

1 **Title page**

2  
3 Title: Size, composition and distribution of health workforce in India: why, and where to invest?  
4

5  
6 Authors: Anup Karan<sup>1</sup> Himanshu Negandi<sup>1</sup> Suhaib Hussain<sup>1</sup> Tomas Zapata<sup>2</sup> Dilip Mairembam<sup>3</sup>  
7 Hilde De Graeve<sup>3</sup> James Buchan<sup>4</sup> Sanjay Zodpey<sup>1</sup>  
8

9 Affiliations:

- 10 1. Indian Institute of Public Health-Delhi, Public Health Foundation of India, Plot No. 47, Sector  
11 44, Institutional Area, Sector 32, Gurugram, Haryana 122002India.  
12 2. South-East Asia Regional Office, World Health Organization, Indraprastha Estate, Mahatma  
13 Gandhi Marg, Outer Ring Rd, New Delhi, Delhi 110002, India.  
14 3. Health Systems, World Health Organization, Office of the WHO Representative to India  
15 537, A Wing, Nirman Bhawan, Maulana Azad Road, New Delhi 110 011, India.  
16 4. WHO Collaborating Centre, Faculty of Health, University of Technology, Sydney, Australia

17  
18  
19  
20  
21 Corresponding Author:

22  
23 Dr. Anup Karan  
24 Additional Professor  
25 Indian Institute of Public Health, Delhi,  
26 Public Health Foundation of India  
27 Plot no 47, Sector 44  
28 Institutional Area, Gurugram  
29 122002  
30 India

31  
32 Email: [anup.karan@iiphd.org](mailto:anup.karan@iiphd.org)  
33  
34  
35

36 **Word count**

37 Abstract: 351

38 Manuscript: 5,335

## ABSTRACT

39

40 BACKGROUND: Investment in human resources for health not only strengthen the health  
41 system but also generates employment and contributes to economic growth. India can gain  
42 from enhanced investment in health workforce in multiple ways. This study in addition to  
43 presenting updated estimates on size and composition of health workforce, identifies areas of  
44 investment in health workforce in India.

45 METHODS: We analyzed two sources of data: i) National Health Workforce Account (NHWA)  
46 2018 and ii) Periodic Labour Force Survey 2017-18 of the National Sample Survey Office (NSSO).  
47 Using the two sources we collated comparable estimates of different categories of health  
48 workers in India, density of health workforce and skill-mix at the all India and state levels.

49 RESULTS: The study estimated (from NHWA 2018) a total stock of 5.76 million health workers  
50 which included allopathic doctors (1.16 million), nurses/midwives (2.34 million), pharmacist  
51 (1.20 million), dentists (0.27 million), and traditional medical practitioner (AYUSH 0.79 million).  
52 However, the active health workforce size estimated (NSSO2017-18) is much lower (3.12  
53 million) with allopathic doctors and nurses/midwives estimated as 0.80 million and 1.40 million  
54 respectively. Stock density of doctor and nurses/mid-wives are 8.8 and 17.7 respectively per  
55 10,000 persons as per NHWA. However, active health workers' density (estimated from NSSO)  
56 of doctor and nurses/mid-wives are estimated to be 6.1 and 10.6 respectively. The numbers  
57 further drop to 5.0 and 6.0 respectively after accounting for the adequate qualifications. All  
58 these estimates are well below the WHO threshold of 44.5 doctor, nurses and midwives per  
59 10,000 population. The results reflected highly skewed distribution of health workforce across  
60 states, rural-urban and public-private sectors. A substantial proportion of active health worker

61 were found not adequately qualified on the one hand and on the other more than 20% of  
62 qualified health professionals are not active in labour markets.

63 CONCLUSION: India needs to invest in HRH for increasing the number of active health workers  
64 and also improve the skill-mix which requires investment in professional colleges and technical  
65 education. India also needs encouraging qualified health professionals to join the labour  
66 markets and additional trainings and skill building for already working but inadequately  
67 qualified health workers.

68

69

70 Key Words: Health workforce, Human resource for health, Investment in health, India

## 71 INTRODUCTION

72 Human resources for health (HRH) are a core building block of health systems [1]. The High-Level  
73 Commission on Health Employment and Economic Growth (ComHEEG) [2] emphasized that a  
74 targeted investment in health workforce promotes economic growth through range of pathways  
75 such as enhanced productivity and output, social protection and cohesion, social justice,  
76 innovation and health security. Investment in health workforce is a driver of progress towards  
77 several Sustainable Development Goals (SDGs) [2-4]. This aligns with the *Global Strategy on*  
78 *Human resources for Health: Workforce 2030* Report, which notes that adequate investment in  
79 health workforce along with availability, accessibility, acceptability and coverage leads to overall  
80 social & economic development along with improvements in population health [4].

81 Despite this increased recognition of a central role of health workforce in attaining health  
82 outcomes and enhanced economic growth, the investment in health workforce, particularly in  
83 lower and middle income countries (LMICs) is lower than desired levels for education and training  
84 for health workers and ensuring health worker accessibility [4,5]. This present paper aims to  
85 identify the current challenges of HRH and the areas of investment in HRH in India.

86 An enhanced investment in HRH has multiple benefits with the potential for a positive impact  
87 going far beyond the health sector. Further, the impact of such investments can be maximized  
88 by improving the efficiency of HRH spending in a country [2, 4]. This requires a comprehensive  
89 analysis of health workforce situation in a country and identifying the areas of investments in  
90 health workforce. Improved health workforce information base, mapping geographical regions  
91 of workforce shortage, identifying work-load and staff distribution pattern, mapping of skill-mix  
92 and training and capacity building of health workforce are of crucial importance for investment

93 decisions at the policy levels in most LMICs [5, 6]. For instance, recent research suggesting that  
94 investment in more diverse staff and skill mix can result in improved quality of care, quality of  
95 life, and job satisfaction [7-10]. Women constitutes a significant proportion of health workforce  
96 globally. However, concentration of women in low profile jobs within the health sector and the  
97 related gender inequality has been a serious concern particularly in (LMICs) including India  
98 [11,12]. Profiling of health workers by age and gender helps understanding the gender issues of  
99 health workforce and women health professionals not participating in the labour markets.

100

101 The investment case for HRH in India is exemplified by the fact that India has a very low density  
102 of health workers per 10,000 population and the distribution of health workforce across the  
103 Indian states is highly skewed [13,14]. A recent WHO report mentions that India needs at least  
104 1.8 million doctors, nurses and midwives to achieve the minimum threshold of 44.5 health  
105 workers per 10,000 population in 2030 [15]. Also, India's National Health Policy (NHP) 2017  
106 recommended strengthening existing medical education system and the development of a cadre  
107 of mid-level care providers [16]. Similarly, the *NITI Aayog's* Strategy for "New India@75" aims at  
108 generating 1.5 million jobs in the public health sector by 2022-23 [17]. The current COVID-19  
109 pandemic has further exposed the acute shortage of health workers in India's health system. In  
110 addition, OECD countries have benefited by the presence of Indian origin and Indian trained  
111 doctors and nurses [8], whilst during the COVID-19 situation the health system in India is  
112 struggling with low numbers of trained health personnel.

113 An enhanced investment in health workforce in India has the potential of not only strengthening  
114 the health system and improving the accessibility to health workers but also generating

115 employment for health professionals, associate health workers and subordinate/support staff,  
116 enhancing female labour force participation and share of formal employment in total  
117 employment [15].

118 Recent research [13-, 18-21] has identified several areas of concern related to Indian health  
119 workforce. Studies have highlighted that there has been acute shortages of doctors and nurses  
120 along with low levels of skill-mix. A lack of adequate number of institutions providing training in  
121 nursing, and international migration of nurses from India are the two most prominent reasons  
122 for the shortage of trained nurses in India [22-25]. Moreover, studies have also highlighted low  
123 quality of a large share of total number of nurses in India [16, 26]..

124 Against this background, the main research question in the present study is: what are the  
125 dimensions of HRH in India which are crucial for policy attention and enhanced investment. While  
126 doing so, the study presents an updated estimate of health workforce at disaggregated  
127 geographical regions and identify issues related to difference between health workforce  
128 estimates and the stock of health professionals registered with different councils. In addition, the  
129 study also estimates level of skill-mix at the all India and state levels. To address the gender  
130 dimension of the health workforce, the study estimated level of women participation in health  
131 workforce and presents age and gender profile of health professionals who are not active in  
132 labour market.

