to work due to disability, others (including begging, prostitution, etc)*

Source: NSSO 2017–18

3.6. Vacancy rates in the public sector

The vacancy rates for health manpower in the public sector were reported in the Rural Health Statistics Reports (Department of Statistics, Ministry of Health and Family Welfare 2019). Vacancy rates were an indicator of funded but unfilled posts. The Statistics Division of the MoHFW, GoI generated these reports at regular intervals. The 2018–19 report captured the data for 157 411 Sub-centres (SC), 248 55 PHCs and 5335 CHCs functioning in rural areas. The report noted that the number of health workers [female] rose from 133 194 in 2005 to 234 220 in 2019. Similarly, the number of doctors at PHCs grew from 203 08 in 2005 to 297 99 in 2019.

The details of the state-wise vacancy numbers for select positions at Sub-centre, PHC and CHC level as on 31 March 2019 are provided in Appendix-A IX. At the all-India level, there was a vacancy of 139 09 and 294 21 positions for health worker (female) and health worker (male) respectively. There was a shortage of 7715 allopathic doctors and 1807 AYUSH doctors at the PHC level. For nurses the shortage was reported as 6126 and 7336 at PHC and CHC respectively. There was a shortage of 9147 specialists at CHCs.

Table 7: Forecasted number of seats available annually from 2020 – 2030

Qualification	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Allopathic doctors +	571 38	614 24	65 710	69 997	74 283	78 569	828 55	871 41	91 428	95 714	100 000
Dentists ^	274 39	27929	284 19	289 09	293 99	298 89	303 79	308 69	313 59	318 49	323 39
AYUSH*	408 81	416 99	425 16	433 34	441 51	449 69	457 87	466 04	474 22	482 40	490 57
Nurses**	982 29	100 194	102158	104 123	106 087	108 052	110 017	111 981	113 946	115 910	117 875
Pharmacists*	476 46	484 97	493 47	501 98	510 49	519 00	527 51	536 02	544 52	553 03	561 54
ANMs**	562 68	572 73	582 77	592 82	602 87	612 92	622 96	633 01	643 06	653 11	663 16

Note: For allopathic doctors a number of 100 000 was used as the size of the supply side in 2030

*Sources: Annual seat capacity (2019): +MCI data, ^ Dental Council of India – 2019-20 session (as on 10 Sept 2019), *NHP 2018, ** Indian Nursing Council 2017-18 Annual Report (as on 31st March, 2018), #NIAHS report, Public Health Foundation of India*

3.7. Estimated size of the workforce for 2030

The forecasted supply side from 2020–2030 is shown in Table 7. The number of MBBS seats were used for allopathic doctors and for dentistry it was the BDS seats numbers that were used. The AYUSH numbers were composed of number of seats across the BAMS, BYMS, BUMS, BSMS, BHMS programmes. The nurses' numbers were obtained from the BSc Nursing programme and the pharmacist numbers were taken from the B.Pharmacy programme. The ANM numbers were reported for the ANM programme. These numbers represented the supply side growth as per current trends of growth in the past.

Table 8: Estimated number of skilled health workers produced annually for the years 2019, 2025 and 2030

Year/Forecast point	Doctors	AYUSH	Nurses	Total seats in a year (current growth)	Nurses number (with 200% growth in nursing seats)	Total seats in a year (with 200% growth in nursing seats)
2019/ Baseline	50093	40151	96475	186719	96475	186719
2025/Forecast mid-point	78569	44969	108052	231590	196458	319996
2030/ Forecast end-point	100000	49057	117875	266932	294687	443744

Table 8 depicts the estimated number of skilled health workers produced annually for the years 2019, 2025 and 2030. The supply side of health professionals for doctors, AYUSH personnel and nurses was expected to grow significantly by 2030 if the present rates of growth of numbers was sustained in the current decade. The total annual supply estimated doctors, AYUSH professionals and nurses were set to reach approximately 0.26 million by 2030. If India must improve its current skill-mix ratio of doctors (+AYUSH): nurses to 1:1.5 by 2030, a much larger rise would be needed in the nursing supply. To reach this ratio, the nursing supply will have to rise to 0.29 million by 2030. If that were to happen, the total annual supply estimates of doctors, AYUSH professionals and nurses would approximately be 0.44 million by 2030.

Table 9: Projected skilled health workforce, 2019–2030

Year/ Forecast point	Population in billion (India)	Doctors (in million)	AYUSH (in million)	Nurses (in million)	Projected skilled health workforce (in million)	Skilled health workforce needed to reach 25/ 10,000 (in million)	Gap (in million)
2019/ Baseline*	1.369	0.65	0.32	0.80	1.77	3.42	1.65
2025/ Forecast mid-point	1.452	0.76	0.42	1.04	2.23	3.62	1.40

2025/ Forecast mid-point	1.513	0.93	0.50	1.22	2.65	3.78	1.13

Note: These figures consider adjusted NSSO numbers (workforce numbers adjusted for education qualifications)

*From NSSO estimates

Table 9 depicts the estimated the number of skilled health workers (doctors/ nurses and midwives) per 10 000 population for 2019 through 2030. The projected skilled health workforce numbers were estimated to rise from the current estimates of 1.77 million to 2.65 million in 2030. However, even this large decadal growth in absolute numbers would not result in a rise of the skilled health workforce density (when adjusted for educational qualifications). This number would be approximately 17.5 per 10 000 population in 2030. There would be a shortfall of approximately 1.13 million skilled health workers to reach 25 skilled health workers per 10 000 population.

However, if there was a scale-up of nursing supply to approximately 200% growth by 2030, the resultant number of nurses will be 2.02 million in 2030 and the total skilled health workforce number will be 3.45 million in 2030 (22.76 skilled health professionals per 10 000 population).

