CSEP Working Paper-55
July 2023

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MEDICAL EDUCATION IN INDIA

A STUDY OF SUPPLY-SIDE DYNAMICS

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Recommended citation: Agarwal, A., Balani, K., and Venkateswaran S. (2023). *Medical Education in India: A Study of Supply-side Dynamics* (CSEP Working Paper 55). New Delhi: Centre for Social and Economic Progress.

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MEDICAL EDUCATION IN INDIA

A STUDY OF SUPPLY-SIDE DYNAMICS

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The authors thank Amarjeet Sinha, Dr Ashwani Aggarwal, Dr Girija Vaidyanathan, and Dr Rakesh Mohan for their valuable comments on previous drafts of this paper. The authors also thank Professor Avinash Supe for his insights on the medical education system in the country.

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List of Abbreviations

AIIMS	All India Institute of Medical Sciences
AISHE	All India Survey of Higher Education
ALIs	AIIMS-like Institutions
CBHI	Central Bureau of Health Intelligence
CHC	Community Health Centre
CPS	College of Physicians and Surgeons
DALY	Disability-adjusted Life Years
DNB	Diplomate of National Board
EAG	Empowered Action Group
GSDP	Gross State Domestic Product
IGNOU	Indira Gandhi National Open University
MBBS	Bachelor of Medicine, Bachelor of Surgery
MCI	Medical Council of India
MoHFW	Ministry of Health and Family Welfare
NBEMS	National Board of Examinations
NCD	Non-communicable Diseases
NMC	National Medical Commission
NSSO	National Sample Survey Office
PG	Postgraduate
PGDCC	Postgraduate Diploma in Clinical Cardiology
UG	Undergraduate
UGC	University Grants Commission
UHC	Universal Health Coverage

Abstract

India's health system faces considerable challenges in the provision of health provision. Like in many other countries, health workforce gaps are a particular contributor to this issue shortage of doctors, skewed distribution, and mismatch in skills, all result in a system that is often provisioning below par. Recognising the demand–supply gaps in medical education, attempts have been made to increase the medical seat capacity, with public medical colleges leading the bulk of the seat capacity expansion, and infrastructure requirements for setting up medical colleges have also been relaxed.

While policy initiatives have led to an increase in the number of medical colleges and seats, yet gaps between demand and supply remain. India has the largest number of medical colleges in the world, but the number of medical graduates per 100,000 population is 4.1, which is among the lowest in the world. Despite the explicit focus on increasing the penetration of doctors in under-served regions, the bulk of seat capacity expansion has taken place in only a few, mostly developed states. In underserved areas where colleges have been developed, unaddressed structural issues have led to intra-country migration, which continues to skew the distribution of doctors. Teaching faculty shortfall (despite attempts to augment the teaching pool), continuing requirements for setting up and running medical colleges, and the unattractive economics of setting up medical colleges, have emerged as key barriers to scaling medical colleges. To counter this, the focus has largely been on relaxing the existing student intake norms, and augmenting physical infrastructure. However, adequate attention has not been given to addressing crucial economic barriers, and the structural barrier of faculty shortage, which remain critical impediments.

Amongst the supply gaps, the shortage of specialists is particularly acute. This is a matter of concern, considering that the disease burden associated with six of the top ten causes of deaths in India require the attention of specialist doctors as well. Select states have attempted to address this shortage by promoting alternative routes to specialisation (e.g., DNB, CPS), but a lack of uniform recognition across states and by the National Medical Commission has affected the uptake of these courses and, in turn, the availability of specialists.

The paper argues for a rethink of the existing regulatory and policy requirements pertaining to setting up and, more importantly, scaling up medical colleges, in order to ensure a greater number of seats per college, and for a more equitable distribution of seats. The paper simultaneously highlights the need to address the structural aspects that lead to the gaps between production and availability of doctors. It makes a case for addressing the teaching staff shortfall by targeting the core issue of the high financial opportunity cost of giving up full-time practice. The current policy focus on reforms like increasing the retirement age and allowing visiting faculty, bypass this core concern and provide only short-term solutions to this structural problem. The analysis emphasises the need for the optimal utilisation of the existing workforce through greater task shifting between specialists and general practitioners, and a stronger referral-based integrated system that enables better utilisation of scarce specialist resources. The analysis also brings forth the lacunae in India's existing data collection systems, thereby necessitating more systematic mechanisms for data collection and dissemination.

Summary of Key Fin dings

Availability of doctors

- There has been an overall improvement in the availability of doctors over the past decade, with India's reported doctor-population ratio being 0.9 per 1,000 population in 2019, in comparison with 0.66 in 2010. After adjusting for double counting, lack of updated data and non-practising doctors, the effective ratio stands at an estimated 0.6–0.7 per 1,000.
- However, distributional inequalities in the availability of doctors remain, with the 2019 doctor-population ratio being 2.5 per 1,000 for Goa, and 0.06 per 1,000 for Nagaland. Much of the increase in the overall availability of doctors has been contributed to by a limited number of states.
- The state-wise availability of doctors is influenced by state-specific incentives and disincentives. Lack of uniformity of government college fees and bond conditions have implications for inter-state migration of doctors, which is, currently a bigger policy concern given the ongoing challenges of distributional inequities in the workforce.
- The weak association between state public health expenditure and the supply of doctors, as well as between the level of medical education infrastructure and doctor supply suggests that the mere development of infrastructure and production of doctors is not the key driver of supply. Rather, states' per capita incomes, state-specific policies, and incentives for retention play a significant role.
- Over the last decade (2010-2021), the migration of Indian doctors to developed countries has seen a declining trend. The inflow of doctors has outpaced the outflow, with the impact of migration on the availability of doctors being net-positive.

Availability of specialists

- The supply of specialists remains scarce in the country. Data on their availability in community health centres (CHCs) suggests that the shortfall of specialists has widened considerably between 2005 and 2022, from 46% to 80%.
- The extent of the shortage of specialists in rural areas has widened over the past decade, with the vacancy rate for specialists' positions increasing from 47% in 2005 to 68% in 2022.
- The demand for specialists is likely to increase as six of the current top ten causes of death in India require the attention of specialists as well.

Availability of medical colleges and seats

- Over the last decade, there has been a large increase in the availability of both seats and medical colleges, most of which have been led by government medical colleges.
- The number of medical colleges increased from 335 in 2010–11 to 612 in 2022–23, whereas the number of MBBS seats increased from 40,775 to 92,127 over the same period.
- The increase in medical seats has varied across private and public medical colleges, and across different states. For each year between 2010–11 and 2020, the number of private seats was higher than that of public seats at the undergraduate (UG) level. Efforts to address this disparity led to the addition of a large number of public medical colleges and, consequently, medical seats in 2020.

- The sub-national distribution of MBBS seats did not change much, with almost half of the total seats in the country being concentrated in the developed southern and western states (Uttar Pradesh is the only less-developed state that saw a large increase in seats).
- Despite the overall increase in seats, there exists a wide gap between students who have qualified for the National Eligibility cum Entrance Test (NEET) UG exam and those who have managed to secure a seat: less than 15% of those who qualify secure a seat.
- There has been an improvement in the overall availability of postgraduate (PG) seats, largely led by the government institutions.
- Despite the shortages, there are vacancies in seats at the PG level. This suggests a possible mismatch between the demand and supply of seats within specialisations. The increase in PG seats has been partly led by the increase in seats in those specialities, that have been historically characterised by low demand. The key constraints with regard to the expansion of high-demand specialities - availability of beds and faculty, persist, thereby widening the gap between the need for and production of specialists. This is an area that requires special policy attention.
- The PG to UG seat ratio in India is lower than that of other countries; this figure is 0.67, as compared with 1.85 in the United States (US), 1.01 in China and 5.98 in the United Kingdom (UK).
- India's PG to UG ratio of less than one, and the inability to make rapid strides in this aspect explains one of the key barriers on the input side, which results in the shortage of specialists in the country.
- The PG to UG ratio of public and private medical colleges is skewed, with the public sector disproportionately contributing to PG seat expansion. The adverse PG to UG ratio in general, and particularly in the case of the private sector, points to the need for attention to the current incentive structure, in order to encourage greater private sector participation.
- India has the largest number of medical colleges in the world, but its number of seats per college is lower than that of comparable developing countries. India's annual output of graduates per medical college is 151, as compared with 220 in Eastern Europe and 930 in China. Greater attention needs to be directed towards the output of medical colleges in India.

Challenges of the teaching faculty

- Even as the government has made rapid strides to augment the physical capacity of medical institutions, teaching faculty and other support staff shortages persist in both older and newly created medical institutions, especially in the All India Institute of Medical Sciences (AIIMS). Of the 18 functional AIIMS, as many as 11 have a more than 40% shortage of teaching faculty, skewing the teacher-student ratio to as high as 1:5.4, against the norms of 1:2 and 1:3
- There has been a reduction in the number of sanctioned teaching posts, coupled with an increase in the vacancy rate. Several of the AIIMS institutions established seven to 13 years ago still have large vacancies that persist. Vacancies are higher in public institutions compared with their private counterparts. The shortage of faculty has been accompanied by higher student-teacher ratios in the newly created AIIMS-like institutions as well, overburdening the existing resources.