133

#### 134 *HRH policy and structure of health workforce in India*

135 Indian healthcare system is characterized by a pattern of mixed ownership (public and private)  
136 and systems of medicine (Allopathic and indigenous including Homoeopathy, *Ayurvedic*, *Yoga*,

137 *Unani, Siddha etc.* [16]. India's HRH policy is shaped by recommendations by various expert  
138 committees during the past seven decades. Taking note of acute shortages and uneven  
139 distribution of health workforce in India, most of these committees recommended to  
140 significantly increase production, maintain an adequate skill-mix of health workers and  
141 maintaining minimum level of physical infrastructure at population levels [27]. However,  
142 despite these recommendations, India continued to struggle with shortages and uneven  
143 distribution of HRH. Also, sustained under-investment in public health system led private sector  
144 to overtake public in service delivery and employment of health workforce [28]. Recent health  
145 sector reforms, particularly since the launch of the National Rural Health Mission (NRHM) in  
146 2005, focused on strengthening public health system and emphasized on improving health  
147 worker population ratio. More recently in 2019 government of India announced three  
148 strategies to enhance supply of HRH: i) establishing new institutions to produce health workers;  
149 ii) expand the intake capacity of the existing medical institutions and iii) upgrade existing  
150 district hospitals to medical college level [29]. Simultaneously, government also relaxed the  
151 norms of establishing medical colleges and nursing institutions in the private sector. All these  
152 are likely to significantly increase supply of health workers in the near future.

153 Healthcare services in India are offered by a varied range of professionals trained in different  
154 specialties of medicine and healthcare. The supply side information [30] on the availability of  
155 health professionals indicate that these health professionals have varied levels of educational  
156 qualifications and are registered with different councils/agencies [13-14]. Table 1 presents  
157 categories of health professionals directly engaged in services delivery along with their levels of  
158 educational qualification and their registering agencies.

159 AYUSH (an indigenous Indian system of medicine comprising of Ayurvedic, Yoga, Unani, Siddha  
160 and Homeopathic) doctors are bachelor's or postgraduate degree holders in AYUSH. Their  
161 registering institutions are Central Council for Indian Medicine or the Central Council for  
162 Homoeopathy and are authorized to dispense medicines and conduct surgery using their respective  
163 fields of specialization. AYUSH doctors are integral part of HRH in India as their professions are  
164 recognized by a Parliament Act [13-14]. There are also community health workers with 10 years  
165 of formal education and a short training course. The health workforce at the ground level also  
166 includes many informal medical practitioners, such as registered medical practitioners (RMPs)  
167 (including traditional birth attendants, faith healers, snakebite curers, bonesetters etc.) with or  
168 without any formal education or skills/training. RMPs are often the first point of contact for  
169 treatment for a large proportion of population living in rural and remote areas and they may be  
170 dispensing either allopathic or traditional drugs or both as the need arises [13-14].

171

## 172 **METHODS**

173 The present study used data from two main sources: (1) National Health Workforce Accounts  
174 (NHWA) on India -2018 [31] and (2) Periodic Labour Force Survey (PLFS) conducted during July  
175 2017 – June 2018 by the National Sample Survey Office (NSSO 2017-18) [32]. In addition,  
176 information was also collected from Central Bureau of Health Intelligence (CBHI) 2019, Rural  
177 Health Statistics (2019) and population projection from the Census of India (2019) [33].

### 178 *NHWA data*

179 The NHWA for India provides information on different categories of stock of health workers at  
180 national and state levels. The latest information available is for the year 2018. We extracted

181 number of health professionals from NHWA for four different categories (Medical doctors,  
182 Dentist, Nurses/midwives/Auxiliary nurse and midwives (ANM), and Pharmacist) at the all India  
183 and state levels for the year 2018.

184 *NSSO data*

185 The sample size of PLFS 2017-18 is 102,113 households (56,108 rural and 46,005 urban) covering  
186 433,339 individuals (246,809 rural and 186,503 urban). The survey collected information related  
187 to the nature of occupation of workers using National Classifications of Occupation (NCO) 2004  
188 and the National Industrial Classification (NIC) 2008. NSSO data also provide information on  
189 detailed activity status such as worker, unemployed and out of labour force, location of workers  
190 by state and rural and urban, general educational and technical educational qualifications, place  
191 of working by public and private sectors.

192 *Methods of estimation of health workforce*

193 Total stock of health professionals by types of health professionals (doctors, nurses and  
194 midwives, pharmacists and traditional medicine practitioners) is directly reported in the NHWA  
195 database. We estimated size of comparable categories of health workforce from the NSSO 2017-  
196 18, using the worker population ratio (WPR) and projected population as of January 2018. We  
197 applied the WPR at the disaggregated occupational levels estimated from NSSO 2017-2018 to the  
198 projected population as of 1 January 2018 using population projection at disaggregated levels:  
199 male and female living in rural and urban areas separately in each state. The estimates of HRH  
200 were arrived at using equation (1).

201  $HW_{aijk} = pop_{ijk} * WPR_{aijk} \dots \dots \dots (1)$

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

207 
$$WPR_a = \frac{workers_a}{pop} \dots \dots \dots (2)$$

208 The NSSO survey reports up to two self-reported activities of all persons based on major and  
209 short time dispensation criteria separately. We considered both activities of each individual and  
210 identified health workers on the basis of either primary or secondary status. Information on  
211 activity status and educational background of each individual were used for identifying  
212 'unemployed' and 'not in labour force' statuses of persons with medical qualifications.

213 The existing NCO 2004 and NIC 2008 codes used in the 2017-2018 survey could not identify  
214 disaggregated numbers of health professionals by allopathic doctors, AYUSH doctors and dentists  
215 employed in hospital settings, although the same were identified outside the hospital setting.  
216 We applied the ratio of different health professionals outside the hospital sector on the hospital  
217 sector to arrive at the total estimate of different categories of health workers. The cross  
218 classification of NCO 2004 and NIC 2008 for identifying different categories of workers is  
219 presented in Appendix Table A-I.

220 The two sources (NHWA and NSSO data) identify comparable categories of health professionals.  
221 However, NSSO data base does not provide NCO code for identifying ANM and pharmacists  
222 comparable to the NHWA. It is possible that a part of the total ANM number in the NSSO data  
223 may be clubbed in another category coded as 'health associate professionals'. The pharmacist

224 number presented in this report on the basis of NSSO data only refers to pharmacists engaged in  
225 retail trade.

226

### 227 *Supply side estimation*

228 We estimated the supply of health professionals in future years up to 2030 using estimated  
229 number of seats in different medical colleges/institutions. Institutions offering health programs  
230 in 2019 were identified through Google search engine using keywords such as “health programs”,  
231 “nursing courses”, “AYUSH”, “MBBS”, “BPharma” and “allied health programs”. The search was  
232 limited to programs offered in India. Additionally, the websites of the All India Council of  
233 Technical Education, University Grants Commission, universities and institutions were also  
234 searched, and education supplements of newspapers and commercial web-sites were searched.  
235 The number of seats in various health professional programs was forecasted for the period till  
236 2030. We assumed a seat occupancy rate of 95% for medical doctors for the forecast time period.  
237 For generating the workforce estimates for each year, we added the new supply for each year to  
238 the workforce numbers in the preceding year and subtracted assumed exits from the workforce  
239 to account for mortality, retirement and migration by assuming an overall annual attrition rate  
240 of 7% every year.

241 Finally, we modelled scenarios according to different levels of policy intervention which was  
242 similar to that adopted by Ridoutt et al. [34].

243

## 244 **RESULTS**

### 245 **Size and Composition of Health Workforce**

246 Table 2 presents estimates of HRH, categorized by doctors, dentists, nurses/mid-wives and  
247 pharmacist, at the all India level using the two main sources of data. Since workers self-reported  
248 occupations in the NSSO survey and health workers may or may not have adequate qualifications,  
249 we present estimates on health workforce from NSSO with and without adequate qualifications.  
250 NHWA reports a total stock of approximately 1.16 million allopathic doctors, 2.34 million  
251 nurses/midwives (including ANM), 1.20 million pharmacists, 0.27 million dentists, and traditional  
252 medicine professionals 0.79 million. Both the estimates (with and without adequate  
253 qualifications) from NSSO are invariably lower compared with the NHWA estimates for all the  
254 reported categories. According to NSSO, the numbers of allopathic doctors and nurses/mid-  
255 wives, even before adjusting for the right qualifications, are 0.80 million and 1.4 million  
256 respectively. Estimates on pharmacist, dentist, and traditional medical practitioners from NSSO  
257 are also significantly lower as compared with those recorded in the NHWA.

258 The difference in the estimates from the two sources are the highest for nurses/midwives and  
259 pharmacists. For nurses/midwives categories, ANM is not recorded separately in the NSSO and  
260 may be clubbed partly with nurses/midwives and partly with health associates. For pharmacists,  
261 only pharmacists engaged in the retail trade were identifiable in the NSSO data and pharmacist  
262 assistants are clubbed in the health associate category. The NSSO based estimates after adjusting  
263 for the mandated qualifications are further lower as 18% of health workers who self-reported as  
264 allopathic doctors and 44% of health workers engaged as nurses/midwives had no adequate  
265 qualification.

266 State-wise dis-aggregation of allopathic doctors and nurses reflect large concentration of stock  
267 of health professionals in a few states like Maharashtra, Tamil Nadu and Karnataka (Table 3) and  
268 active health workforce in states of Uttar Pradesh, West Bengal and Kerala (Appendix Table A-II).