Fig.13. Skill-mix doctor (+AYUSH): Nurse in 2019

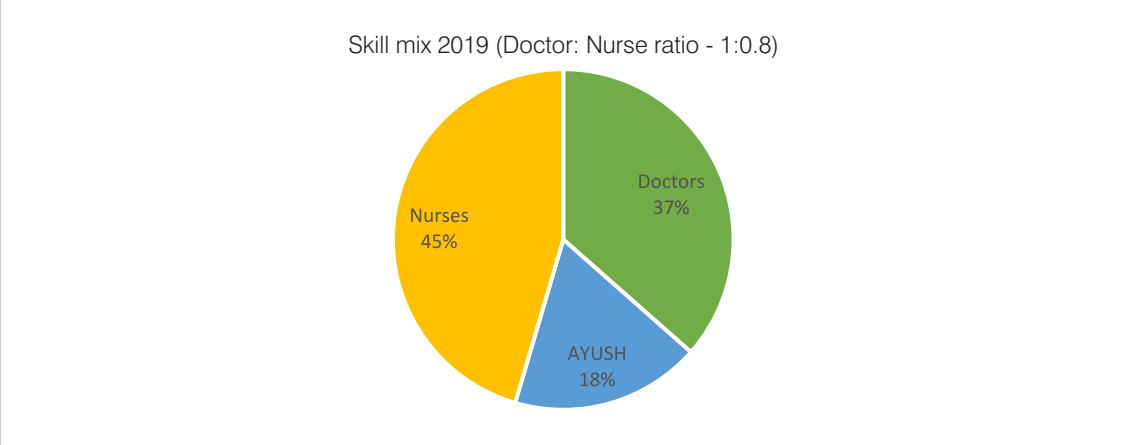


Fig. 14. Skill-mix doctor (+AYUSH): Nurse in 2030 (supply side growth at current rates)

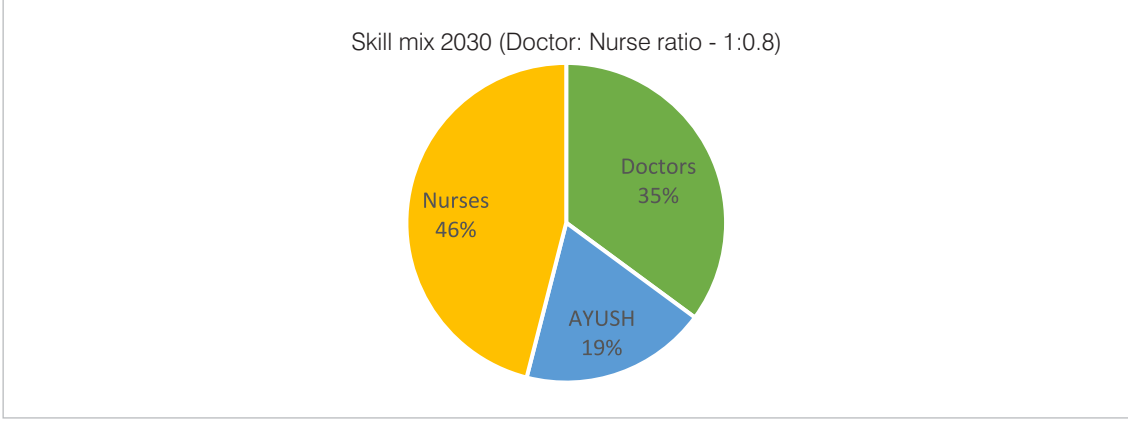


Fig. 15. Skill-mix doctor (+AYUSH): Nurse in 2030
(additional 200% growth in nursing supply)

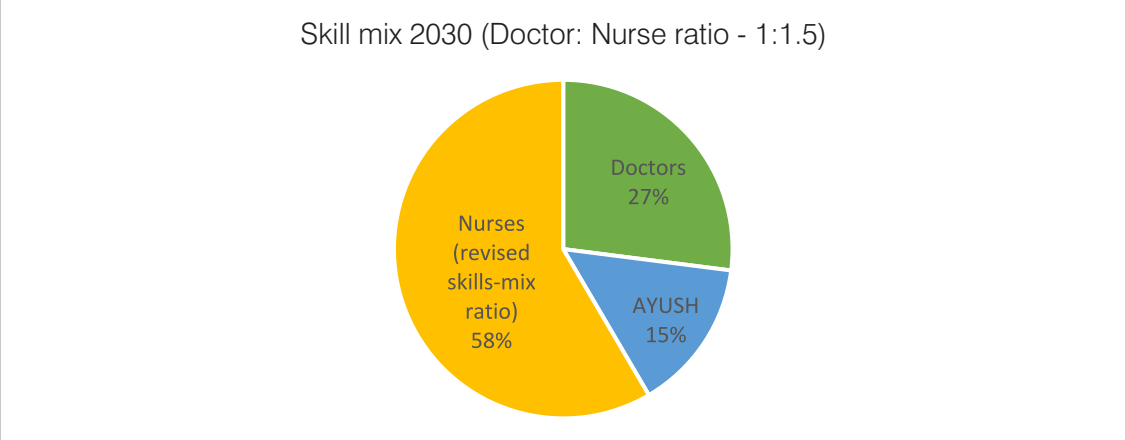


Table 10: Projected skilled health workforce (2019 to 2030) not considering any adjustment for education qualifications of NSSO numbers

Year/ Forecast point	Population in billion (India)	Projected skilled health workforce (in million)	Skilled health workforce needed to reach 25/ 10,000 (in million)	Gap (in million)
2019/ Baseline	1.369	2.60	3.42	0.82
2025/ Forecast mid-point	1.452	2.77	3.63	0.86
2030/ Forecast end-point	1.513	3.03	3.78	0.75

If the NSSO reported data for health professionals is considered without any adjustment for educational qualifications, the projected estimates of skilled health workforce numbers would be 3.03 million in 2030 at current growth rates on the supply side. The skilled health workforce density will be approximately 20.03 per 10 000 population in 2030. There will be a shortfall of approximately 0.7 million skilled health workers to reach 25 skilled health workers per 10 000 population.

If there is a scale-up of nursing supply to approximately 200% growth by 2030, the resultant number of nurses will be 226 684 2 in 2030 and the total skilled health workforce number will be 382 578 4 in 2030 (25.29 skilled health professionals per 10 000 population).