Government initiatives to address the shortage of medical colleges

- Several government measures have been initiated to address the above challenges, thereby reducing concerns pertaining to the overall shortage of doctors. However, these initiatives have been less effective in addressing the supply disparities across states, and rural–urban areas.

- Past and ongoing measures have involved increasing the number of public and private medical colleges, upgradation of central/state government medical colleges to increase the number of MBBS seats, revision of infrastructure requirements pertaining to land, staff, bed strength, equipment and other related infrastructure, permitting the sharing of teaching space across departments, augmenting seat capacity in public colleges by revising the maximum intake capacity at the MBBS level from 150 to 250, and rationalising the student-teacher ratio and bed requirements.

- Measures have also been introduced to address the shortage of specialists, including the introduction of alternate PG-level courses and the rationalisation of the teacher-student ratio.

- As efforts towards augmenting the pool of specialists continue, an area of policy attention is optimising the current specialists' health workforce by enabling them to attend to tasks that only they can address. This can be done through both shifting of tasks across the workforce and through systems designed to gatekeep, with the aim of reducing the unnecessary load on specialists.

- The expansion in seat capacity has largely been driven by the relaxation in teacher-student ratio norms and other norms for the operation of medical colleges, particularly at the PG level. However, the teaching faculty shortage continue to persist, despite the relaxation of the norms permitting individuals with a diploma degree to teach, increasing the retirement age, etc. However, the key structural barrier of the disincentives of moving from medical practice to teaching has not been addressed adequately such that the trade-offs are not as unfavourable as they currently are.

- The data system on the registration of doctors remains weak; double counting occurs since all states require registration with their respective medical councils, and this data is not updated. There are government initiatives to collect data on doctors, but this data has not yet been made available in the public domain in its complete form.

- The absence of a comprehensive database in the public domain, pertaining to private hospitals in general and private medical colleges in particular, has also been a hurdle in the detailed assessment of the availability of specialists.

1. Background

The shortage of human resources in the health sector has been a concern since pre-Independence days. However, even 75 years after Independence, India's doctor-population ratio in India stands at 0.9 per 1,000 (CBHI, 2021), with substantial inter-state differences (ranging from 0.06 to 2.5 per 1000). After accounting for double counting,[1] out-migration of doctors and the lack of timely updating of medical registries, the effective active number of doctors per 1,000 population ranges from 0.6 (Karan et al, 2021) to 0.7.[2] This is much lower than the World Health Organization (WHO) recommended norm of one doctor per 1,000 population.[3] Within the overall shortage, of particular concern is the shortage of specialists, which is further aggravated by the increasing burden of non-communicable diseases (NCDs) and the ageing population (Dandona et al, 2017). In 2021, the population over 60 years of age constituted 10% of the country's total population (NSO, 2021). Today, the disease burden associated with six of the top ten causes of death in India require the attention of specialist doctors as well (GoI, 2017). These gaps have caused substantial delays in providing treatment. In select instances, the wait time for brain and heart surgeries has been as high as three to four years in AIIMS Delhi, which is the premier tertiary care institute in the country (Dutt, 2017; Jha, 2022).

There are several reasons for the health workforce shortage; the key amongst these relate to India's medical education system, which serves as the pipeline for doctors. The gaps between the demand and supply of seats in medical education institutions, financing architecture that disincentivises the equitable distribution of the health workforce, and quality of medical education, all combine to create challenges within the medical education system and, consequently, in the production of medical doctors.

Recognising the challenges in the education system, several government initiatives have been launched over the last few years to reform the same, and improve the supply and distribution of doctors. In 2003, the Government of India (GoI) announced the Pradhan Mantri Swasthya Suraksha Yojana (PMSSY),[4] with a focus on building new AIIMS-like institutions (ALIs) in each state. Therefore, the policy focus of this scheme and other related centrally sponsored schemes has largely been on augmenting physical infrastructure through an increase in the number of seats and medical colleges, even as the shortage of requisite human capital for the optimal functioning of these institutes persists.

The impact of the current structure of the medical education system and state-level policies on the future supply and distribution of doctors has received limited attention in the literature. This paper reviews the medical education system, with a view to examine the constraints on the supply and distribution of allopathic doctors in the country. It acknowledges the policy interventions undertaken and progress made, and also identifies the existing gaps with respect to the policy focus, data avaialbility and structural issues. While the shortage in the medical workforce includes that of doctors, nurses and paramedical personnel, this paper limits its focus to the shortage of allopathic doctors and specialists. Specifically, the paper attempts to address the following specific questions:

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[1] A doctor can be registered with multiple state medical councils, as they migrate from one state to another, with registrations with both the previous and current state remaining active. This results in an inflated estimate of the number of active doctors.

[2] The standard assumption held by the MoHFW is that only 80% of the registered doctors in the country are part of the active workforce (GoI, 2022a). Karan et al's (2021) estimates peg the actual availability of doctors at lower than 80% based on analysis of National Health Workforce Account (2018) and NSSO's Periodic Labour Force Survey 2017-18.

[3] Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) doctors are not included in this analysis. There were 6.4 lakh AYUSH doctors in the country in 2019, according to the National Health Profile, 2021. Assuming that 80% of the workforce is active, the 2019 doctor-population ratio, inclusive of AYUSH doctors, stands at 1.1:1000. Interestingly, the origin of the 1:1,000 doctor-population norm was not traceable to any single document or mission statement.

[4] While the scheme was launched in 2006, it was announced in 2003.

1. What is the availability of medical doctors by state, and what are the factors driving the same?
2. What are the demand–supply dynamics of MBBS doctors and specialists?
3. What have been the impacts of reforms in the medical education system to date on the production and distribution of doctors?
4. What are the "missing links" in the current policy discourse to address the shortage of specialist doctors, in particular?
5. What are some successful global practices that can inform thinking in the Indian context?

This paper is divided into five sections. Section 2 briefly discusses the availability of data and sources for the same. Section 3 considers the current scenario in terms of availability and production of doctors and discusses trends in growth and geographical differences. It examines differentials across public and private sector, as well as the growing role of the public sector, and explores key challenges beyond infrastructure and seats, such as teaching faculty shortages. It focuses specifically on the availability of specialists and finds that the challenges here are similar, but with a higher degree of severity. Section 4 highlights some relevant global experiences, and Section 5 concludes by summarising the key findings and outlining the way forward.

2. Data and Methods

This study employs both primary and secondary data collection. Data pertaining to seats and medical colleges have been sourced from IndiaStat and Centre for Monitoring Indian Economy (CMIE) States of India. The data on the number of outstanding and newly added doctors and dental surgeons has been sourced from the National Health Profile (CBHI, 2021) and Health Information of India (CBHI, 2005) released over different years. The data presented as part of the Lok Sabha Question & Answers has been another source of information. The data for international comparison has largely been sourced from the Organisation for Economic Co-operation and Development (OECD) Health Statistics.

Secondary data was complemented with primary data, largely through interviews with key informants such as teachers in medical colleges, academic researchers, and government officials. The qualitative insights informed the better interpretation of secondary data and facilitated the identification of the most appropriate benchmarks to analyse the functioning of the Indian education system vis-à-vis OECD countries and other comparable emerging economies.

3. Results

3.1 Availability of Allopathic Doctors by State and Drivers of this Availability

As mentioned above, India's doctor-population ratio is at 0.9 per 1,000, adjusted to approximately 0.6 to 0.7 per 1000, after taking into consideration data and other challenges, with wide variance across states (See Table 1). The differences in the number of registered doctors are not only a reflection of the actual supply, but also the differences in the requirements of state medical councils and the quality of data reporting with respect to registration. Delhi, for instance, mandates that all doctors completing their MBBS degree in Delhi be registered with the Delhi Medical Council, resulting in an inflated number[5] with respect to the total supply of doctors. At the all-India level, the National Medical Register maintained by the National Medical Commission (NMC) may include

[5] A medical student in Delhi might register with Delhi Medical Council, because its mandatory for every student to do so, even though he may choose to practice in some other state and then register with their respective state medical council as well.

duplications, as there are instances of doctors being registered with multiple state governments. Additionally, the database is not updated regularly to reflect those who have left the country or are not actively practising. The registry has data on doctors registered till 2021, except for states like Karnataka, Arunachal Pradesh, and Delhi that have added data for subsequent years as well.

In May 2023, the NMC announced that every doctor in the country would be assigned a unique identification number (UID), and was mandatorily expected to register or apply for renewal of licenses in the next 90 days for the same (NMC, 2023). This would be valid for five years, following which doctors are expected to renew their licenses and update their information in the portal once again. This will enable better tracking of the actual availability of doctors in the country, both at the all-India and state levels and also across public and private sectors. It will also enable the tracking of unqualified practitioners and doctors whose licenses have been suspended by state medical councils.

The doctor-population ratio has improved since 1980, from 0.4 per 1,000 population in 1980 to 0.9 per 1,000 in 2019, with the rate of expansion being highest between 2010 and 2019, at 1.39x. We also observe that China, during the same time period, had a much higher rate of expansion (1.12x – 1.56x), starting with a higher base than India in 1980 (0.7 doctors per 1,000 population in China vs 0.4 doctors per 1,000 in India 1980).