269

### 270 **Density of Doctors and Nurses and Skill-mix**

271 At the all India level, stock density of doctor and nurses/mid-wives are 8.8 and 17.7 respectively  
272 per 10,000 persons (Figure 1). If we add total stock of dentists and traditional medicine  
273 practitioners, total stock density in India is estimated as 34.6 per 10.000 persons. However,  
274 density of active workers (as estimated from the NSSO) of doctor and nurses/mid-wives (without  
275 adjusting for adequate qualification) are estimated to be 6.1 and 10.6 respectively. The density  
276 further drops to 5.0 and 6.0 respectively after adjusting for the adequate qualifications. Total  
277 active worker density is estimated to be 26.5 and 16.7 respectively before after adjusting for  
278 qualifications.

279 Among the states, Kerala reported the highest density of active doctor workforce (25.4) whereas  
280 Delhi had the highest density of active nurse/midwives workforce estimated from NSSO.  
281 Considering doctor and nurse workforce together, Kerala, Delhi and Tamil Nadu are on the top  
282 of the list with a great deal of variations across states (Figure 2). (see Appendix Table A-III for  
283 details).

284 As far as the skill-mix ratio is concerned, the stock data of NHWA suggests nurse to doctor ratio  
285 as to be 2.02:1 at the all India level, with large scale variations across states varying from 10.7:1  
286 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  
287 in Uttarakhand. The nurse to doctor ratio on the basis of the NSSO data, however, is estimated

288 to be 1.7:1 at the all India level with Punjab (7.1:1) and Delhi (4.8:1) on the higher side and states  
289 of Bihar, Jammu & Kashmir and Madhya Pradesh having less than 1 nurse per doctor on the lower  
290 side (Table 4). Figure 3 presents skill-mix ratio as against density of doctors at the state levels.

291

292

### 293 **Estimated Skilled Health Workforce Size by 2030**

294 Table 5 depicts the estimated number of skilled health workers (doctors/ nurses and midwives)  
295 for 2019 through 2030. The base line number for 2019 has been taken from the education  
296 adjusted estimates of health workforce from the NSSO 2017-18 (Table 2). The projected skilled  
297 health workforce numbers will rise from current estimates of 1.77 million to 2.65 million in 2030.  
298 However, even this will not result in a rise of the skilled health workforce density as the density  
299 will be approximately 17.5 per 10,000 population in 2030. There will be a shortfall of  
300 approximately 1.13 million skilled health workers to reach 22.8 skilled health workers per 10,000  
301 population. However, if there is a scale-up of nursing supply to approximately 200% growth by  
302 2030, the resultant number of nurses will be 2.02 million in 2030 and the total skilled health  
303 workforce number will be 3.45 million in 2030 (22.76 skilled health professionals per 10,000  
304 population).

305

306 If the NSSO reported data for health professionals without any adjustment for educational  
307 qualifications is considered as the baseline, the projected estimates of skilled health workforce  
308 numbers would be 3.03 million and density will be approximately 20.03 per 10,000 population in  
309 2030 at current growth rates. There will be a shortfall of approximately 0.7 million skilled health

310 workers to reach 25 skilled health workers per 10,000 population. The forecasted supply side  
311 scenario from 2020 to 2030 is presented in Appendix Table A-IV.

312

### 313 **Distribution of Health workforce by Gender and Age**

314 The gender and age distribution of health workforce (Figure 4 and Figure 5 respectively) reveals  
315 that there is a clear numerical dominance of males in doctors, dental and AYUSH categories  
316 whereas females outnumber male in the nurse's category. Approximately two-thirds of all health  
317 workforce are below age 40 years while more than 25% being in the young age group of below  
318 30 years. Nurses and dentists reflect higher concentration, 38% 30% respectively, in the younger  
319 age group (15-29 years) as compared with doctors (23%) and other health workers. Accordingly,  
320 doctors have higher concentration in the older age group of 50 years and above (18%) as against  
321 3% dentists and 5.5% nurses in the same age group.

322

### 323 **Distribution across Rural–Urban and Public–Private**

324 The uneven distribution of health workers is also reflected across rural–urban and public-private  
325 settings (Appendix Figure-A-I and Figure A-II). Although rural India constituted approximately  
326 66% of the total population in 2018, only 33% of all health workers are in rural areas. This  
327 proportion is a quite lower for dental work force. The proportions of doctor and nurses in rural  
328 areas are 27% and 36%, respectively. Further, the bulk of the total health workforce is employed  
329 in the private sector. Approximately 60% of inpatient care and 70% of outpatient care in India is  
330 provided by private sector [34]. The proportions employed in the private sector: doctors (65%),

331 dentists (89%), AYUSH (93%) and other health workers (67%) are also to a great extent  
332 commensurate to the proportion of service delivery.

333

#### 334 **Person with Medical Education but Out of Labour Force**

335 Further a substantial proportion of medically qualified persons are not the part of current health  
336 workforce. The estimates from the NSSO indicate that among the individuals with a qualification  
337 of degree in medicine (graduate and above), 27% are not active in labour market while  
338 approximately 4% are currently unemployed and looking for jobs (Figure 6). Similarly, among the  
339 diploma holders, above or below graduate levels, only 63% reported currently employed.

340 We also examined the gender and age profile of the persons who have technical education in  
341 medicine but are 'out of labour force' and noted that female shares an overwhelming proportion  
342 (31%) of persons with technical education in medicine but are out of labour force. Proportions of  
343 persons with technical education in medicine but out of labour force is higher in the younger and  
344 elderly age groups. However, approximately 20% female who are not in the labour force and  
345 have technical education in medicine are in the age group of 30-40 years (Appendix Figure A-III).  
346 An overwhelming proportion of these women reported themselves engaged in household work  
347 as against joining labour markets.

348

#### 349 **DISCUSSIONS AND POLCY IMPLICATIONS**

350 Investment in HRH to improve availability of health workforce has gained increased attention in  
351 recent years [2,5]. In India such investments also have potential to enhance female labour force  
352 participation and formalization of labour market [15]. These discussions on enhancing the

353 investment and policy attention to health workforce related issues has assumed centrality in the  
354 presence of the COVID-19 pandemic.

355 In the present report we presented different dimensions of HRH in India, along with existing and  
356 emerging challenges which needs to be addressed for improved availability of health workforce  
357 in the country as a whole and at the state levels. We used two nationally representative data  
358 sources on health workforce: i) stock of health workforce from the NHWA 2018 and ii) National  
359 sample survey data (NSSO) 2017-18 on labour force to identify HRH challenges and areas of  
360 investment in HRH in India. Our estimates from the NHWA data are almost similar to the results  
361 as reported in a recent WHO report [15]. However, NHWA and NSSO based estimates in the  
362 present study reflect widely varied estimates on the size of health workforce with the NHWA  
363 based estimates significantly higher to the NSSO based estimates.

364 Several reasons have been highlighted explaining the difference between the estimates of health  
365 professionals from the NHWA data and health workers as reported in the NSSO data [14,18].

366 Most of these reasons are related to the fact that a large proportion of the health professionals  
367 registered with different councils and associations are not part of the current health workforce  
368 in India. One widely discussed reason is the migration of qualified health professionals from India  
369 to other developed countries [8,13,35,36].

370 In addition, there are reasons related to the veracity and updating of the NHWA data. For  
371 instance, the NHWA data is collated from different professional councils, which do not maintain  
372 a live register and do not require renewing the registration. The information they provide is  
373 fraught with non-adjustment of health professionals leaving the workforce because of death,

374 retirement and double counting of workers because they have registered in more than one state  
375 [14,18].

376 However, one of the most important reasons of this differential estimate is that the NHWA  
377 provides total stock of health professionals but not all of them are active in labour markets. Using  
378 NSSO, we reported in this paper that a substantial proportion of medically qualified individuals,  
379 overwhelmingly women, is currently not a part of workforce, either because they are currently  
380 unemployed but available for work or they do not want to join labour markets. This is particularly  
381 amplified for nurses/midwives, for whom the difference between the registered and active  
382 workers is the highest. If we apply this proportions (% employed) over the NHWA stock data, we  
383 come to pretty close estimates from the two sources.

384 Despite the differences in estimates of health workforce across the two main sources of  
385 information, both the sources indisputably reflect skewed distribution of health workforce across  
386 states and inadequate skill-mix ratio.

387 AYUSH practitioners are recognised health professionals by government of India and they use  
388 indigenous system of healthcare. Use of indigenous knowledge in health system is not unique in  
389 India. Such system exist in many developing countries including Bangladesh, China and South  
390 Africa [37-39] and the Traditional Chinese Medicine was also used as a safeguard against SARS  
391 and COVID-19 in China [40]. In India a large section of population has significant belief in AYUSH  
392 system and for many chronic conditions AYUSH is often preferred over modern healthcare by a  
393 large proportion of population [41, 42]

394 Density of health workforce with respect to population is an important indicator of availability of  
395 health workforce. Density of allopathic doctors and nurses who are active in labour market are

396 as low as 6.1 and 10.6 respectively per 10,000 persons (16.7 in total), which is well below the  
397 WHO threshold of 44.5 doctors, nurses and midwives per 10,000 population. If we add dentists  
398 and AYUSH professionals, the total active health workforce density comes to be approximately  
399 22 per 10,000 persons. The present study clearly reveals that new investment for improving the  
400 size of active health workforce is the most important area which needs policy attention in India.  
401 In addition, we also find a sub-optimal skill-mix between doctor and nurse and doctor and allied  
402 health professional. Size of traditional medicine practitioners (including AYUSH) in India is quite  
403 sizeable. Total number of active AYUSH practitioners is almost 70% of the total number of active  
404 allopathic doctors.