Fig. 13 and 14 depict the skill-mix in 2019 and 2030 respectively. These estimates consider allopathic doctors and AYUSH professionals as doctors. The number of nurses is composed of graduate nurses. These show that the ratio of doctors: nurses is unlikely to change at the present rates of growth. Fig. 15 depicts the doctor: nurse ratio calculated in a similar way with an additional 200% growth on the supply side.

IV. Discussions and policy implications

Investment in HRH to improve availability of health workforce in a health system has gained increased attention in recent years (Cometto and Campbell, 2016; WH0 2016b). It has been emphasized that investment in HRH leads to multiple benefits to society and economy. Investment in health, including HRH, not only strengthens the health system but also generates employment and enhances economic growth through multiple channels such as increased economic output, social protection and cohesion, innovation and health security (WHO 2016 b; WHO 2017b). In India, such investments also have the potential to enhance the female labour force participation as females share comparatively higher proportion of workforce in the health sector as compared with other sectors (WHO 2020). In addition, investment in health will lead to formalization of the labour market in the country, as share of formal employment in health sector is far higher (60%) as compared with other sectors (20%).

The ComHEEG notes that while an estimated 40 million new jobs are projected to be added by 2030, LMICs will continue to grapple with shortages. These countries are projected to have a shortfall of 18 million health workers to achieve and sustain the SDGs. However, it is equally important to understand, what are the important HRH challenges which need policy attention and enhanced investment (WHO 2016b).

These discussions on enhancing the investment and policy attention to health workforce related issues has assumed centrality in the presence of the COVID-19 pandemic sweeping across the world. Health systems are stretched to deliver preventive and clinical care when faced with a surge of cases that raise demand for quality services and health workers. In the present report different dimensions of HRH have presented for the country, along with existing and emerging challenges which need to be addressed for improved availability of health workforce in the country as a whole and at the state levels.

Two important sources of data on health workforce are: i) stock of health workforce from the NHWA and ii) National sample survey data (NSSO) on labour force.

The team found that although the stock data reflected a higher number of qualified health workforce at the all-India level, the labour force survey exemplified that the active health workforce in the country and most of the states was considerably lower as compared with the stock data. Density of allopathic doctors and nurses who were active in the labour market were as low as 6 and 10 respectively per 10 000 persons. To this, if dentists and AYUSH professionals were added, the total active health workforce density would stand at approximately 22 per 10 000 persons, which was well below the WHO threshold of 44.5 doctors, nurses and midwives per 10 000 population (WHO Global Strategy 2016) and even below the WHO recommendations about the lowest thresholds of 23 health workers per 10 000 persons. New investment for improving the size of active health workforce was probably the most important area which needs policy attention in India.

Different types of skill-mix situation were estimated at the all-India and state levels. In general, a sub-optimal skill-mix was found between doctor and nurse and doctor and allied health professional. Size of traditional medicine practitioners (AYUSH) in India was quite sizeable. Total number of active AYUSH practitioners was almost 70% of the total number of active allopathic doctors.

However, number of nurses per doctor was less than two. This number was even lower and closer to one if BSc Nursing qualifications were considered. In most OECD countries there were 3-4 nurses per doctor (OECD 2019). Although total stock of nurses in the country stood at approximately three times the number of doctors, a large proportion of nurses were not actually active in the labour market. In order to increase nurses' participation in the active health workforce, creating a smooth employment environment for nurses was suggested as another area of policy intervention. It was felt that this would improve the population's health and overall wellbeing.

Delhi, Punjab, Himachal Pradesh, and Chhattisgarh had a high nurse-doctor ratio but here the density of doctor per 10 000 persons was very low. There was need to strike a balance between densities of doctors and nurses, both for better availability of health professionals and ensuring the skill-mix. Similarly, doctor-allied health professionals' ratio was also very poor which merits due attention. The Global Strategy report (WHO 2016b) and other similar studies (PHFI 2012) emphasized developing enough allied health professionals by improving training and educational infrastructure for the cadre.

While these numbers across states reflected the overall workforce within the geographies, these workforce numbers were distributed across the public and private sector. The public sector traditionally experienced a high number of vacancies against the sanctioned positions within the public system. While a definitive number of vacancies for positions across rural India were presented in the Rural Health Statistics reports published by the MoHFW, Government of India; there was no single source of manpower numbers in the public sector across urban areas.

The urban health delivery system was complex with the responsibility for health-care shared by Municipal Councils and Municipal Corporations. Lopsided distribution of health workforce across states and rural-urban settings was yet another area which merits policy attention. Nearly two-thirds of all health workforce in India was found to be concentrated in urban areas leaving rural population either in extreme unmet need of health workers or to avail their services by travelling in urban areas or both. More than 68% allopathic doctors and 61% nurses work in urban areas. The lopsided distribution of health workforce was pronounced across Indian states. Most of the less developed states such as Bihar, Jharkhand, Odisha, Rajasthan, Uttar Pradesh etc. reflected very low density of health workforce per 10 000 persons. In contrast, developed states like Tamil Nadu, Delhi, Kerala etc had more than the national average density of health workers.

As far as public-private division of health workforce was concerned, bulk of doctors' employment was in the private sector while nurses were almost equally distributed across the public and private sector. Public sector seemed to be sole employer of traditional

medical practitioners. This lopsided distribution of health workers not only created a shortage of trained health workforce in many states and rural areas but also led to an unequal skill-mix across different types of health workers in different settings. These findings were in conformity with earlier studies (Rao et al. 2015, Karan et al. 2019) on the distribution of health workforce in India.

Meanwhile, the public sector is also challenged by a high number of vacancies in sanctioned positions. The Rural Health Statistics highlights this issue. While the shortage is most pronounced for specialists posted at CHCs, shortages are encountered across the states for various positions. A review of the serially published reports of the Rural Health Statistics however showed a slow but definite growth in the number of health providers at the overall country level. The vacancies were attributed to diverse reasons (REF) that ranged from barriers in recruitment, litigations against recruitment processes and premature exits from the system, especially in contractual positions.