It is important to note that the effective doctor-population ratio, accounting for multiple registrations[6] and an "active workforce," translates into approximately 0.74 doctors per 1,000 population. There are significant inter-state differences (see Table 1) in the availability of doctors (and active doctors) ranging from 2.53 per 1,000 (~2.02 per 1,000) in Goa to 0.06 per 1,000 in Nagaland (~0.05 per 1,000)[7]. The pace of expansion over the last 40 years has been uneven. Some states like Andhra Pradesh and Kerala have reported an expansion in their doctor-population ratio of 4.32 times and 4.2 times, respectively, against the all-India average expansion rate of 2.3 times. Similarly, starting from a low base, we see that the state of Madhya Pradesh improved its doctor-population ratio by 6.9 times during the same time period, which is a significant improvement in comparison to its empowered action group (EAG) counterparts (See Table A.5 in the Appendix). Seventeen of 28 states have still not achieved the WHO doctor-population recommended ratio of 1:1000. Our analysis further suggests that given the rate of expansion of the previous decade (compound annual growth rate [CAGR] of doctor-population ratio between 2010–19), and assuming that a similar rate of expansion continues, states like Bihar will take about 224 years to reach the 1:1,000 doctor-population ratio, whereas Uttar Pradesh will take about 48 years, and Jharkhand will take approximately 31 years. At the all-India level, at the current rate, we are 2.3 years away from achieving the WHO norm of 1:1,000 (we are only considering allopathic doctors here, and have excluded dental surgeons and AYUSH doctors). This is based on the reported doctor-population ratio of 0.9. Considering the assumption of 80% actual availability of doctors in 2010 (0.53 per 1,000) and 2019 (0.74 per 1,000), it will take India nine years to reach the 1:1000 doctor-population norm.

[6] Doctors have to apply for a fresh registration with their respective state government's medical council each time they migrate.

[7] We report both the doctor–population ratio based on actual available numbers, and the ratio we calculate assuming availability of 80% workforce (mentioned in parenthesis).

Table 1. State-wise doctor-population ratio for 2019

State	Doctor-population Ratio per 1,000 (2019)	Need-Availability gap	Rate of expansion 2010–2019 (CAGR in %)	Number of years to reach the 1:1,000 norm	Real per capita GSDP (2018–19) (in Rs)
Goa	2.53	NA	2.60	NA	345,462
Sikkim#	2.13	NA	7.77	NA	282,197
Karnataka	1.92	NA	2.82	NA	165,083
Tamil Nadu	1.91	NA	6.13	NA	159,457
Kerala	1.87	NA	4.51	NA	159,879
Andhra Pradesh	1.77	NA	8.42	NA	122,050
Punjab	1.70	NA	1.69	NA	129,660
Maharashtra	1.50	NA	1.88	NA	162,147
NCT of Delhi	1.26	NA	11.88	NA	287,610
Jammu & Kashmir	1.15	NA	2.23	NA	85,529
Gujarat	1.03	NA	2.57	NA	177,141
Uttarakhand	0.8	0.2	8.91	2.6	167,824
Arunachal Pradesh	0.78	0.22	12.14	2.2	111,429
West Bengal	0.76	0.24	1.52	17.8	76,468
Assam	0.70	0.3	1.19	30	67,680
Rajasthan	0.60	0.4	3.41	15.3	83,667
Odisha	0.55	0.45	3.11	19.5	86,209
Haryana	0.51	0.49	8.93	8	185,837
Madhya Pradesh	0.49	0.51	2.70	26.9	66,446
Tripura@	0.49	0.51	34.54	2.4	92,509
Himachal Pradesh	0.43	0.57	12.43	7.1	159,905
Bihar	0.38	0.62	0.43	224.5	32,109
Uttar Pradesh	0.37	0.63	2.12	47.8	48,942
Chhattisgarh	0.33	0.67	9.94	11.6	82,413
Telangana	0.21	0.79	NA	NA	164,021
Jharkhand	0.18	0.82	5.79	30.8	61,666
Mizoram*@	0.08	0.92	82.63	4.2	135,754
Nagaland@	0.06	0.94	57.96	6.1	78,674
India	0.92	0.08	3.39	2.3	105,448

Note: The numbers reported here are based on actual reported numbers, and no adjustments are made to reflect the active workforce. The numbers based on the active workforce are reported in the Appendix (See Table A.1 in Appendix).

@The first data entry for Tripura, Mizoram and Nagaland was made in 2012, 2015 and 2014, respectively and CAGR has been adjusted accordingly to reflect that start date.

Source: CBHI (2021), CMIE States of India

In the analysis of factors influencing the availability of doctors, the role of state policies stands out. At the national level, migration—both in and out—has been an influencing factor. Even as the inflow of doctors has outpaced the outflow in recent times (NBEMS, 2021), the out-migration of the high-quality workforce has prevented internalising of the potential externalities for research and teaching output in the country. Between 1989 and 2000, 54% of graduates from AIIMS Delhi, which is India's premier medical college, migrated abroad; students belonging to the general category (unreserved, open merit students) were twice as likely to migrate than others (Kaushik et al, 2008a). Similarly, medical graduates from high-ranking medical colleges were twice as likely to emigrate to the UK and US than those from lower-ranking medical colleges (Kaushik et al, 2008b). In recent years, however, tighter immigration and visa regulations have reduced the outflow of Indian graduates to the UK, especially since 2005 (Potnuru and Khadria, 2018). Most recently, the inflow of Indian students trained in Chinese universities back to the country has received attention. Nundy and Baru (2019) discuss the issues faced by Indian students moving to China for undergraduate (UG) education and the confusion caused by constant changes in the Foreign Medical Graduate Examination guidelines.

Over the last decade, the inflow and yearly production of doctors has been higher than the outflow, a clear reversal from previous outflows during the 2000–10 period (See Table 2 and Figure 4). Over the last decade, American medical graduates trained abroad have replaced Indian graduates entering the US. The number of Indian graduates certified by the Educational Commission for Foreign Medical Graduates to enter PG training in the US has reduced from its peak of 27% of the total foreign-trained doctors' pool in 2007, to 11% in 2017 (Lafortune et al, 2019). During the same period, this figure increased from 17% to about 32% for US graduates (Lafortune et al, 2019).

Hence, though there has been a systematic loss of highly qualified doctors from premier educational institutes in the country, which has affected the research output and general pedigree of medical education in the country, recent statistics suggest that at an aggregate level, India has managed to reverse this brain drain. This has been a result of both, the push (changes in the recruitment strategy in the UK[8] and US[9]) as well as pull factors (increased income and private investments in medical research in India), operating to varying degrees.

At the state level, various factors were analysed. The relationship between a state's economic development and the availability of doctors appears to be linear (Figure 1). The hilly states and the remote north-eastern states, however, have a relatively low density of doctors despite their high per capita income. There exists virtually no relationship between public health expenditure (per capita) and the availability of doctors (Figure 2). Even the relationship between the specific budget head of Medical Education, Training and Research and the availability of doctors, while stronger than the relationship with public health expenditure, is still fairly weak (See Figure 3). This has partly to do with the complexities of the accounting practices, whereby tertiary hospitals are included in the broad budget head of Medical Education, and later on some of these tertiary hospitals have been converted into medical colleges. The funding received from Centre for setting up colleges is not always reflected in the state health budget.

The relationship between the availability of seats and that of doctors in a state appears to be strong. This is especially true in the case of government medical colleges (See Figure 5), where concerted investments in local production of seats have translated into increased availability of doctors. The presence of this strong relationship is mediated by the structure of the medical education system,

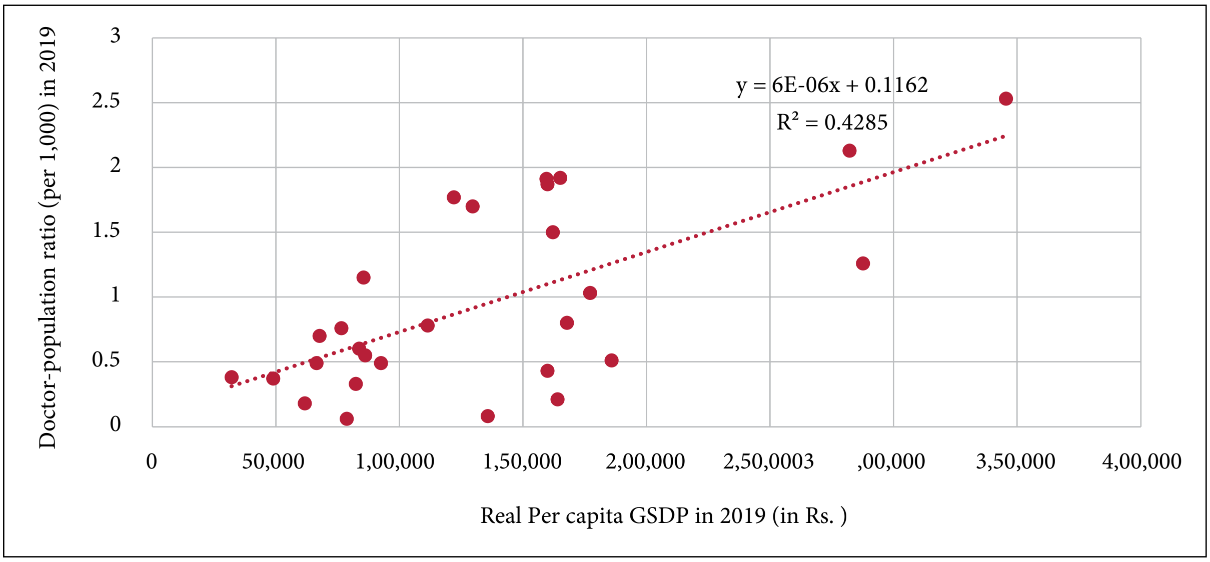
8 An increasingly restrictive visa regime for doctors moving to the UK since the early 2010s, perceived bias in the Britain medical examination system, and implementation of the Resident Labour Market test which explicitly preferred the existing permanent residents of the UK, had made migration more unattractive over the years (Khanna, 2016; PTI, 2016; PTI, 2014).