405 However, the number of nurses per doctor is less than 2. This number is lower to 1 if we consider  
406 BSc Nursing qualifications. In most OECD countries there are 3-4 nurses per doctors [8]. We find  
407 that although total stock of nurses in the country is approximately 3 times number of doctors, a  
408 large proportion of nurses are not actually active in labour market. In order to increase nurses'  
409 participation in active health workforce, creating a smooth employment environment for nurses  
410 may be another area of policy intervention. There is a need to make balance between densities  
411 of doctor and nurse both for a better availability of health professionals and skill-mix. Similarly,  
412 doctor/allied health professionals' ratio is also very poor which needs attention. The Global  
413 Strategy report [4] and other similar studies [43] also emphasized creation of enough allied health  
414 professionals through improved training and educational infrastructure.

415 Skewed distribution of health workforce across states and rural-urban setting is yet another area  
416 which needs policy attention. Nearly two-thirds of all health workforce in India is concentrated  
417 in urban areas leaving rural population either in extreme unmet need of health workers or to

418 avail their services by travelling in urban areas or both. The lopsided distribution of health  
419 workforce is also pronounced across Indian states. Most of the less developed states such as  
420 Bihar, Jharkhand, Odisha, Rajasthan, Uttar Pradesh etc. reflect the acute shortage of health  
421 workforce. To understand the reasons of such skewed distribution across states and to  
422 understand regional level complexities a more detailed and deeper study is required.

423 As far as public-private division of health workforce is concerned, the bulk of doctors'  
424 employment is in private sector while nurses are almost equally distributed across public and  
425 private sector. Public sector seems to be sole employer of traditional medical practitioners. These  
426 lop-sided distribution of health workers not only create shortage of trained health workforce in  
427 many states and rural areas but also leads to unequal skill-mix across different types of health  
428 workers in different settings. These findings are in conformity with earlier studies [14,20].

429 The public sector is also challenged by a high rate of vacancy of sanctioned positions [44]. While  
430 the shortage is most pronounced for specialists at Community Health Centres, the shortages are  
431 prominently witnessed across the states for various positions. The existing vacancies are  
432 attributed to diverse reasons that range from barriers in recruitment, litigations against  
433 recruitment processes and premature exits from the system, especially in contractual positions.  
434 Filling up existing vacancies in government sector requires urgent policy attention.

435 An analysis of the health workforce projections suggests that the estimated density of skilled  
436 health professionals (doctors, nurses & midwives) per 10,000 population is unlikely to alter from  
437 current levels by 2030 if the current rates of growth are sustained. While we are to witness an  
438 absolute rise in numbers by 2030, the density of the health workforce is unlikely to change by  
439 2030. AYUSH represents Indian systems of medicine which are predominantly accessed by

440 people of Indian origin, and their inclusion might introduce difficulty in creating comparisons with  
441 other countries. Nonetheless, we feel that since there is a significant government emphasis and  
442 investment in their training and deployment, as well as them sharing a large clientele in the  
443 population, they merit an inclusion in the overall workforce numbers. We have presented the  
444 AYUSH numbers as distinct from doctors, but we have included them in the calculation of the  
445 overall skilled health worker density.

446 At the present level of the growth in the supply side, the skill-mix ratio of doctor: nurse is unlikely  
447 to alter by 2030. A near 200% growth in the supply side for nurses will improve the doctor: nurse  
448 ratio to 1:1.5 by 2030. This will require a further rapid scale-up of nursing programs. The High  
449 Level Expert Group report for the Planning Commission in 2012 [45] had suggested a ratio of  
450 1:2:1 for doctor: nurse: ANM for India. For achieving this number of nurses by 2030, simultaneous  
451 efforts will have to be undertaken on the demand side of the market as well. The roles for nurses  
452 and the functions that are performed by them will need closer attention.

453 The analysis in this study throws several points for policy interests as follows:

454 **Expanding the supply side of the health workforce:** The expansion of medical educational  
455 institutions (medicine, nursing, dentistry etc.) should be prioritized across geographical regions  
456 with a shortage of health workforce and the passed out from these institutions should be  
457 encouraged to work in local areas. Thailand represents a good example of effective  
458 implementation of rural retention policies for medical doctors [46]

459 **Growth in the number of nurses in the workforce needs priority attention:** The creation of new  
460 infrastructure/institutions for nursing may be a medium to long term intervention. Also, efforts  
461 should be taken to expand the capacity and quality of existing institutions to train the nurses.

462 **Increasing participation of trained personnel in the workforce:** A significant proportion of the  
463 trained manpower, especially women, is not present in the workforce. Strategies for re-skilling  
464 these graduates and attract them in labour markets should be worked out.

465 **Balancing the skill-mix:** The existing skill-mix is doctor-centric with a lower number of nurses. An  
466 emphasis on significantly increasing nursing supply and retaining the nurses in the workforce  
467 needs to be evolved at the national level. The specific role of task-shifting and its impact on  
468 patient-care and well-being will need greater attention.

469 **Fast-Tracking recruitment and deployment for public health facilities:** Improve effectiveness of  
470 recruitment processes by walk-in interviews or contractual/flexible norms of engagements to  
471 reduce the existing human resource gaps in public sector institutions, particularly at the primary  
472 levels.

473 **Harnessing technology:** Covid-19 has highlighted the potential to make more effective use of  
474 new and emerging technology to improve the delivery of care, to enable rapid and effective  
475 communications, and to improve access to care via e-health and m-health interventions. This is  
476 an area where investment in technology and in training the workforce can have dividends

477 **Up-skilling programs for less qualified care providers:** There is a section of the health workforce  
478 which has lower than desirable qualification as reported in the NSSO data. This issue needs  
479 deliberation within the Councils and the Ministry of Health at the national level to identify the  
480 mechanisms to address the issue. While we do not recommend their formalization in the  
481 workforce in the present form, the government can consider up-skilling programs to improve the  
482 quality of services and engage them in a range of care giving and non-medical health services.

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

489 Implementing the above recommendations will require substantive increase on investment in  
490 the health workforce, which will contribute to inclusive economic growth in India.

491

492

493 LIST OF ABBREVIATIONS

494 ANM – Auxiliary Nurse Midwife; AYUSH – Ayurveda, Yoga and Naturopathy, Unani, Siddha and  
495 Homeopathy; CBHI – Central Bureau of Health Intelligence; ComHEEG – High-Level Commission on  
496 Health Employment and Economic Growth; HRH – Human Resources for Health; LMICs – Lower and  
497 Middle Income Countries; MoHFW – Ministry of Health and Family Welfare; NCO – National  
498 Classification of Occupations; NHP – National Health Policy; NHWA – National Health Workforce  
499 Account; NIC – National Industrial Classification; NITI Aayog – National Institution for Transforming India;  
500 NSSO – National Sample Survey Office; OECD – Organisation for Economic Cooperation and  
501 Development; PLFS – Periodic Labour Force Survey; RMP – Registered Medical Practitioner; SDG’s –  
502 Sustainable Development Goals; UN – United Nations; WHO – World Health Organisation; WPR –  
503 Worker Population Ratio.

504

505 DECLARATIONS

506 ETHICS APPROVAL: Ethical clearance for this study was obtained from the Institutional Ethics Committee  
507 (IEC) of the Indian Institute of Public Health Delhi under 'Expedited Review'.

508 Consent to participate – Not applicable.

509

510 CONSENT FOR PUBLICATION: Not applicable

511 AVAILABILITY OF DATA AND MATERIALS: Data for this study was used from secondary sources. Micro data  
512 from the NSSO is available for free in public domain from the official website  
513 ([http://www.mospi.gov.in/unit-level-data-report-nss-75th-round-july-2017-june-2018-schedule-](http://www.mospi.gov.in/unit-level-data-report-nss-75th-round-july-2017-june-2018-schedule-250social-consumption-health)

514 [250social-consumption-health](http://www.mospi.gov.in/unit-level-data-report-nss-75th-round-july-2017-june-2018-schedule-250social-consumption-health)) of the National Sample Survey Office, Ministry of Statistics and  
515 Programme Implementation, Government of India.

516

517 COMPETING INTERESTS: No competing interest

518

519 FUNDING: This article is part of a research project funded by WHO (grant number [WHO Registration](#)  
520 [2020/996952-0](#); [Purchase Order 202512192](#)) to the Public Health Foundation of India.

521

522 AUTHOR'S CONTRIBUTIONS

523 AK, DM, HN, JB, SZ and TZ jointly conceptualised the idea. AK, DM, JB, HN and TZ developed early analytical  
524 framework. AK, HN, SH and TZ analysed the data. AK, HN and SH prepared the first draft. DM, HG, JB, SZ  
525 and TZ provided extensive comments to the first draft and contributed to developing the final draft. AK,  
526 DM, HG, HN, JB, SH, SZ and TZ all reviewed the final draft and consented to the final manuscript.