An analysis of the health workforce projections suggested that the estimated density of skilled health professionals (doctors, nurses and midwives) per 10 000 population was unlikely to alter from current levels by 2030 if the current rates of growth were sustained. While an absolute rise in numbers is expected by 2030, this rise would be balanced by a rise in the country's population. For these projections, the study team used education adjusted NSSO numbers in the current workforce instead of the overall numbers who self-reported themselves as qualified. In 2030, the 2.65 million skilled health workforce (education adjusted) is estimated to be lower than the 3.03 million skilled health workforce if no adjustments are made to account for educational attainment in the NSSO data. However, it was important to use the education adjusted estimates which while being conservative, provided the minimum standard qualification that was expected for their role within the health system.

The current doctor: nurse ratio was approximately 1:1 when doctors were compared with graduate nurses. For this analysis, doctor numbers were composed of two distinct groups (medical doctors and AYUSH providers). Both represented professional degrees registered by their respective councils, finding widespread acceptance among the population. There was greater emphasis on provision of AYUSH facilities and medicines through public facilities. While AYUSH represents uniquely Indian systems of medicine which are predominantly accessed by people of Indian origin, there are limited opportunities to adequately account for their counterparts in several countries. Therefore, their inclusion might introduce difficulty in creating comparable numbers at the global level.

Nonetheless, it was felt that since a significant government emphasis and investment was noticed in their training and deployment, as well as them sharing a large clientele in the population, they merited an inclusion in the overall workforce numbers. AYUSH numbers were presented as distinct from doctors, but were included in the calculation of the overall skilled health worker density.

At the present level of growth on the supply side, the skill-mix ratio of doctor: nurse was unlikely to alter by 2030. A near 200% growth on the supply side for nurses was expected to improve the doctor: nurse ratio to 1:1.5 by 2030. This would require a further rapid scale-up

of nursing programmes. The High Level Expert Group report for the Planning Commission in 2012 (REF) suggested a ratio of 1:2:1 for doctor: nurse: ANM for India. For achieving this desired number of nurses by 2020, simultaneous efforts have to be undertaken on the demand side of the market as well. The roles for nurses and the functions performed by them will need closer attention. The team's recommendations for the Government for assuring an adequate and adroit workforce include the following:

Expanding the supply side of the health workforce. The expansion must be prioritized across geographical regions with a shortage of HWF. Since such deficient geographies report a shortage of several categories of health workforce, a systematic effort for co-locating multiple teaching institutions such as medicine, nursing, dentistry etc. should be encouraged linked to curriculum relevant to local population health needs. In addition, there could be a policy focus on encouraging more applicants for training from underserved areas

Growth in the number of nurses in the workforce needs priority attention. The creation of new infrastructure and graduation of the first new cohort can take five to eight years depending on the speed of construction and accreditation by the councils. An alternative strategy would be to examine the possibility of speeding-up existing applications for creating new educational infrastructure and exploring the possibility for expanding the capacity of existing institutions to train the workforce. These efforts have to be complemented by exploring mechanisms to re-skill those nursing professionals who are professionally qualified but are not currently part of the workforce.

Increasing participation of trained personnel in the workforce. A significant proportion of the trained manpower is not present in the workforce. The number that is currently not in the workforce is especially high for women. Re-skilling these graduates to make the market-ready will need customized access to high-quality content which can be rapidly scaled-up to cater to a wide audience with varying needs. The role of e-learning platforms can be useful for such programmes.

Balancing the skill-mix. The existing skill-mix is doctor-centric with a lower number of nurses. This is linked to an increase in deployment of advanced nurse practitioners and other mid-level cadres. An emphasis on significantly increasing nursing supply and retaining nurses in the workforce will have to be evolved at the national level. The role of nurses and their functions within the health system can be examined in the current circumstances. The specific role of task-shifting and its impact on patient-care and well-being will need greater attention.

Fast-tracking recruitment and deployment for public health facilities. Improve effectiveness of recruitment processes by walk-in interviews or contractual/flexible norms of engagements. Other options could include employing retired doctors and nurses to meet the existing human resource shortfall.

Harnessing technology. COVID-19 highlighted the potential to make more effective use of new and emerging technology to improve delivery of care, to enable rapid and effective communications and to improve access to care via e-health and m-health interventions. This is an area where investment in technology and training the workforce to optimize the use of technology can yield dividends

Upskilling programmes for less qualified care providers. There is a section of the health workforce which has lower than desirable qualification as reported in the NSSO data. This issue needs deliberation within the councils and the MoH at the national level to identify mechanisms to address the issue. While their formalization in the workforce is not recommended, the government can consider upskilling programmes to improve quality of services delivered by them if they meet the vision of MoH.

Improving HWF information. A significant overhaul and improvement of data on registration of health professionals with live registers of health professionals at the country level is required, with a regular/periodic update and adjustment of the database. The presence of live registers will replace the reliance on estimates from surveys and give a clearer picture for prompt decision-making and workforce planning for the future, as well as contributing to ongoing quality assurance of the registered professionals.

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VI. Appendices

Appendix A-I. State-wise percentage of doctors and nurses reporting adequate* technical education

	Doctors		Nurses	
States	No technical education	Adequate technical education	No technical education	Adequate technical education
Delhi	34.09	65.91	65.13	34.87
Haryana	8.42	91.58	51.76	48.24
Himachal	10.33	89.67	13.74	86.26
J&K	14.31	85.69	62.08	37.92
Punjab	6.74	93.26	64.81	35.19
Rajasthan	9.52	90.48	34.35	65.66
Uttarakhand	85.19	14.81	10.51	89.49
Assam	36.31	63.69	63.24	36.76
NE States	30.06	69.94	62.52	37.48
Chhattisgarh	0	100	74.9	25.1
Madhya Pradesh	20.05	79.95	52.42	47.58
Uttar Pradesh	37.61	62.39	35.31	64.68
Bihar	26.3	73.7	34.29	65.71
Jharkhand	0	100	61.82	38.18
West Bengal	16.59	83.41	73.97	26.03
Odisha	0	100	50.31	49.69
Maharashtra	0.21	99.78	56.44	43.56
Gujarat	22.16	77.84	54.31	45.69
Andhra Pradesh	27.39	72.61	31.95	68.05
Karnataka	12.5	87.5	17.03	82.97
Kerala	5.14	94.86	17.43	82.57
Tamil Nadu	17.06	82.94	16.52	83.48
Telangana	19.08	80.92	58.24	41.76
UTs	3.57	96.43	32.69	67.31
Total	17.93	82.07	44.54	55.46