9 Doctors from other countries who have come to the US on J-1 visa are required to return to their country of origin for a duration of two years after completion of their residency before they can return and apply for another visa. Only a select few are able to circumvent this two-year return condition, provided they practise in rural and under-served areas for a stipulated period of time.

where the state quota in the public medical colleges means that 85% of the total seats UG level are available to the residents of that state. Similarly, the bond conditions in most of the states, which necessitate compulsory service in government hospitals for a fixed duration after graduation ensures a steady flow of doctors in these states. The duration of the bond is unique to each state, revealing that the state-specific policies and availability of other related infrastructure play a role in influencing the supply of doctors. Several state governments have also incentivised service in rural and remote areas by preferential reservation for doctors working in rural areas in the state quota of the PG seats, but the decision has been met with opposition from the larger pool of aspirants (Hemant, 2022b).

The relationship between the overall seats (government and private) and overall availability of doctors is relatively less strong (See Figure 6), as private medical colleges do not have to honour similar bonds as their public medical college counterparts, even though the former have state-quota reservations at the time of admission. The provision of state quota is only applicable to private medical colleges, and not to deemed universities, which means that the latter can fill their seats by accepting aspirants from all over India. Thus, the incentive structures have a potential role to play, based on the uneven pace of increase in the supply of doctors between 1980–2019, reflecting state-wise differences in incentive structures, public-private mix of colleges, college fees and bond conditions (See Table A.13 and A.14 in Appendix).

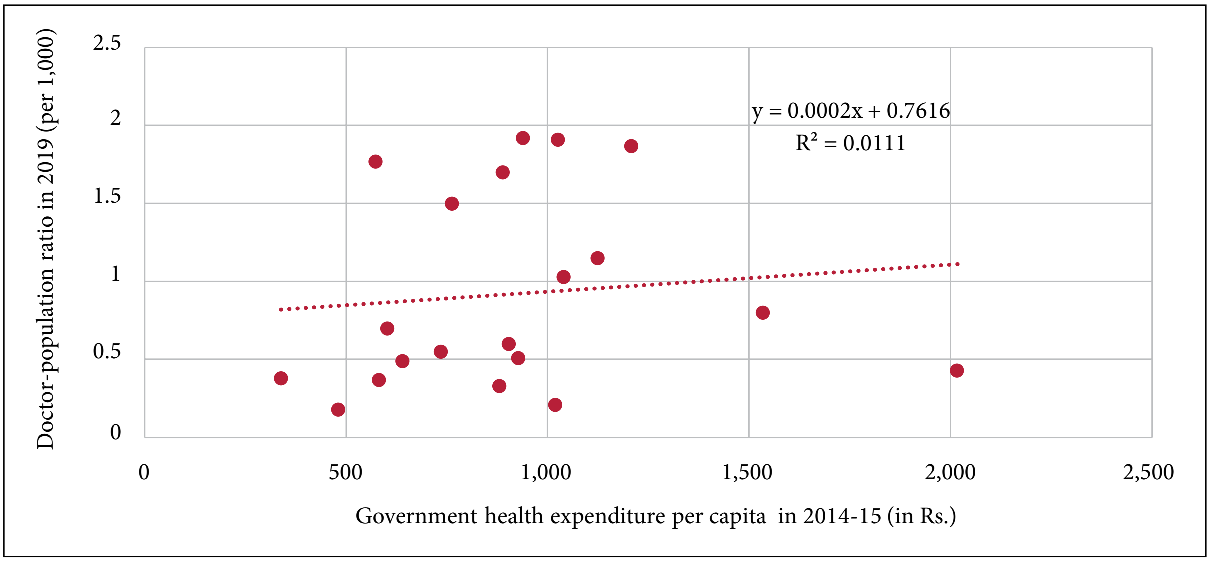
Figure 1. Relationship between income and availability of doctors



Source: CBHI (2021) and CMIE States of India

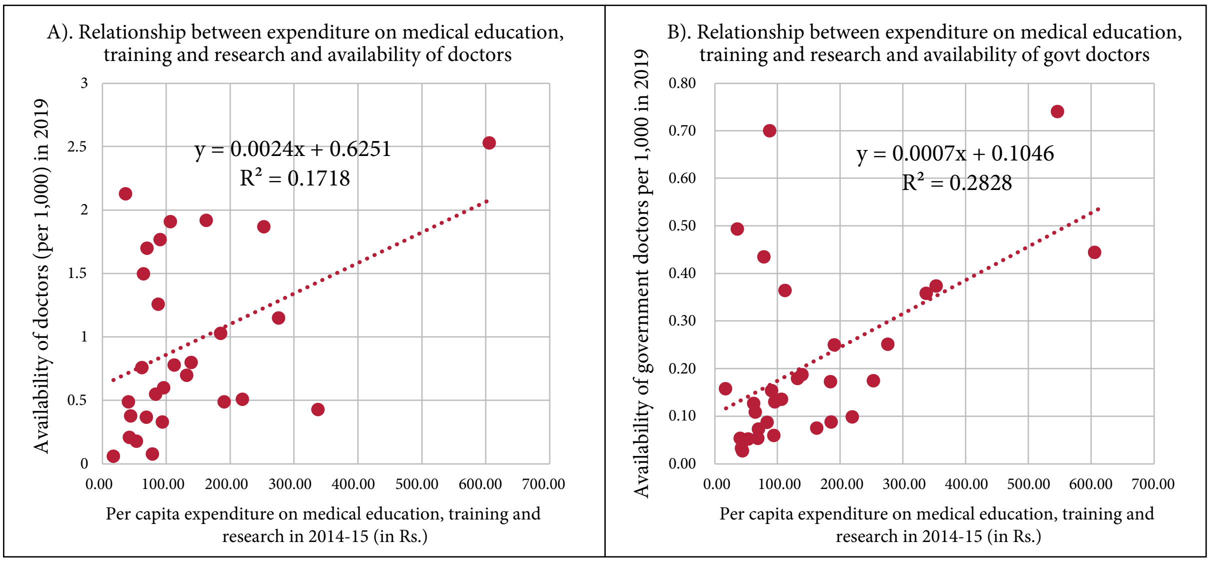
Note: The real GSDP per capita is at 2011–12 constant prices. Here the term doctor refers to allopathic doctors. See Figure A.1 in the Appendix for the relationship between allopathic doctors + dental surgeons and real GSDP per capita. Also see Figure A.2 in the Appendix for the relationship between allopathic doctors + dental surgeons+ AYUSH practitioners and real GSDP per capita.

Figure 2. Relationship between Government health expenditure per capita and availability of allopathic doctors



Source: CBHI (2021) and National Health Accounts (2014-15)

Figure 3. Relationship between the expenditure on Medical education, training and research and availability of doctors



Source: CAG Combined Finances (2014-15), MoHFW, CBHI (2021)

Note: Data on doctors practising in Puducherry, Meghalaya and Manipur is not reported in National Health Profile (2021), hence these states were dropped from the analysis

Source: CAG Combined Finances (2014-15), MoHFW, CBHI (2020)

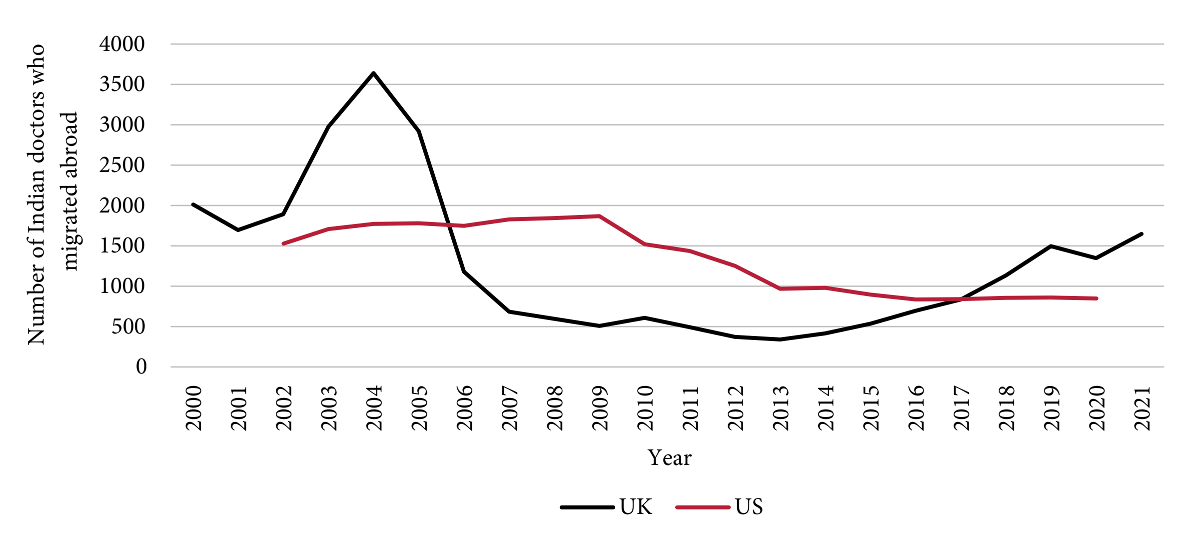
Table 2. Trends in the migration of doctors