527

528 ACKNOWLEDGEMENT – None

529 **REFERENCES**

- 530 1. WHO. The World Health Report - working together for health. Geneva, World Health Organization.  
531 2006. ([https://www.who.int/whr/2006/whr06\\_en.pdf?ua=1](https://www.who.int/whr/2006/whr06_en.pdf?ua=1)) ( Accessed 20 April 2020)
- 532 2. WHO. High-Level Commission on Health Employment and Economic Growth. Geneva, World  
533 Health Organization. 2016.  
534 [https://apps.who.int/iris/bitstream/handle/10665/250040/9789241511285-](https://apps.who.int/iris/bitstream/handle/10665/250040/9789241511285-eng.pdf;jsessionid=E7906442B2EC6417EBE3C5F7D45715FC?sequence=1)  
535 [eng.pdf;jsessionid=E7906442B2EC6417EBE3C5F7D45715FC?sequence=1](https://apps.who.int/iris/bitstream/handle/10665/250040/9789241511285-eng.pdf;jsessionid=E7906442B2EC6417EBE3C5F7D45715FC?sequence=1) (Accessed 20 April  
536 2020)
- 537 3. Scheil-Adlung X, Thorsten Behrendt T, Wong L. Health sector employment: a tracer indicator for  
538 universal health coverage in national social protection floors. Hum Resour Health. 2015; 13:66.
- 539 4. WHO. Global Strategy on Human Resources for Health: Workforce 2030. Geneva, World Health  
540 Organization. 2019.  
541 ([https://www.who.int/hrh/resources/global\\_strategy\\_workforce2030\\_14\\_print.pdf?ua=1](https://www.who.int/hrh/resources/global_strategy_workforce2030_14_print.pdf?ua=1))  
542 (Accessed 20 April 2020)
- 543 5. Cometto G, Campbell J. Investing in human resources for health: beyond health outcomes. Hum  
544 Resour Health. 2016; **14**, 51. <https://doi.org/10.1186/s12960-016-0147-2>
- 545 6. Driessen J, Settle D, Potenziani D, Tulenko K, Kabocho T, Wadembere I. Understanding and valuing  
546 the broader health system benefits of Uganda’s national Human Resources for Health Information  
547 System investment. Hum Resour Health. 2015; 13:49.
- 548 7. WHO. National health workforce accounts: a handbook. World Health Organization. 2017.  
549 (<https://apps.who.int/iris/bitstream/handle/10665/259360/9789241513111-eng.pdf> (Accessed  
550 20 April 2020)

- 551 8. OECD. Recent trends in international mobility of doctors and nurses. In: Recent Trends in  
552 International Migration of Doctors, Nurses and Medical Students, OECD Publishing, Paris, 2019.  
553 <https://dx.doi.org/10.1787/5ee49d97-en>. (Accessed 20 April 2020)
- 554 9. Koopmans L, Damen N, Wagner C. Does diverse staff and skill mix of teams impact quality of care  
555 in long-term elderly health care? An exploratory case study. BMC Health Serv Res. 2018; **18**, 988.
- 556 10. European Union. Task Shifting and Health System Design: Report of the Expert Panel on Effective  
557 ways of Investing in Health. Publications Office of the European Union. 2019.
- 558 11. Newman, C. Time to address gender discrimination and inequality in the health workforce. Hum  
559 Resour Health 12, 25 (2014). <https://doi.org/10.1186/1478-4491-12-25>
- 560 12. WHO. Gender equity in the health workforce: Analysis of 104 countries. World Health  
561 Organization. 2019  
562 [https://apps.who.int/iris/bitstream/handle/10665/311314/WHO-HIS-HWF-Gender-WP1-2019.1-](https://apps.who.int/iris/bitstream/handle/10665/311314/WHO-HIS-HWF-Gender-WP1-2019.1-eng.pdf)  
563 [eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/311314/WHO-HIS-HWF-Gender-WP1-2019.1-eng.pdf) (Accessed 20 January 2021)
- 564 13. Rao M, Rao KD, Kumar AS, Chatterjee M, Sundararaman T. The Lancet. 2011; 377: 587–598.
- 565 14. Karan A, Negandhi H, Nair R, et al. Size, composition and distribution of human resource for  
566 health in India: new estimates using National Sample Survey and Registry data. BMJ Open 2019;  
567 9:e025979. doi: 10.1136/ bmjopen-2018-025979
- 568 15. WHO. Decade for health workforce strengthening in SEAR 2015-2024, mid-term review of  
569 progress. World Health Organization. 2020  
570 [file:///C:/Users/zapatat/Downloads/9789290227779-eng%20\(6\).pdf](file:///C:/Users/zapatat/Downloads/9789290227779-eng%20(6).pdf)  
571 (Accessed 30 September 2020)
- 572 16. Ministry of Health and Family Welfare. National Health Policy. Ministry of Health and Family  
573 Welfare, Government of India. 2017.  
574 <https://main.mohfw.gov.in/sites/default/files/9147562941489753121.pdf> (Accessed 20 April  
575 2020)

- 576 17. NITI Aayog. Strategy for New India @ 75, Government of India, NITI Aayog. 2018.  
577 [https://niti.gov.in/sites/default/files/2019-01/Strategy\\_for\\_New\\_India\\_0.pdf](https://niti.gov.in/sites/default/files/2019-01/Strategy_for_New_India_0.pdf) (Accessed 20 April  
578 2020)
- 579 18. Rao KD, Bhatnagar A, Berman P. So many, yet few: Human resources for health in India. Hum  
580 Resour Health. 2012; **10**, 19. <https://doi.org/10.1186/1478-4491-10-19>
- 581 19. Hazarika I. Health workforce in India: assessment of availability, production and distribution. WHO  
582 South-East Asia J Public Health 2013;2:106-12
- 583 20. Rao KD, Shahrawat R, Bhatnagar A. Composition and distribution of the health workforce in India:  
584 estimates based on data from the National Sample Survey. WHO South-East Asia J Public Health  
585 2016; 5(2): 133–140.
- 586 21. Anand S, Fan V. The health workforce in India. In: Human Resources for Health Observer Series  
587 No.16. World Health Organization. 2016 .  
588 [http://www.who.int/hrh/resources/16058health\\_workforce\\_India\\_pdf?ua=1](http://www.who.int/hrh/resources/16058health_workforce_India_pdf?ua=1) (Accessed 20 April  
589 2020).
- 590 22. Nair S, Percot M. Transcending Boundaries: Indian nurses in Internal and International Migration.  
591 Occasional Paper, New Delhi: Centre for Women’s Development Studies, 2007.
- 592 23. Garbayo A, Maben J. Internationally recruited nurses from India and the Philippines in the United  
593 Kingdom: the decision to emigrate. Human Resources for Health. 2009 ; 7 (37)
- 594 24. Gill R. Nursing Shortages in India: A Preliminary Study of Nursing Migration. Unpublished M.Phil  
595 dissertation, Center of Social Medicine and Community Health, School of Social Sciences,  
596 Jawaharlal Nehru University. 2009
- 597 25. Gill Reema. Nursing shortage in India with special reference to international migration of nurses.  
598 Social Medicine. 2011; 6(1): 52–59.

- 599 26. Gill R. Scarcity of Nurses in India: A Myth or Reality? Journal of Health Management. 2016;  
600 18(4):509-522. doi:[10.1177/0972063416665932](https://doi.org/10.1177/0972063416665932)
- 601 27. High Level Expert Group Report on Universal Health Coverage for India, Planning Commission of  
602 India, 2012.  
603 [https://niti.gov.in/planningcommission.gov.in/docs/reports/genrep/rep\\_uhc0812.pdf](https://niti.gov.in/planningcommission.gov.in/docs/reports/genrep/rep_uhc0812.pdf) (Accessed  
604 20 April 2020).
- 605 28. Mackintosh M , Channon A , Karan A , et al . What is the private sector? Understanding private  
606 provision in the health systems of low-income and middle-income countries. The Lancet  
607 2016;388:596–605. [https://doi.org/10.1016/S0140-6736\(16\)00342-1](https://doi.org/10.1016/S0140-6736(16)00342-1)
- 608 29. Ministry of Health and Family Welfare. Guidelines for Centrally Sponsored Schemes.  
609 Establishment of New Medical Colleges attached with existing District/Referral hospitals.  
610 Ministry of Health and Family Welfare, Government of India.  
611 <https://main.mohfw.gov.in/sites/default/files/42758936271446789560.pdf> (Accessed 25  
612 January 2021)
- 613 30. Central Bureau for Health Intelligence. Directorate General of Health Services, Ministry of Health  
614 and Family Welfare, Government of India. 2017.  
615 [http://www.cbhidghs.nic.in/E-Book%20HTML2017%20PART-I/files/assets/basic-html/page-](http://www.cbhidghs.nic.in/E-Book%20HTML2017%20PART-I/files/assets/basic-html/page-1.html)  
616 [1.html](http://www.cbhidghs.nic.in/E-Book%20HTML2017%20PART-I/files/assets/basic-html/page-1.html) (Accessed 20 April 2020).
- 617 31. National Health Workforce Accounts (NHWA), WHO Database, 2018.  
618 <https://apps.who.int/gho/data/node.country.country-IND?lang=en>
- 619 32. Periodic Labour Force Survey (PLFS) 2017-18, Ministry of Statistics and Program  
620 Implementation, Government of India. May 2019.  
621 <http://microdata.gov.in/nada43/index.php/catalog/146>