Source: Estimates from NSSO 2017– 18

Appendix A-II. Percentage distribution of doctors and nurses across states

	NHWA (in thousands)					NSSO (in thousands)					
States	Allopathic doctors	Nurses	Traditional including AYUSH	Dental	Pharmacist	Allopathic doctors	Nurses	Traditional including AYUSH	Dental	Allied	Pharmacist
Andhra Pradesh	100.6	371.1	22.0	21.4	51.8	29.3	81.9	20.9	4.7	38.7	9.4
Assam	23.9	50.3	2.2	2.7	12.3	13.2	50.4	9.3	0.7	25.9	10.3
Bihar	40.6	18.0	136.5	8.6	24.3	48.6	22.0	41.9	2.6	3.5	9.9
Chhattisgarh	8.8	26.4	5.6	3.8	17.3	8.0	38.5	10.3	2.1	8.9	11.4
Delhi	21.4	71.9	12.2	15.3	30.9	15.3	69.2	9.1	15.1	9.3	0.0
Gujarat	66.9	171.7	50.0	15.0	69.5	30.4	64.0	27.4	11.1	70.4	10.8
Haryana	5.7	57.0	14.1	8.8	35.4	10.9	37.4	13.0	5.0	29.5	7.2
Himachal Pradesh	3.1	32.6	11.6	2.4	9.1	1.3	7.2	2.8	3.9	6.6	0.0
Jammu & Kashmir	15.0	0.0	6.1	4.0	0.0	18.0	10.6	8.2	4.4	16.7	5.8
Jharkhand	5.8	8.1	0.8	0.1	3.5	11.7	21.0	17.0	2.0	6.9	2.2
Karnataka	122.9	285.7	48.3	43.9	60.5	36.3	59.2	26.5	18.6	29.1	19.8
Kerala	59.4	306.3	41.6	21.3	68.4	76.3	65.3	29.3	3.1	35.0	13.7
Madhya Pradesh	38.2	158.4	67.1	8.0	59.2	69.9	43.1	25.8	7.6	38.2	18.1
Maharashtra	173.4	210.3	153.1	40.5	250.0	64.3	130.3	54.0	56.0	74.5	11.7
Odisha	22.5	137.7	14.7	2.0	34.1	9.4	34.0	13.0	3.0	17.9	9.2
Punjab	48.4	99.7	16.0	15.6	49.1	7.4	47.5	11.9	2.1	31.9	18.7
Rajasthan	43.4	308.9	18.8	6.6	51.5	19.3	71.8	17.8	3.4	21.6	26.6
Tamil Nadu	135.5	351.5	18.8	22.8	87.9	61.3	148.8	66.9	15.9	62.3	16.5
Telangana	4.9	15.3	20.9	1.0	64.9	27.6	52.5	12.8	6.7	54.9	12.1
Uttar Pradesh	77.5	135.0	85.5	18.5	91.3	115.0	143.6	69.7	10.2	137.9	20.3
Uttarakhand	8.6	5.0	4.1	1.2	17.3	5.8	26.0	4.3	0.5	3.8	0.9
West Bengal	72.0	136.1	46.9	5.7	89.6	84.6	87.7	44.7	1.8	52.3	2.8
NE States	4.3	40.2	1.4	1.1	9.7	13.8	37.9	1.8	1.6	11.0	0.3

Source: Estimates from NSSO 2017– 18

Appendix A-III. State-wise density of the health workforce in India, 2018

	Doctors		Nurses		Traditional		Allied
State	NSSO	NHWA	NSSO	NHWA	NSSO	NHWA	NSSO
Delhi	6.41	8.98	29.05	30.20	3.83	5.12	3.89
Haryana	3.77	1.97	12.89	19.67	4.48	4.87	10.17
Himachal	1.72	4.18	9.91	44.61	3.86	15.90	9.02
J&K	13.94	11.67	8.23	0.00	6.38	4.76	12.96
Punjab	2.45	16.06	15.79	33.12	3.95	5.31	10.60
Rajasthan	2.51	5.65	9.35	40.24	2.32	2.45	2.81
Uttarakhand	5.24	7.74	23.33	4.51	3.89	3.66	3.45
Assam	3.90	7.06	14.89	14.86	2.74	0.64	7.66
NE States	9.10	2.82	24.93	26.45	1.21	0.89	7.24
Chhattisgarh	2.94	3.24	14.24	9.75	3.81	2.07	3.27
Madhya Pradesh	8.51	4.65	5.24	19.28	3.14	8.17	4.66
Uttar Pradesh	4.97	3.35	6.20	5.83	3.01	3.69	5.96
Bihar	4.48	3.75	2.03	1.66	3.87	12.59	0.33
Jharkhand	3.31	1.65	5.95	2.29	4.83	0.23	1.96
West Bengal	8.75	7.45	9.08	14.08	4.63	4.86	5.41
Odisha	2.14	5.15	7.77	31.47	2.97	3.36	4.10
Maharashtra	5.12	13.79	10.36	16.73	4.29	12.18	5.93
Gujarat	4.64	10.22	9.76	26.20	4.19	7.63	10.75
Andhra Pradesh	5.54	19.00	15.48	70.10	3.95	4.15	7.31
Karnataka	5.63	19.08	9.19	44.35	4.11	7.50	4.52
Kerala	20.96	16.30	17.93	84.11	8.04	11.43	9.61
Tamil Nadu	8.69	19.18	21.08	49.78	9.48	2.66	8.82
Telangana	7.27	1.30	13.81	4.03	3.37	5.50	14.45
Uts	14.70	0.00	28.22	0.00	7.42	0.29	25.39