Year	Outflow of Doctors	Inflow of Doctors	Newly Added Doctors
2012–14*	4,329	7,335	112,084
2015–18*	6,625	8,764	194,197
2019	2,350	7,375	54,238
2020	2,195	5,897	49,356
2021	2,499	9,996	NA

Source: National Board of Examinations in Medical Sciences (NBEMS) Annual report (Various Years) CBHI 2021

**Data is not available on an annual basis for this time period, instead it is bundled up to these respective years*

Figure 4. Annual Outflow of Indian Doctors to the US and UK



Source: OECD Statistics

Note: In 2015–16, Indians were the single biggest contributor to the pool of foreign-trained doctors in the US and UK, constituting 32% and 21%, respectively, of the total foreign-trained pool. Both the US and UK together host more than 50% of foreign-born doctors.

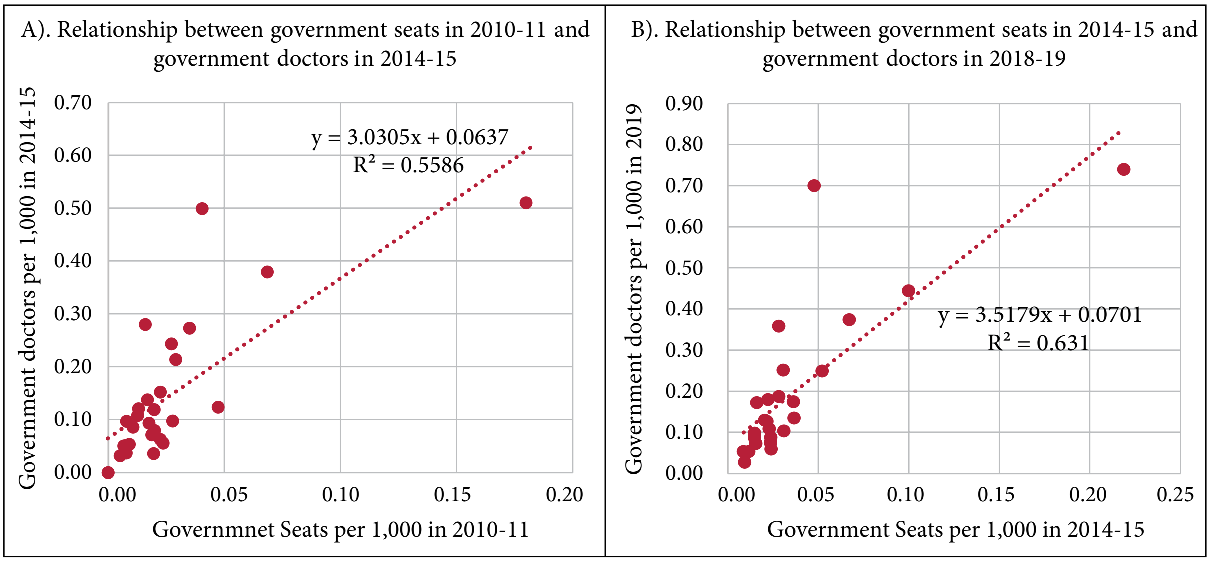
Doctors trained in India can directly emigrate to the UK after clearing the General Medical Council examination. In the case of the US, besides clearing their exam, they also receive their postgraduate degree from a US medical college.

The inter-state migration of doctors has implications for the availability of doctors at the state level. Here, the state-wise supply of the newly added doctors is compared to the number of seats in the state. We compare the ratio of the state-wise MBBS seats in 2014–15 with the supply of newly added doctors in 2019[10], which corresponds to the period five years following their enrolment. A value of greater than 1 corresponds to the production being greater than supply, which means that the number of medical graduates was higher than number of newly-added doctors. In the case of production, we assume that all the seats are occupied, and that all students have passed. What we observe is that there is sizeable difference in the ratio across states (See Table 3 and Figure 7) indicating net migration, in or out. Besides the expected rate of return on investment, students'

[10] There are state-wise differences in registration norms, because some states have intermediate/temporary registration after course-work and then full registration after internship. Some states like Delhi require mandatory registration in the state even if the graduating student practices elsewhere.

enrolment and practice decisions are also related to the incentives and disincentives of studying (admission bond, service bond, college fee)[11]and working in particular states. The lack of uniformity of fees in government colleges and bond conditions has an impact on the inter-state migration of doctors, which is currently a bigger policy concern, given the ongoing challenges of distributional inequities in the workforce.

Figure 5. Relationship between the availability of government seats and government allopathic doctors

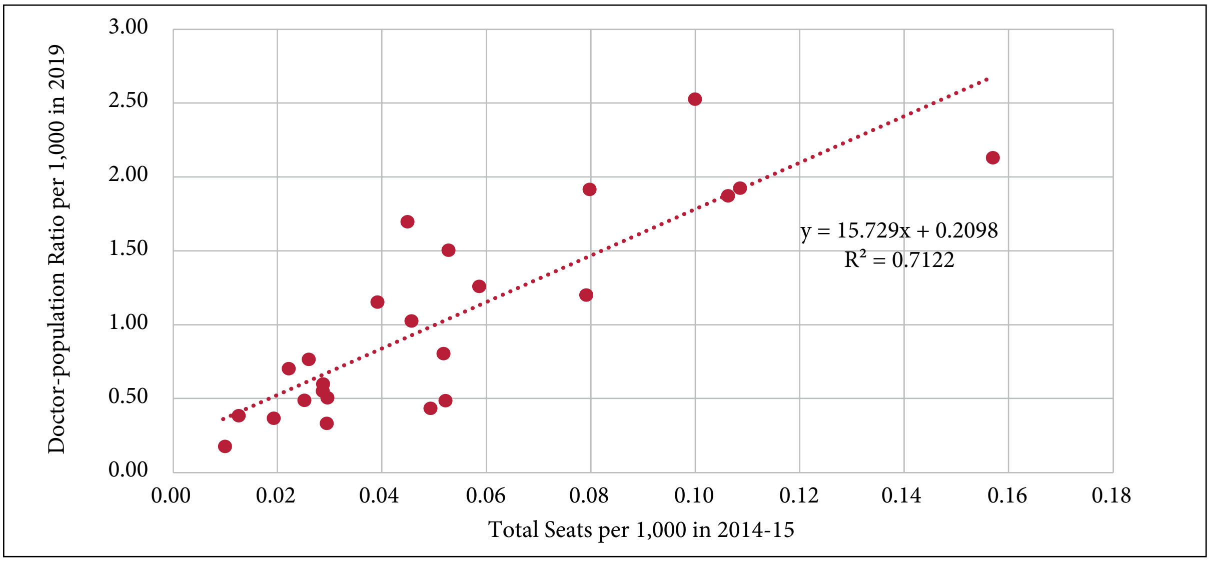


Source: CBHI (2015) and Lok Sabha Questions

Note: Chandigarh was dropped in 2018-19 analysis because it was an outlier

Source: CBHI (2021) and Lok Sabha Questions

Figure 6. Relationship between the availability of total seats (govt + private) and total doctors (govt + private)



Source: Indiastat and CMIE

[11] It also explains partly the high outflow from Andhra Pradesh, because of its relatively student friendly bond conditions.

Based on the above analysis, four broad categories of states emerge – 1. High availability (doctor-population ratio is greater than 1:1,000) and net exporters (Ratio of production: supply >1) – Andhra Pradesh, Karnataka and Jammu & Kashmir 2. High availability (doctor-population ratio is greater than 1:1,000) and net importers (Ratio of production: supply < 1) – Delhi, Maharashtra and Tamil Nadu 3. Low availability (doctor-population ratio is lower than 1:1,000) and net importers (Ratio of production: supply < 1) – Rajasthan, Jharkhand, Haryana and Odisha 4. Low availability and exporters (Uttar Pradesh, Bihar and West Bengal). It is observed that states with a higher availability of seats per million in a private sector were more likely to be net exporters as the private sector does not have service bond conditions. These categories underscore the need for incentivizing doctors to move towards low-availability areas, and need to also retain doctors in states which are classified as 'low availability and net exporters.'