- 622 33. MOHFW: Population projections for India and states 2011 – 2036: Report of the technical group  
623 on population projections. New Delhi, National Commission on Population, Ministry of Health &  
624 Family Welfare. November, 2019.  
625 [https://nhm.gov.in/New\\_Updates\\_2018/Report\\_Population\\_Projection\\_2019.pdf](https://nhm.gov.in/New_Updates_2018/Report_Population_Projection_2019.pdf)
- 626 34. Ridoutt L, Cowles C, Madden L, Stewart G. Planned and Unplanned Futures for the Public Health  
627 Physician Workforce in Australia. Australasian Faculty of Public Health Medicine: Sydn. 2017
- 628 35. Mullan F. Doctors For the world: Indian physician emigration. Health Aff. 2006; **25**: 380–93.
- 629 36. Kaushik M, Jaiswal A, Shah N, Mahal A. High-end physician migration from India. Bull World Health  
630 Organ. 2008; **86**: 40–45.
- 631 37. Davids B. More bogus doctors slipping through. Independent Online (IOL) 2017; 25 May.
- 632 38. El-Saharty S, Sparkes SP, Barroy H, Ahsan KZ, Ahmed SM. The path to universal health coverage in  
633 Bangladesh: bridging the gap of human resources for health. The World Bank 2015; Washington  
634 DC.
- 635 39. Yuan L. Older Miao people and rural health policy in China: Barriers and Opportunities of Older  
636 Miao People under the new Rural Cooperative Medical Scheme. LAP Lambert Academic Publishing  
637 2012.
- 638 40. Y. Yang, M.S. Islam, J. Wang, Y. Li, X. Chen Traditional Chinese medicine in the treatment of  
639 patients infected with 2019-new coronavirus (SARS-CoV-2): a review and perspective Int J Biol Sci,  
640 16 (10) (2020), pp. 1708-1717. <https://dx.doi.org/10.7150%2Fijbs.45538>
- 641 41. P.L.T. Girija, Nithya Sivan, Ayurvedic treatment of COVID-19/SARS-CoV-2: A case report, Journal  
642 of Ayurveda and Integrative Medicine, 2020. <https://doi.org/10.1016/j.jaim.2020.06.001>.
- 643 42. Goyal M. Threats and challenges of emerging viral diseases and scope of Ayurveda in its  
644 prevention. AYU. 2019; 40: 67–68.

- 645 43. Public Health Foundation of India. From Paramedics to Allied Health Professionals: Landscaping  
646 the Journey and Way forward. National Initiative for Allied Health Sciences. A Report  
647 Commissioned by the Ministry of Health and Family Welfare. Government of India. New Delhi.  
648 2012.
- 649 44. Rural Health Statistics, Government of India Ministry of Health and Family Welfare Statistics  
650 Division, 2019.  
651 [https://main.mohfw.gov.in/sites/default/files/Final%20RHS%202018-19\\_0.pdf](https://main.mohfw.gov.in/sites/default/files/Final%20RHS%202018-19_0.pdf) (Accessed 20  
652 April 2020).
- 653 45. NSSO. *Social Consumption in India: Health*. NSSO 75<sup>th</sup> Round 2017-18. National Statistical  
654 Office, Ministry of Statistics and Programme implementation, Government of India. 2019
- 655 46. WHO, Regional Office for South-East Asia. Improving retention of health workers in rural and  
656 remote areas: Case studies from WHO South-East Asia Region. 2020, World Health  
657 Organization. Regional Office for South-East Asia.  
658 <https://apps.who.int/iris/handle/10665/334227>. (Accessed 30 September 2020  
659

## FIGURES

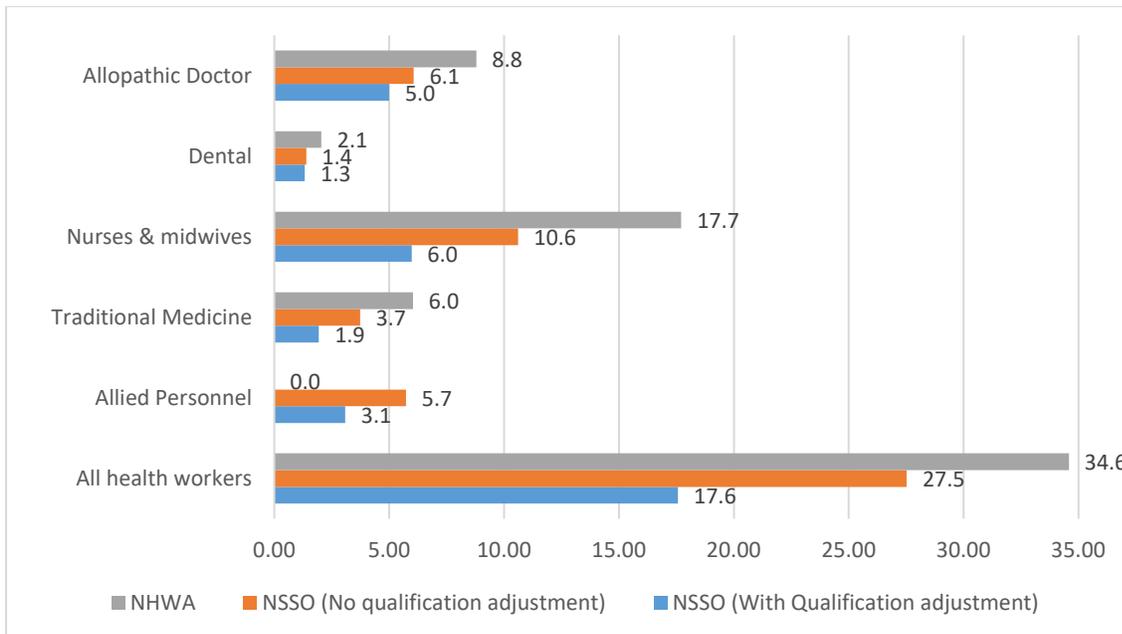


Figure 1: Number of health professionals/workers per 10,000 persons, 2018

Sources: Estimates from NHWA 2018 and NSSO 2017-18

Note: using population projection as of 1<sup>st</sup> January 2018 from Census of India 2011

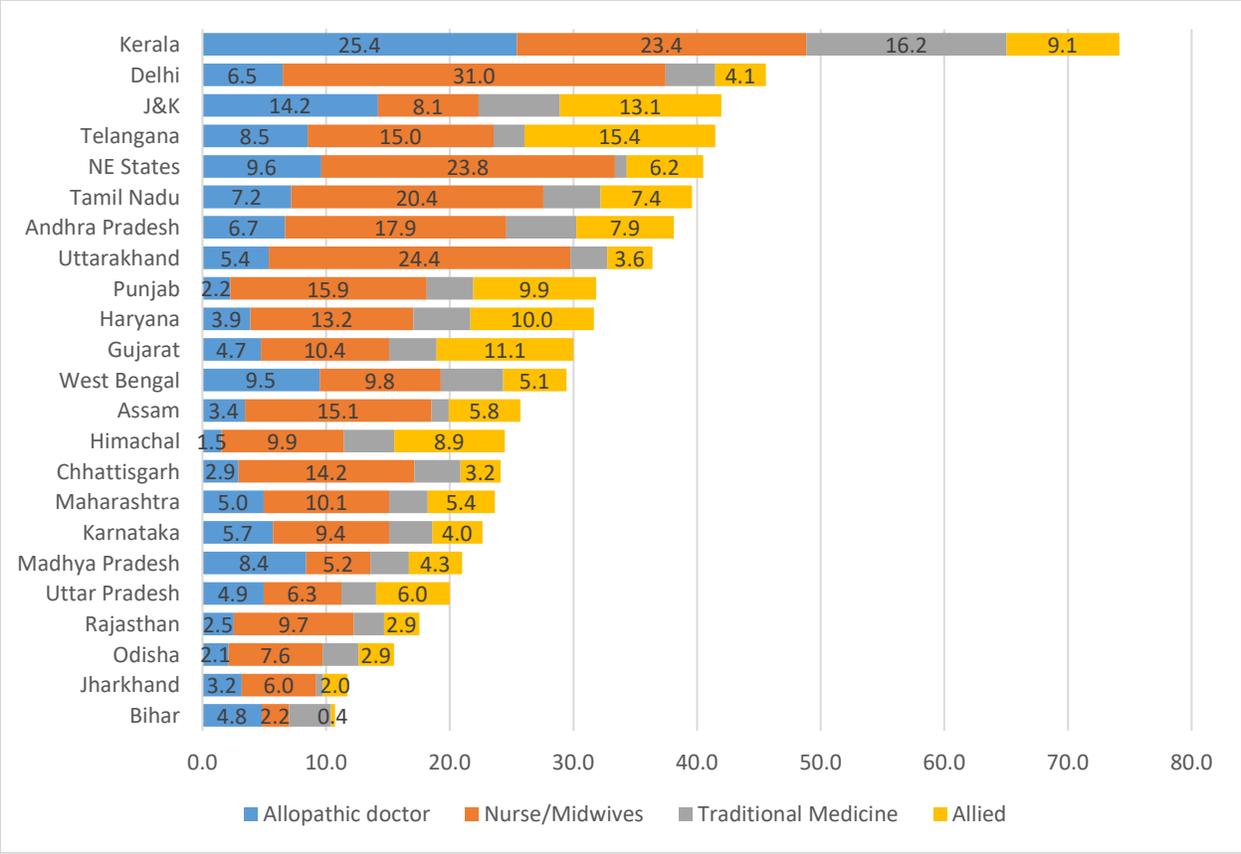


Figure 2. Density of health workers/professionals in states, 2018

Sources: Estimates from NSSO 2017-18

Note: using population projection as of 1<sup>st</sup> January 2018 from Census of India 2011