Source: Estimates from NSSO 2017– 18

Appendix A-IV. Distribution of doctors and nurses by gender across major states in India, 2018

	Doctors		Nurses	
State	Male	Female	Male	Female
Delhi	47.3	52.7	6.58	93.42
Haryana	82.14	17.86	29.99	70.01
Himachal	26.69	73.31	8.08	91.92
J&K	72.44	27.56	9.9	90.1
Punjab	76.94	23.06	17.03	82.97
Rajasthan	86.09	13.91	28.73	71.27
Uttarakhand	27.05	72.95	8.4	91.6
Assam	80.83	19.17	2.17	97.83
NE States	69.2	30.8	22.81	77.19
Chhattisgarh	84.12	15.88	2.75	97.25
Madhya Pradesh	89.06	10.94	52.09	47.91
Uttar Pradesh	85.45	14.55	32.24	67.76
Bihar	96.91	3.09	70.43	29.57
Jharkhand	78.13	21.87	52.03	47.97
West Bengal	77.79	22.21	2.46	97.54
Odisha	100	0	10.48	89.52
Maharashtra	69.91	30.09	11.89	88.11
Gujarat	58.81	41.19	40.62	59.38
Andhra Pradesh	73.79	26.21	15.51	84.49
Karnataka	63.84	36.16	20.04	79.96
Kerala	35.37	64.63	16.21	83.79
Tamil Nadu	53.61	46.39	12.13	87.87
Telangana	67.12	32.88	16.9	83.1
UTs	43.38	56.62	1.46	98.54
Total	70.24	29.76	19.06	80.94

Source: Estimates from NSSO 2017– 18

Appendix A-V. Distribution of doctors by age across major states in India, 2018

	Age group				
State	15-29	30-40	41-50	51-65	Above 65
Delhi	44.4	10.91	34.7	9.99	0
Haryana	0	59.78	23	17.22	0
Himachal	0	75.46	11.48	0	13.07
J&K	10.65	35.68	16.87	36.81	0
Punjab	34.08	13.43	6.39	46.09	0
Rajasthan	32.69	41.85	25.46	0	0
Uttarakhand	7.36	57.96	19.77	14.91	0
Assam	39.74	41.82	13.89	4.56	0
NE States	17.64	42.35	19.16	20.86	0
Chhattisgarh	7.53	66.61	25.86	0	0
Madhya Pradesh	19.14	34.51	22.73	23.62	0
Uttar Pradesh	36.93	23.2	31.93	7.95	0
Bihar	63.55	14.02	14.74	7.69	0
Jharkhand	6.53	73.96	14.59	4.92	0
West Bengal	8.41	40.46	30.06	17.44	3.64
Odisha	9.82	68.52	6.95	14.7	0
Maharashtra	12.28	52.68	25.89	7.5	1.65
Gujarat	15.6	53.4	6.75	23.01	1.24
Andhra Pradesh	7.25	29.97	17.92	37.99	6.88
Karnataka	15.67	43.14	21.14	10.23	9.82
Kerala	40.74	11.8	24.45	23.01	0
Tamil Nadu	17.98	33.52	27.79	18.13	2.59
Telangana	0	73.28	18.53	8.2	0
UTs	11.04	59.7	11.16	18.1	0
Total	22.75	36.35	23.24	15.83	1.84

Source: Estimates from NSSO 2017– 18

Appendix A-VI. Distribution of nurses by age across major states in India 2018

	Age group				
State	15-29	30-40	41-50	51-65	Above 65
Delhi	29.66	13.49	56.85	0	0
Haryana	11.27	36.56	35.16	0	17.01
Himachal	40.62	21.34	38.04	0	0
J&K	23.78	53.75	7.97	7.67	6.83
Punjab	42.02	42.37	15.61	0	0
Rajasthan	16.83	40.01	31.46	11.7	0
Uttarakhand	26.15	70.25	3.6	0	0
Assam	36.24	39.28	23.96	0.51	0
NE States	28.99	32.06	33.79	5.16	0
Chhattisgarh	30.45	23.3	34.5	11.74	0
Madhya Pradesh	16.75	56.19	12.79	14.26	0
Uttar Pradesh	42.99	38.43	9.24	9.35	0
Bihar	6.13	67.61	12.46	13.8	0
Jharkhand	10.03	77.37	12.6	0	0
West Bengal	15.53	34.84	41.95	7.68	0
Odisha	25	52.39	11.1	11.51	0
Maharashtra	43.43	32.77	19.31	0.46	4.02
Gujarat	75.2	9.02	15.79	0	0
Andhra Pradesh	45.98	29.79	15.21	9.03	0
Karnataka	41.53	41.73	16.75	0	0
Kerala	33.6	40.32	22.52	3.56	0
Tamil Nadu	68.59	17.08	12.96	1.37	0
Telangana	25.49	31.5	43.01	0	0
UTs	31.96	29.44	33.61	4.99	0
Total	37.78	34.12	22.58	4.63	0.89

Source: Estimates from NSSO 2017– 18

Appendix A-VII. Distribution of doctors and nurses across rural – urban and major states in India, 2018

	Doctors		Nurses	
State	Rural	Urban	Rural	Urban
Delhi	0	100	0	100
Haryana	32.84	67.16	39.67	60.33
Himachal	54.24	45.76	79.81	20.19
J&K	26.41	73.59	64.72	35.28
Punjab	0	100	39.71	60.29
Rajasthan	31.26	68.74	36.16	63.84
Uttarakhand	52.19	47.81	37.11	62.89
Assam	7.69	92.31	90.14	9.86
NE States	42.07	57.93	56.08	43.92
Chhattisgarh	18.22	81.78	64.77	35.23
Madhya Pradesh	23.81	76.19	43.56	56.44
Uttar Pradesh	51.92	48.08	42.03	57.97
Bihar	56.2	43.8	27.42	72.58
Jharkhand	49.98	50.02	55.78	44.22
West Bengal	37.68	62.32	42.86	57.14
Odisha	34.79	65.21	27.96	72.04
Maharashtra	8.6	91.4	18.87	81.13
Gujarat	29.22	70.78	11.7	88.3
Andhra Pradesh	29.21	70.79	52.58	47.42
Karnataka	41.97	58.03	28.36	71.64
Kerala	55.52	44.48	60.74	39.26
Tamil Nadu	2.57	97.43	29.97	70.03
Telangana	35.08	64.92	42.2	57.8
UTs	8.52	91.48	23.7	76.3
Total	31.25	68.75	38.06	61.94