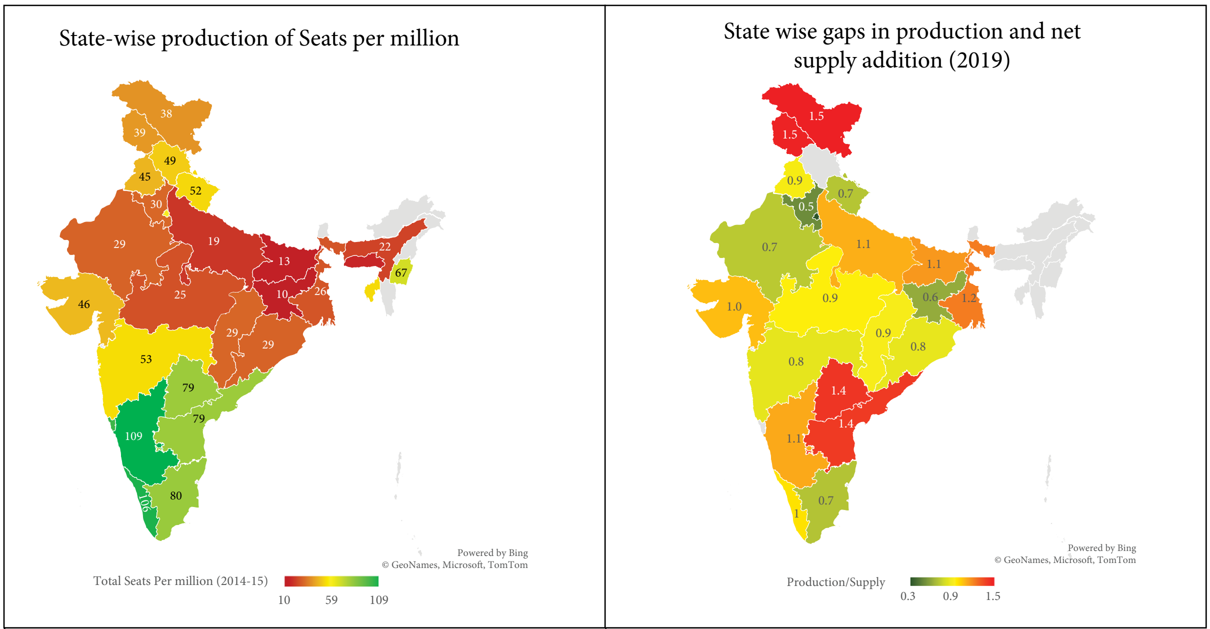
Table 3. Inter-state gap in production and supply of doctors

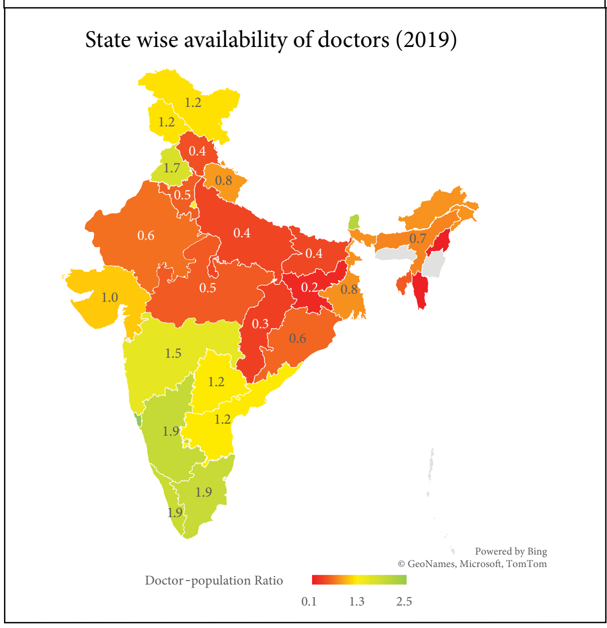
State	Doctor patient Ratio per 1,1000 (2019)	**Ratio of Production/Supply**
I. High Availability and Net Exporters		
Jammu and Kashmir	1.2	1.5
Undivided Andhra Pradesh	1.2	1.4
Karnataka	1.9	1.1
Gujarat	1	1.05
II. High Availability and Net Importers		
Kerala	1.9	0.96
Punjab	1.7	0.9
Maharashtra	1.5	0.8
Tamil Nadu	1.9	0.7
Delhi	1.3	0.3
III. Low Availability and Net Importers		
Madhya Pradesh	0.5	0.9
Chhattisgarh	0.3	0.9
Odisha	0.6	0.8
Rajasthan	0.6	0.7
Uttarakhand	0.8	0.7
Jharkhand	0.2	0.6
Haryana	0.5	0.5
IV. Low Availability and Net Exporters		
West Bengal	0.8	1.2
Bihar	0.4	1.1
Uttar Pradesh	0.4	1.1

Note: AIIMS seats not included in calculation because no state quota. Himachal Pradesh, Sikkim, Assam and Goa were excluded from analysis because the newly added doctors in 2019 deviated substantially from the long-term average.

Source: CBHI (2021), IndiaStat

Figure 7. Inter-state gaps in the production and supply of doctors





Note: AIIMS seats not included in calculation because no state quota

Source: CBHI (2021), MoHFW, Lok Sabha Questions

The low availability of doctors despite the high density of medical colleges in select states necessitates a rethinking of the incentives to retain doctors. The role of state-specific bond conditions—pertaining to both rural service and admission bonds—along with potential return on investment in a given state influence decisions to both, study and practice in a given state. There are also state-wide variations in the both the recruitment procedures (walk-in interviews versus delays in posting of vacant positions) and salary & incentives offered for MBBS doctors under various National Health Mission initiatives. A potential proxy for student's decision to study in a particular state is the state-wise MBBS seat vacancy rate (See Table A.17 in Appendix). It was found that the EAG states accounted for the bulk of seat vacancies over the 2018–19 and 2019–20 period. The duration of the bond ranges from 20 years in Assam to zero in Andhra Pradesh, Delhi and Haryana, which do not have such a requirement after completion of UG education. Similarly, following completion of students' postgraduate (PG) education, this duration ranges from five years in Uttarakhand, Tamil Nadu, Tripura, and Meghalaya, to zero in Andhra Pradesh, Haryana, Himachal Pradesh, Jharkhand, Kerala, Manipur, Puducherry, Odisha. The bond Amount ranges from Rs 1 lakh (Odisha) to Rs 1 crore (Uttarakhand) for UG, and Rs 3 lakh (Andhra Pradesh) to Rs 2.5 crore (Uttarakhand) for PG.

In summary, the doctor-population ratio has improved over the last four decades but remains extremely variable across states, with a small number of states contributing to much of this increase. At 0.9:1,000, the reported doctor-population ratio is close to the WHO norm, but after adjusting for double counting, lack of updated data and non-practising doctors, the effective number of doctors stands at an estimated 0.6–0.7 per 1,000 population. While out-migration from premier Indian medical institutes to other countries remains high, its overall impact is low in terms of total numbers, with the inflow of doctors outpacing the outflow. However, out-migration remains a challenge with regard to the high quality doctors migrating abroad. The weak association between public health expenditure at the state level and supply of doctors, as well as between medical education infrastructure and doctor supply, suggests that the mere development of infrastructure and production of doctors is not the key driver of supply; rather, the state's per capita income, state-specific policies and incentives for retention play a much bigger role.

3.2 Production of Doctors and its Drivers

The production of doctors is influenced by the number of medical colleges and seats, as well as the availability of teaching faculty, hospital support staff, and beds in teaching hospitals. The performance of each of the above variables is examined, except the last one, due to the absence of data.

Availability of medical seats has remained a key concern in India, with a large, continuing gap between the demand for and supply of medical seats (See Table 4). The gap between aspirants, individuals who qualify the exam and those who finally manage to secure a seat in the exam is sizeable. An estimated 1.76 million aspirants answered the NEET-2022 exam, of which 56.3% qualified, but only 8.8% of those who qualified, actually secured a seat in a medical college (NTA, 2022). Less than 15% of the individuals who qualified for the exam have actually managed to secure a seat in the last seven years. This is indicative of the need for improvement and expansion of seat capacity to absorb the large unmet demand.[12]

Table 4. Gap in demand and supply of medical seats

Year	2016	2017	2018	2019	2020	2021	2022
Number of Individuals who sit for exams*	731,223	1,138,890	1,326,725	1,410,755	1,366,945	1,544,275	1,764,571
Number of individuals who clear exams (Qualified)	409,477	611,739	634,897	797,042	771,500	870,074	993,069
Proportion of individuals who qualified the exam (in %)	56	53.7	47.9	56.5	56.4	56.3	56.3
Total MBBS seats	57,138	65,183	67,352	70,412	81,569	83,275	88,120
MBBS Seats as a proportion of those who cleared the exam (in %)	14.0	10.7	10.6	8.8	10.6	9.6	8.8

*Note: *Different from the number of people who actually registered for the exam*

Source: National Testing Agency

[12] One school of thought believes that the cut-off for qualifying the exam is set on the lower side and needs to be raised.