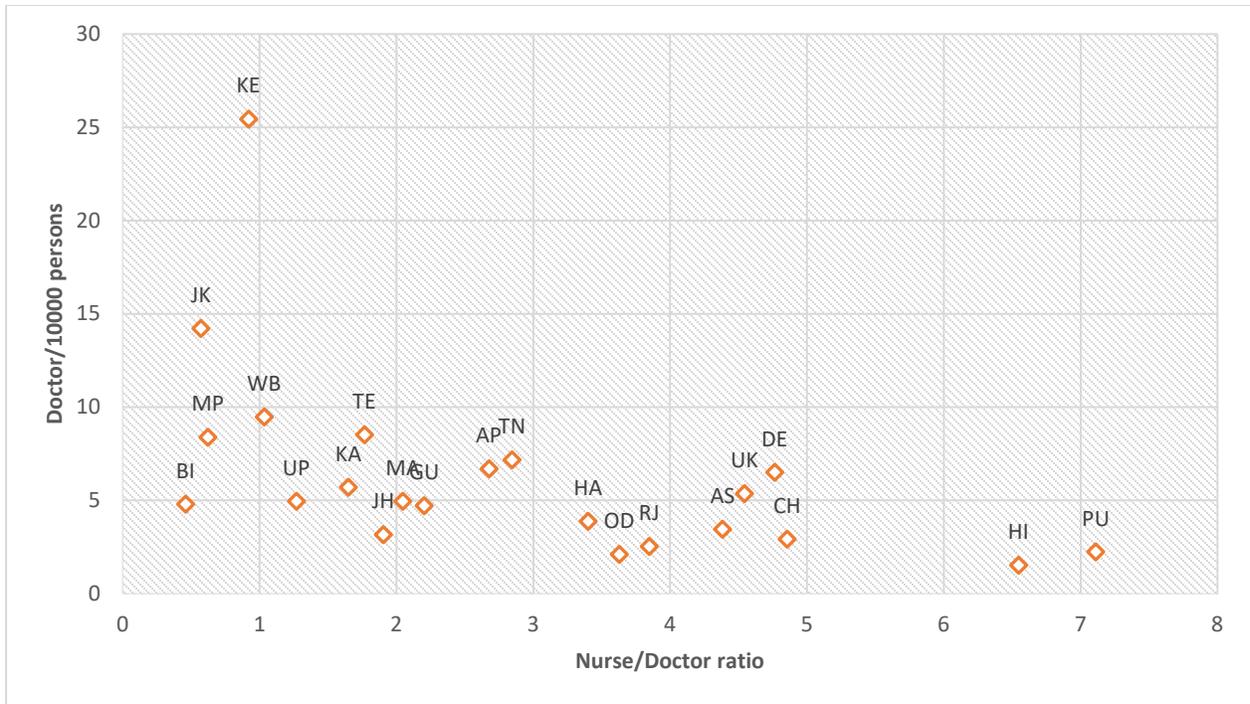


Figure 3: States with varied density of doctors and nurse/doctor ratio

Source: Sources: Estimates from NSSO 2017-18 and Census of India 2011.

Note: using population projection as of 1<sup>st</sup> January 2018 from Census of India 2011