Source: Estimates from NSSO 2017– 18

Appendix A-VIII. Distribution of doctors and nurses across public-private and major states in India, 2018

	Doctors		Nurses	
State	Private	Public	Private	Public
Delhi	24.1	75.9	62.52	37.48
Haryana	67.62	32.38	65.93	34.07
Himachal	75.35	24.65	14.44	85.56
J&K	21.13	78.87	14.42	85.58
Punjab	32.14	67.86	48.37	51.63
Rajasthan	72.49	27.51	25.71	74.29
Uttarakhand	30.12	69.88	57.55	42.45
Assam	87.36	12.64	19.66	80.34
NE States	21.57	78.43	18.92	81.08
Chhattisgarh	14.46	85.54	15.23	84.77
Madhya Pradesh	74.85	25.15	38.9	61.1
Uttar Pradesh	88.21	11.79	45.37	54.63
Bihar	90.01	9.99	51.43	48.57
Jharkhand	72.17	27.83	60.95	39.05
West Bengal	65.64	34.36	43.23	56.77
Odisha	66.05	33.95	25.24	74.76
Maharashtra	57.67	42.33	62.64	37.36
Gujarat	45.61	54.39	38.25	61.75
Andhra Pradesh	61.69	38.31	64.49	35.51
Karnataka	61.99	38.01	66.88	33.12
Kerala	59.63	40.37	74.04	25.96
Tamil Nadu	67.26	32.74	74.68	25.32
Telangana	86.11	13.89	50.13	49.87
UTs	60.55	39.45	57.57	42.43
Total	65.17	34.83	50.81	49.19

Source: Estimates from NSSO 2017– 18

Appendix A-IX. State-wise vacancy numbers for select positions at sub-centre, PHC and CHC level (as on 31st March 2019)

	Sub-centre		Primary health centre (PHC)						Community health centre (CHC)			
State/ UT	Health worker [Female]/ ANM	Health worker [Male]	Health worker [Female]/ ANM	Health Assistant [Female]/ LHV	Health Assistant [Male]	Allopathic doctors	AYUSH doctors	Nursing staff	Nursing staff	Allopathic General Duty Medical officers	Total Specialists	AYUSH doctor
Andhra Pradesh	2460	2062	0	86	0	147	55	212	117	93	58	0
Arunachal Pradesh	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bihar	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chhattisgarh	*	1345	29	354	351	471	109	460	348	*	610	4
Goa	58	0	0	2	0	*	*	*	*	2	0	*
Gujarat	535	1197	939	455	460	453	418	846	166	196	483	NA
Haryana	*	313	*	7	7	142	*	145	100	178	36	*
Himachal Pradesh	618	1405	*	23	31	236	NA	294	144	136	NA	NA
Jammu & Kashmir	398	109	151	78	8	623	65	197	134	130	102	10
Jharkhand	2656	693	36	279	336	331	237	348	1261	203	634	297
Karnataka	10	2487	*	530	2535	16	0	*	156	37	327	0
Kerala	*	0	0	*	0	*	*	*	*	*	*	0
Madhya Pradesh	1274	291	1452	1892	1133	971	*	1091	1751	1785	1132	195
Maharashtra	558	3638	1082	60	*	238	*	151	108	26	338	158
Manipur	96	102	47	11	0	30	*	47	7	4	1	*

Meghalaya	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*
Mizoram	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nagaland	*	NA	*	0	0	*	1	NA	0	2	NA	0
Odisha	*	1986	*	0	*	533	*	*	*	*	1293	*
Punjab	140	1602	*	73	117	13	*	228	*	*	403	*
Rajasthan	2491	237	521	697	82	336	305	1102	1321	368	979	59
Sikkim	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tamil Nadu	74	1004	1078	619	792	1067	167	244	707	221	NA	93
Telangana	1064	1260	0	187	0	41	151	164	286	122	367	29
Tripura	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uttarakhand	440	*	18	26	60	207	6	18	45	*	257	*
Uttar Pradesh	517	2551	*	1865	4719	1329	274	*	*	0	1615	0
West Bengal	506	7139	121	194	203	516	17	572	679	231	503	241
A& N Islands	14	0	0	0	0	8	2	0	6	13	9	3
Chandigarh	0	0	0	0	0	0	0	0	0	0	0	0
D & N Haveli	*	*	*	0	0	0	*	0	0	0	0	0
Daman & Diu	0	0	3	0	0	5	0	7	0	0	0	0
Delhi	*	0	1	1	0	2	0	0	0	0	0	0
Lakshadweep	0	0	0	0	0	0	0	0	0	0	0	0
Puducherry	NA	0	NA	3	5	*	NA	*	NA	NA	*	NA
All India2/ Total	13909	29421	5478	7442	10839	7715	1807	6126	7336	3747	9147	1089

Source: Rural Health Statistics: 2018-19, Ministry of Health and Family Welfare, Government of India

NA - Not available
All India figures for vacancy and shortfall are the totals of state-wise vacancy and shortfall ignoring surplus in some States / UT
*: Surplus
Figures includes data of SCs and HWC-SCs in rural areas

Technical annexure

Estimation of health workforce using PLFS 2017-18

In PLFS 2017–18 workers were identifiable using the activity status codes of individuals in the sample. Each individual in the survey was assigned a code for economic activities (workers), not employed but available for work (unemployed) and neither employed nor available for work (out of labour force). These activity codes were used to identify workers, unemployed and individuals out of labour force. The survey reported up to two self-reported economic activities of all persons based on major and short-time dispensation criteria, separately.