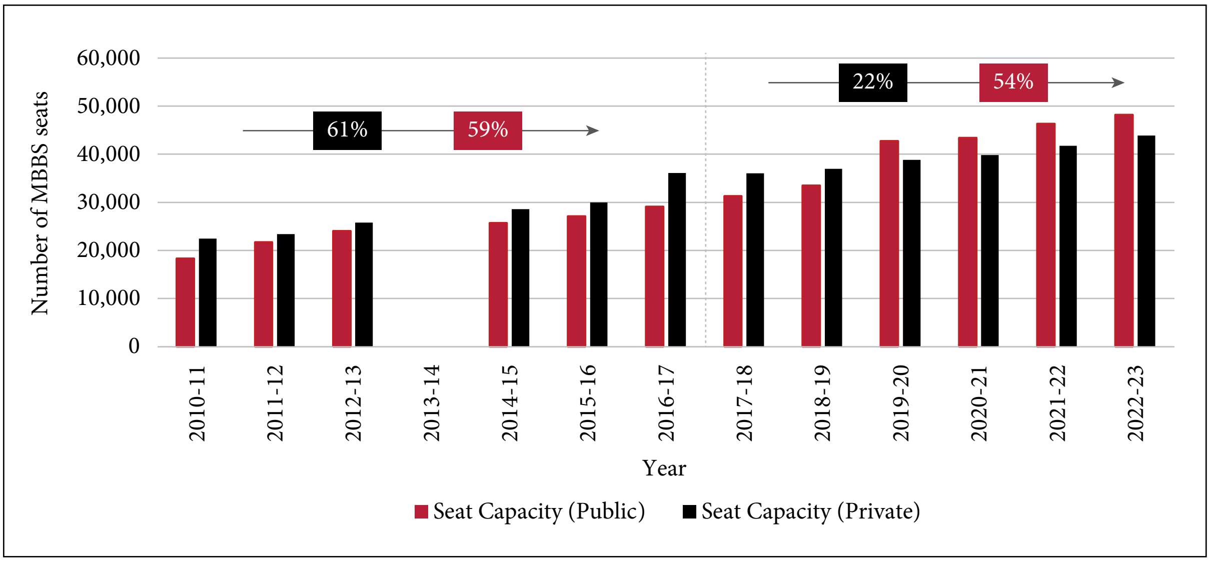
While the number of medical seats has increased over the years, the shift has varied across private and public medical institutions, and across states as well (See Figures 8 and 9). The rapid UG seat expansion over the last five years (2017-18 to 2022-23) was largely concentrated in developed states. In 2017–18, the five states that together accounted for 50.7% of the total seats in India were Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh and Andhra Pradesh. In 2022–23, the list of the top five states constituting 49.5% of the total seats in India, were the same, except that Andhra Pradesh was replaced by Gujarat. The seat expansion was not in line with the population distribution in these states, considering that the five states that comprise 48.6% of India's population are Uttar Pradesh, Bihar, Maharashtra, West Bengal and Madhya Pradesh (See Table A.16 in the Appendix). Thus, seat concentration largely continues in the developed states and has little association with population density.

The rate of increase in UG seats has outpaced the increase in the number of medical colleges (See Section 4.2.1 for more details). Between 2010–11 and 2022–23, the number of UG seats more than doubled, from 40,775 to 92,127 (See Figure 8 and Table A.6 in the Appendix). The number of colleges also increased rapidly, from 335 to 612 (See Figure 9), but output per medical college continues to be fairly low in India (See Table 5 and Table A.12 in the Appendix). As mentioned earlier, India has the largest number of medical colleges in the world. Despite this, India's average annual output of graduates per medical college is 151, as compared with 220 in Eastern Europe and 930 in China (PTI, 2019a). There are no marked differences in the output per college across the public and private sectors. The low number of seats per college is a structural characteristic of India's higher education system. For instance, Indian higher education institutions have an average of only 690 students, versus that of 16,000 students per higher education institute in China (Ravi et al, 2019).

The number of medical graduates per 100,000 population in India is 4.1[13], which is much lower than that of the OECD countries (among these countries, this figure begins from 6.9 per 100,000, for Israel) (See Figure 10). The reasons for low seats per college are largely related to the onerous permission procedures for setting up and running colleges, stringent bed occupancy norms and high initial capital expenditure. In the latest MSR 2023 regulations, the from 2024-25 onwards, the size of the new UG medical colleges will be restricted to 150 seats, and existing colleges with less than 150 seats also will not be able to expand the number of seats beyond 150. These reasons have been discussed in detail in a subsequent paper, which focuses on the cost economics of public and private medical colleges, and the hurdles in capacity expansion created by extant rules and regulations for the establishment of medical colleges.

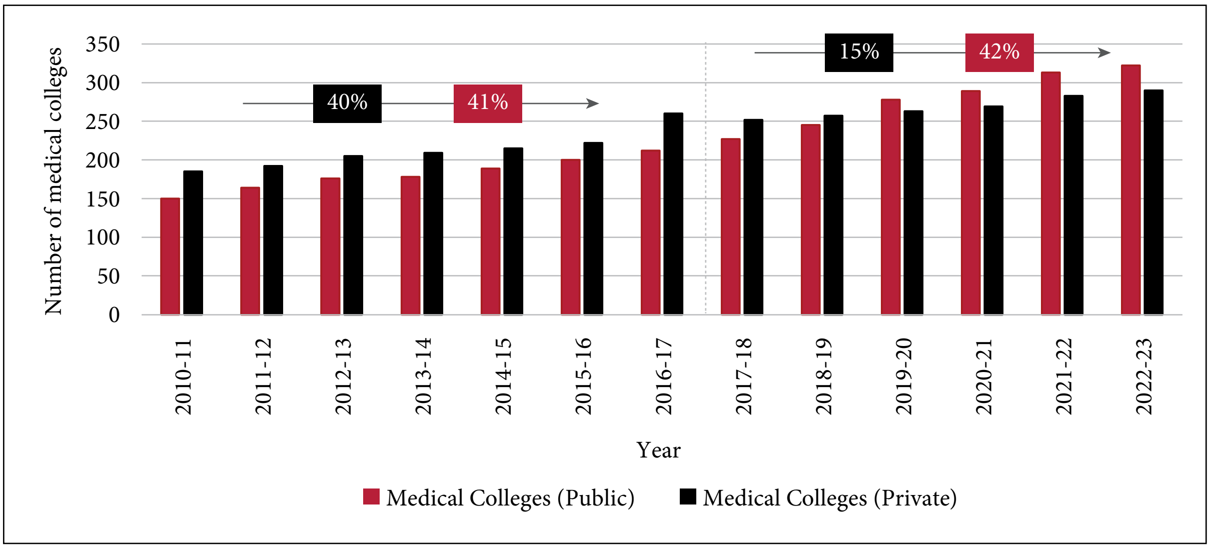
[13] The number of graduates per 100,000 population in India is calculated by authors on the basis of total MBBS seats in the country in five years prior to the date of reporting, i.e., in year 2016-17. The data for the same was sourced from IndiaStat.

Figure 8. Trends in MBBS seat capacity



Source: Lok Sabha Questions and IndiaStat

Figure 9. Trends in medical colleges for MBSS



Source: Lok Sabha Questions and IndiaStat

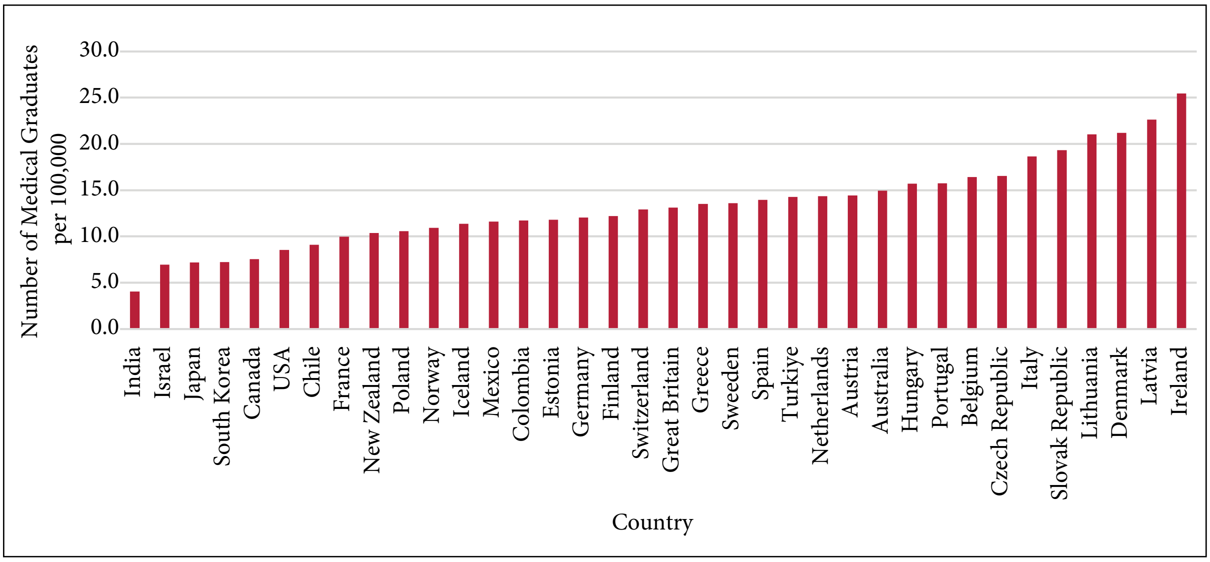
Table 5. Trends in the number of MBBS seats per college

Year	Seats per college (Total)	Seats per college (Public)	Seats per college (Private)
2010–11	122	122	121
2011–12	127	132	122
2012–13	131	137	126
2013–14	134	NA	NA
2014–15	135	136	133