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		

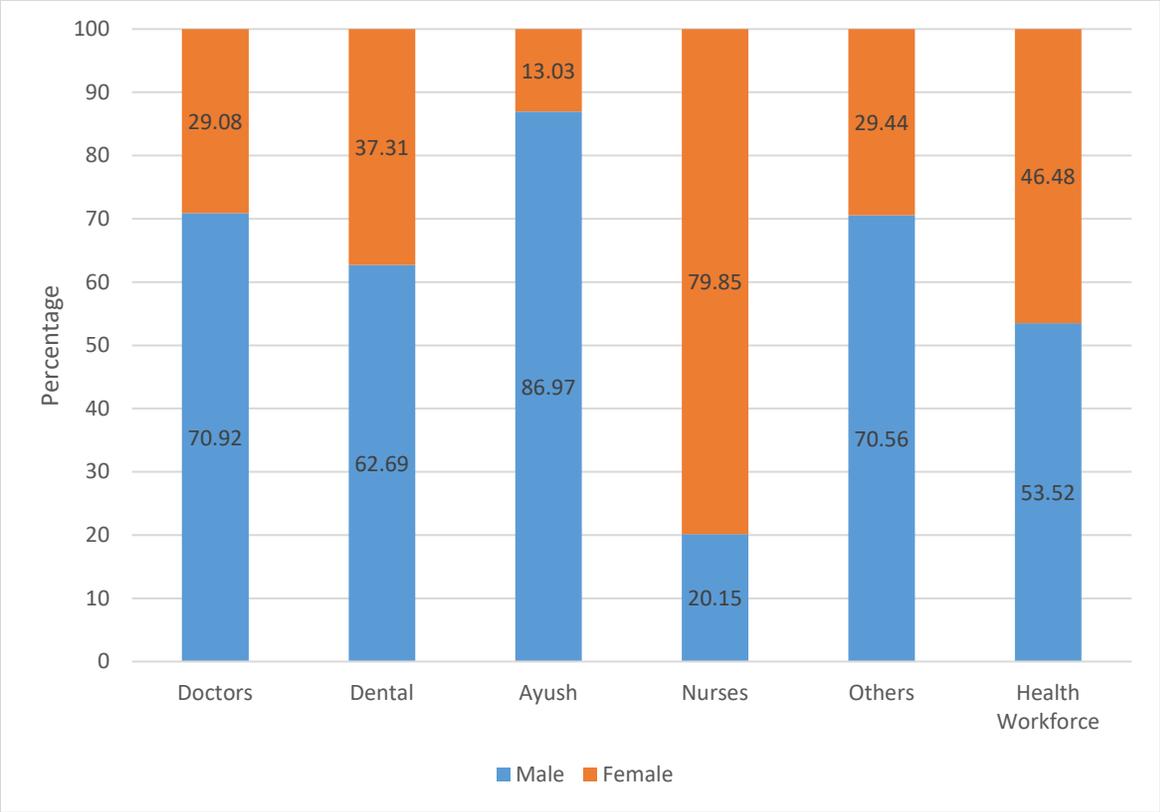


Figure 4. Gender distribution of HRH in India-2018

Source: Estimates from NSSO 2017-18

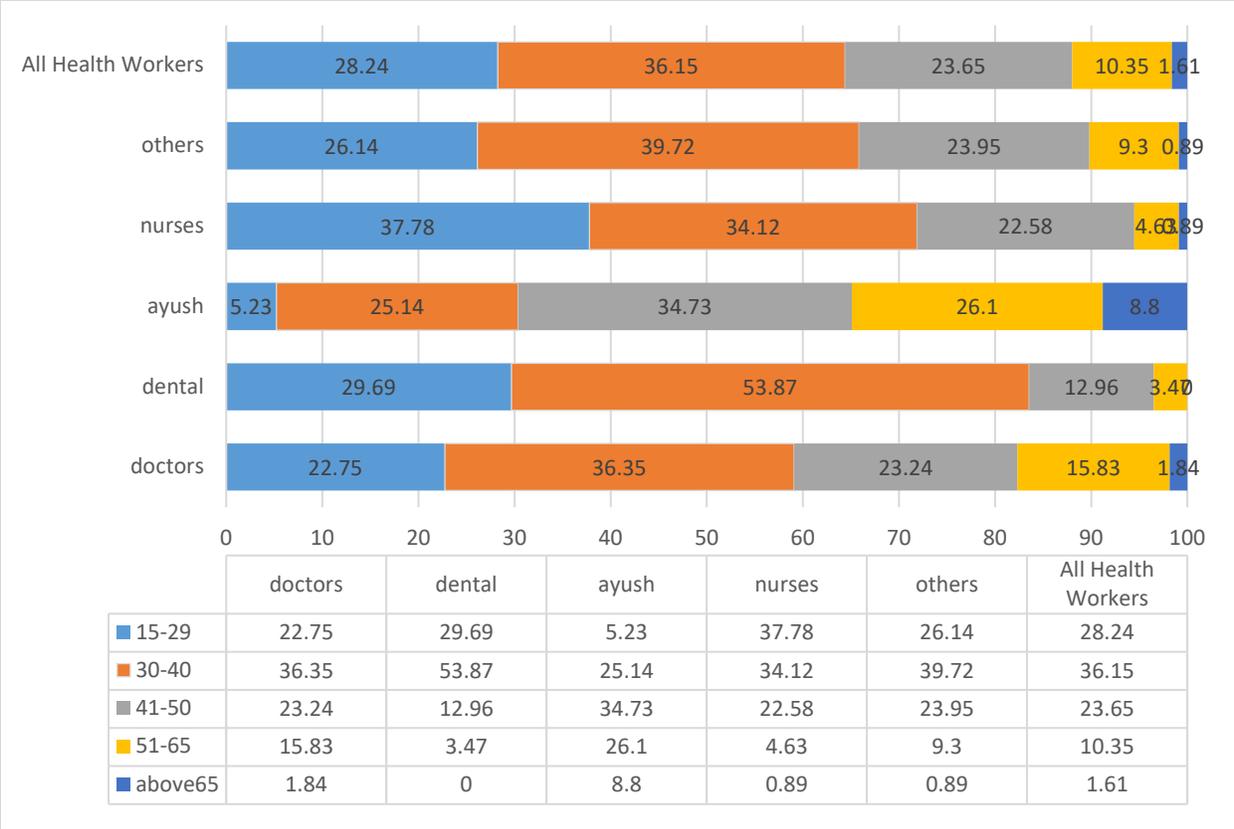


Figure 5. Age distribution of health workforce in India-2018

Source: Estimates from NSSO 2017-18

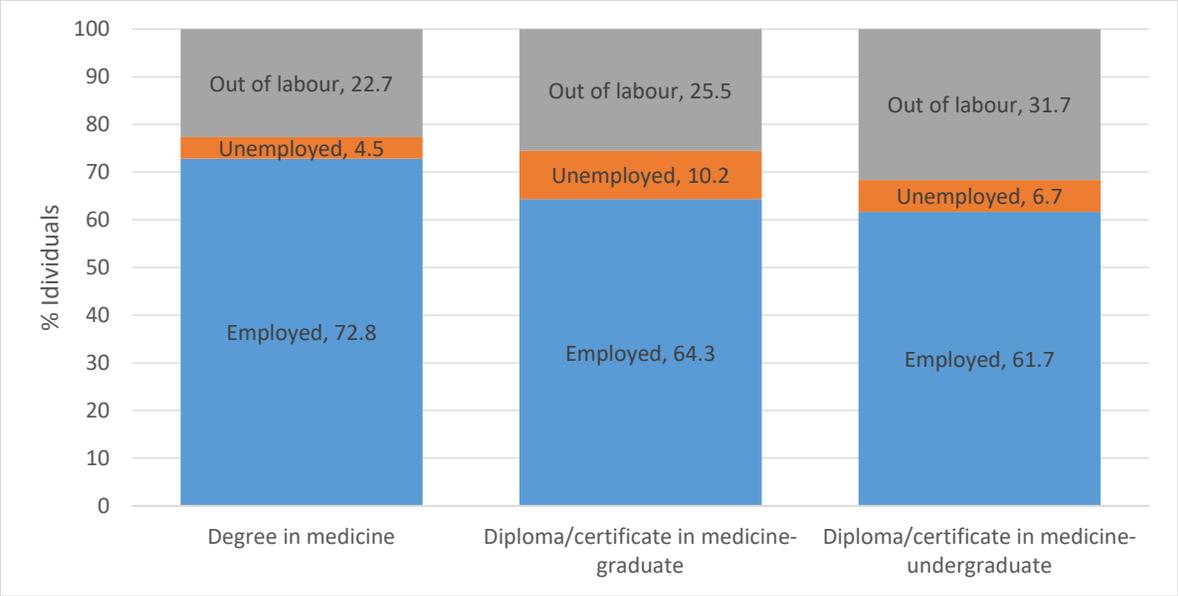


Figure 6: Percentage distribution of individuals with various levels of technical education in medicine as employed, unemployed and out of labour force, 2018  
 Source: Estimates from NSSO 2017-18

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 practitioner	graduates with a bachelor's or postgraduate degree in dentistry	Dental council of India
AYUSH practitioner	graduates with a bachelor's or postgraduate degree in Ayurveda, Unani, Siddha, or Homoeopathy	Department of AYUSH/ MoHFW
Nurse	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 nurse and midwife	a diploma in auxiliary nurse midwifery (2-year course).	Ministry of health and Family Welfare
Pharmacist	diploma or bachelor's degree course in pharmacy	Pharmacy council of India
Physiotherapist, diagnostic and others technician	diploma/certificate in medical allied fields	Indian Association of Physiotherapist and Ministry of health and Family Welfare

Sources: using information from CBHI 2019 and Councils of health professionals

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 doctor	1.16	0.80	0.66	72.7	60.0
Nurse/mid-wives	2.34	1.40	0.79	60.9	34.3
Pharmacist	1.19	0.25	0.21	21.0	17.6
Dentist	0.27	0.18	0.17	66.7	63.0
Traditional medicine professional/AYUSH	0.79	0.49	0.25	62.0	31.6
Health Associates/Allied*	N.A	0.75	0.40	N.A	N.A
overall	5.76	3.87	2.48	67.2	43.1

Sources: NHWA 2018; NSSO 2017-18 and Census of India 2011.

Note: \* includes health assistants, sanitarians, dietitians and nutritionists, optometrists and opticians, dental assistants, physiotherapy associates, pharmacist assistants, occupational therapist chiropodist, masseur etc.

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

State	NHWA		NSSO Estimates	
	Doctors	Nurses	Doctors	Nurses
Andhra Pradesh	9.09	12.38	4.33	6.64
Assam	2.16	1.68	1.46	3.66
Bihar	3.67	0.6	7.04	1.86
Chhattisgarh	0.79	0.88	1.04	2.88
Delhi	1.93	2.4	1.58	4.30
Gujarat	6.05	5.73	3.94	4.97
Haryana	0.52	1.9	1.37	2.66
Himachal	0.28	1.09	0.14	0.51
Jammu and Kashmir	1.36	0	2.38	0.78
Jharkhand	0.53	0.27	1.46	1.59
Karnataka	11.1	9.53	4.65	4.39
Kerala	5.36	10.22	11.10	5.85
Madhya Pradesh	3.45	5.28	8.48	3.02
Maharashtra	15.67	7.02	7.49	8.78
NE States*	0.39	1.34	1.88	2.66
Odisha	2.04	4.6	1.14	2.37
Punjab	4.37	3.33	0.83	3.37
Rajasthan	3.92	10.31	2.41	5.30
Tamil Nadu	12.24	11.73	6.74	10.99
Telangana	0.45	0.51	3.93	3.97
Uttar Pradesh	7.01	4.51	13.72	9.97
Uttarakhand	0.78	0.17	0.74	1.92
West Bengal	6.51	4.54	11.39	6.75
Union Territories	0	0	0.78	0.81

Note: \* includes north-east states of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura

Sources: NHWA 2018 and NSSO 2017-18

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

State	Nurse/Doctor		Traditional including AYUSH / doctor	Medicine / doctor	Allied Professional / doctor
	NSSO	NHWA	NSSO	NHWA	NSSO
Andhra Pradesh	2.7	3.7	0.8	0.2	1.2
Assam	4.4	2.1	0.4	0.1	1.7
Bihar	0.5	0.4	0.7	3.4	0.1
Chhattisgarh	4.9	3	1.3	0.6	1.1
Delhi	4.8	3.4	0.6	0.6	0.6
Gujarat	2.2	2.6	0.8	0.7	2.4
Haryana	3.4	9.9	1.2	2.5	2.6
Himachal Pradesh	6.5	10.7	2.7	3.8	5.9
Jammu and Kashmir	0.6	0	0.5	0.4	0.9
Jharkhand	1.9	1.4	0.2	0.1	0.6
Karnataka	1.7	2.3	0.6	0.4	0.7
Kerala	0.9	5.2	0.6	0.7	0.4
Madhya Pradesh	0.6	4.1	0.4	1.8	0.5
Maharashtra	2.0	1.2	0.6	0.9	1.1
Odisha	3.6	6.1	1.4	0.6	1.4
Punjab	7.1	2.1	1.7	0.3	4.4
Rajasthan	3.8	7.1	1.0	0.4	1.1
Tamil Nadu	2.8	2.6	0.6	0.1	1.0
Telangana	1.8	3.1	0.3	4.2	1.8
Uttar Pradesh	1.3	1.7	0.6	1.1	1.2
Uttarakhand	4.5	0.6	0.6	0.5	0.7
West Bengal	1.0	1.9	0.5	0.6	0.5
India	1.7	2.1	0.6	0.7	0.9

Sources: NHWA 2018 and NSSO 2017-18

Table 5: Projected skilled health workforce (2019 to 2030)

Year/ Forecast point	Population in billion (India)	Projected skilled health workforce (in million)			Projected skilled health workforce (in million)	Skilled health workforce needed to reach 25/10,000 (in million)	Gap (in million)
		Doctors (in million)	AYUSH (in million)	Nurses (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
2030/ Forecast end-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