For instance, an individual may report being primarily a non-worker, but may be pursuing some economic activity for a short period of time in a reference year. Similarly, an individual primarily engaged in non-medical activities based on primary status might pursue some medical/health activities on a secondary status basis only for a shorter time period in the reference year. Both the activities of each individual and identified health workers were considered with primary and subsidiary statuses taken together.

All the workers were assigned codes for their sectors of employment (National Industrial Classification [NIC] 2008) and types of occupation (National Classification of occupation [NCO] 2004). While the NIC 2008 codes were available at a 5-digit level, the NCO 2004 codes were available at a 3-digit level. Both the NCO 2004 and NIC 2008 codes were used to classify the health workforce by broad occupation types (see Box A-I).

Box A-I. Classification and identification of health workforce according to NIC and NCO codes

National Industry Classification (NIC) 2008 uses a five-digit code for classification and identification of all economic activities including health. Health workers are identified by using the codes 86100 to 86909. In addition, workers in the retail trade of pharmacy were identified by the code 47721. Health workers with NIC and NCO codes are given in table below.

National Classification of Occupations (NCO) 2004 is a hierarchical skills-based classification of occupations which consist of 10 divisions (one-digit code); 30 sub-divisions (two-digit code); 116 groups (three-digit code); 439 families (four-digit code) and 2945 occupations (six-digit code). Three digit codes were used for identification in the study since NSSO provided three-digit classification of occupations. The health workers with their respective NCO identification codes are given in table below.

NIC and NCO codes for identifying health workers

NIC codes 2008	NCO codes 2004	Health workforce
86100	222	Doctors, dentists, AYUSH
86201	222	Doctors
86202	222	Dentists
86901–86903	222	AYUSH
86904– 86909	222	Doctors (paramedics)
87100	223	Nurses
86100–86909	323	Midwives
87100 –87900	222,223, 322, 323	Resident nurses
86100 – 86909, 87100 –87900	322,324	Allied personnel
47721	211, 221, 323, 324	Pharmacists

Accordingly, the distribution of these workers by rural–urban, public– private and so on was based on the location of respective activity statuses. Further, using the information on educational background and the activity status of each individual, it was easier to identify health workers with adequate/inadequate qualification on the one hand and 'unemployed' and 'not in labour force' status of persons with adequate medical qualifications on the other.

The existing NCO codes in the PLFS 2017–18 survey could not identify disaggregated numbers of health professionals by allopathic doctors, AYUSH doctors and dentists employed within hospital settings (NIC code 86100), although the same were identified outside the hospital settings. Also, within the AYUSH, the latest NSSO data do not support reliable estimates on different components such as Ayurveda, Unani, Siddha, Naturopathy and Homoeopathy. To estimate the number of allopathic doctors in hospital settings we cross classified hospital professionals with NCO (code 222) and applied the ratio of allopathic doctor, dentist and AYUSH derived from non-hospital setting.

In order to estimate the total number of health workforce as of January 2018, the worker population ratio (WPR) for each identified category of health workers was estimated from PLFS 2017–2018 to the projected population as of 01 January 2018 using the cumulative annual growth rate of the population between 2001 and 2011 population censuses. The population projections were done at disaggregated levels—male and female living in rural and urban areas separately in each state. The final estimates of HRH were arrived at using the formula in equation (1).

$$HW_{aijk} = pop_{ijk} * WPR_{aijk} \quad \text{..... (1)}$$

where 'HW_a' represents health workers from categories 'a' (representing doctors, dentists, AYUSH, nurses and so on); 'pop' is the projected population as of January 2018 and 'WPR_a is worker participation ratio for each category in years 2017–2018. The subscripts i, j and k represent gender, rural-urban and states. Estimation of WPR in each category of workers was arrived at using equation (2).

$$WPR_a = {}^{workers_a}/_{pop} \quad \text{..... (2)}$$

Where, workers in the NSSO data base is identified as individuals with activity codes: 11, 12, 21, 31, 41, 42and 51 either in principal or subsidiary statuses.

Projection of supply side scenario

For estimating the supply of health professionals for future years, up to 2030, the 2019 numbers were considered as the baseline year. To calculate the size of the supply side from 2020 through till 2030, a 20% increase in the seats was assumed by 2030 and number of seats was computed for each intervening year between 2019 and 2030. The annual supply side capacity was obtained from the websites of the respective councils. The data sources included annual seat capacity (2019) from the Medical Council of India data for MBBS doctors, Dental Council of India from the 2019–20 session report, Dental Council of India for dentistry programmes, Indian Nursing Council Annual Report for nurses and ANMs.

For generating the workforce estimates for each year, the new supply was added for each year to the workforce numbers in the preceding year and assumed exits were subtracted from the workforce to account for mortality, retirement and migration. An annual attrition rate of 7% was assumed from the workforce every year based on earlier work.

The workforce numbers that were inputted into the calculations included the updated NSSO numbers that were obtained for 2018 using the methodology detailed in the earlier section. The education adjusted NSSO estimates were used for calculating workforce numbers and generating skill-mix ratios.

Box A-II: Scenario of modelling

Different scenarios were modeled according to different levels of policy intervention which were similar to those adopted in Australia (Ridoutt et al). These included:

- low seat occupancy, i.e. current occupancy rate of courses – the "best guess" scenario, which is most likely to happen without any interventions;
- moderate seat occupancy rates of courses – the "optimistic" scenario, which could happen with feasible policy and administrative interventions; and
- high seat occupancy rates of courses – the "aspirational "scenario, which is unlikely to happen without significant advocacy and appropriate intervention.

Investment in health workforce not only strengthens the health system, it also generates employment and contributes to economic growth. India can gain from enhanced investment in health workforce in multiple ways. This report presents updated estimates on size and composition as well as identifies areas of investment in health workforce in India. These will add to the body of literature to strengthen the case for investments in the health workforce as an integral part of health system strengthening.