Year	Seats per college (Total)	Seats per college (Public)	Seats per college (Private)
2015–16	135	136	135
2016–17	138	137	139
2017–18	141	138	143
2018–19	140	137	144
2019 –20	151	154	148
2020–21	149	150	148
2021–22	148	148	147
2022–23	151	150	151

Source: Indiastat

Figure 10. Cross-country data on the number of medical graduates per 100,000

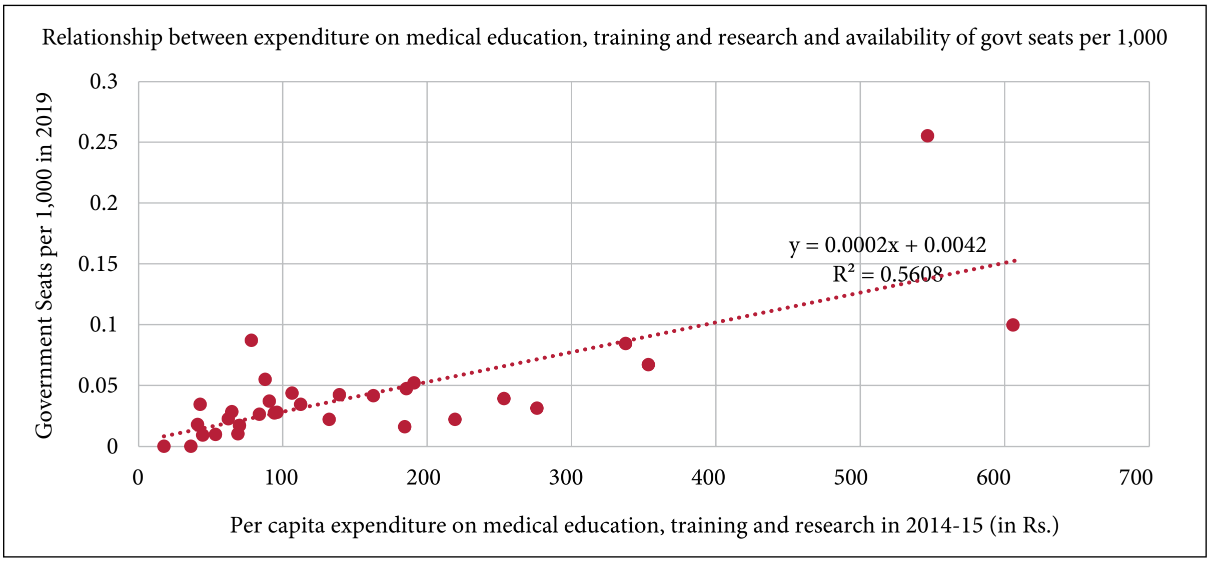


Note: The data is for the most recent year reported, ranging from 2019 to 2021. See Table A.8 in the Appendix for the year of reporting.

Source: OECD (2023)

We observe relatively strong and linear association between state-level expenditure on medical education, training and research and availability of seats at government medical colleges (See Figure 11). Assuming that the impact of this spending will be visible with a lag, we tested the relationship between the state-level per capita expenditure on medical education, training and research in 2014–15 and the availability of seats at government medical colleges in 2018–19 (See Table A.11 in the Appendix, for five-year trends in public spending on medical education). Some states like Nagaland and Sikkim, even though were spending under the budget head of Medical Education, did not have a single seat in government medical college in 2019. On the other extreme, Goa spends Rs 606 per capita (4.6x of the all-India average) and had one medical college, with 0.1 seats per 1,000 population.

Figure 11. Relationship between expenditure on medical education, training and research and availability of government seats



Source: CAG Combined Finances (2014-15), Lok Sabha Questions

3.2.1 Differing Trends in Public and Private Expansion

As mentioned, changes in the number of seats in public and private colleges have varied. For each year between 2010–11 and 2022–23, the number of private seats was higher than that of public seats at the UG level, except since 2020, when the admission capacity of public medical colleges superseded that of private medical colleges. In 2020 alone, 9,257 seats were added by government medical colleges, an increase that was driven by 33 new medical colleges becoming functional that year. Additionally, between 2016–17 and 2017–18, the number of private colleges reduced, from 260 to 252, as a result of a number of them being de-recognised (Nair, 2017). It is observed, while in the first half of the decade (2010–11 to 2016–17), both public and private sector roughly grew at same rate, in the second half (2017–18 to 2022–23), the public sector grew at a much faster rate (42% increase in medical colleges and 54% increase in seats in public versus 15% increase in medical colleges and 22% increase in seat capacity in private sector).

The slowdown in the private sector expansion in medical education space despite its sizeable presence in secondary and tertiary care necessitates a rethink of the incentives and the dis-incentives which have resulted in this muted participation. Barring a few, the leading private sector, super-specialty hospitals have not participated in medical education. Some of them, in the recent years introduced the DNB courses, but have not ventured into MBBS or MD/MS. Policymakers opine that these institutes have state-of-the-art technology and a relatively more varied patient load, so if they were to convert into medical colleges, not only would that reduce the need for greenfield investments in setting up of new medical colleges, but would also increase the overall quality of pedagogy in the country. The current perception of the private sector is that the hospitals contribute to overall revenues, while the medical college is largely a cost.

It is important to note that the expansion in seats in both public and private colleges at the UG level was higher than the rate of expansion of medical colleges, indicating that at least part of this expansion was on account of the relaxation of existing norms, thus enabling higher student intake, without any real augmenting of accompanying physical and human infrastructure. Between 2010–11 and 2022–23, the seat capacity grew 2.3 times, while the medical college capacity grew by 1.8

times[14]. Both, the rate of expansion of seats as well as that of colleges was higher in government medical colleges (2.8 times) than private medical colleges (1.98 times). Across both, private and public institutions, the bulk of seat capacity has been concentrated in developed states (except for the inclusion of Uttar Pradesh) between 2011 and 2023.

In summary, the demand–supply gap in medical seats remains a big challenge, with less than 15% of those who passed the exam being successful in securing a seat in the 2016–2022 period. The increase in the number of medical seats has been higher than the relative increase in that of medical colleges, suggesting a rationalisation in the norms for the operation of medical colleges (See Section 4.4 for details). The seat capacity at the UG level was higher in private institutions until 2018–19, following which public institutes dominated. The same holds for medical colleges.

3.2.2 Teaching Faculty Shortage

We investigate the teaching faculty shortage in detail, as it is one of the structural issues that has plagued the education system well before the onset of expansion reforms. It is important to acknowledge that the teacher in a medical college has multiple roles, in contrast to other streams of education. The teacher is expected to do OPD visits, conduct surgery, aid in administration of college. This is over and above the duties of classroom teaching, and research to be eligible for promotions. With this workload and restrictions on private practice, the attractiveness of a relatively higher paying teaching job in government medical colleges substantially reduces. Even as the government has made rapid strides in augmenting the physical capacity of medical institutions, teaching faculty and other support staff shortage persists in both, the older and newly created AIIMS (See Figures 12 and 13, and Table 6). Thus, the student-teacher ratio varies from 2: 1 in Himachal Pradesh to as high as 5.4:1 in Uttar Pradesh. The discussion here is applicable to the PG level as well, and the same has not been separately addressed in the subsequent section.

Data is a considerable challenge in the analysis of the teaching shortage, as the official teaching faculty database maintained by the NMC is fraught with duplication and is not updated on a timely basis. While both newspaper reports and policymakers acknowledge a faculty shortage, in the absence of a reliable database, uncovering the true extent of this shortage across states is a challenging task. There are also reports of shared faculty between colleges, which further complicates the analysis. The All-India Survey on Higher Education (AISHE) conducted by the Department of Education (Ministry of Education, 2020) routinely collects data on the extent of vacancies across different medical colleges. However, it covers less than 100 of the total 500–600 colleges, and thus the use of this data is limited.

As per the MSR 2023, the government mandated the introduction of Aadhar Enabled Biometric Attendance System (AEBAS) along with installation of Closed-Circuit TV (CCTV) monitoring systems. These systems will be collecting daily attendance information on faculty, residents and supporting staff and will be linked to the Command and Control Centre of NMC. This daily data generated should be made available to NMC and displayed on the college website, in the form of daily attendance dashboard. If this system is implemented in the right earnest[15], this will provide us with a valuable database to understand the extent of shortfall, its state-wise incidence and also specialty-wise incidence, which will inform the government's overarching Human Resource planning strategy. Besides the introduction of technology, there is also need to build local monitoring mechanisms in place, in order to ensure actual availability of teaching faculty at medical colleges.

[14] The seat capacity was also marginally impacted by the January 2022 Supreme Court judgement which enforced Other Backward Class (OBC) reservation (27%) in the all-India quota for both UG and PG medical and dental courses. To maintain the number of general quota seats as before the judgement, the number of seats was increased.

[15] In the past, the NMC had mandated the display of information on a number of indicators of medical colleges – with respect to its financing and infrastructure, in pre-determined proforma on the college website, on a yearly basis. However, it was found that many colleges did not have a website to begin with, and those who did, did not display this information. More than 40% of government colleges, for instance, in the state of Tamil Nadu did not display this information on their websites.

The vacancies in teaching faculty were found to be more acute in public medical colleges, according to the AISHE (2019–20) survey (Ministry of Education, 2020). A detailed analysis of such vacancies in select government medical colleges in Uttar Pradesh (see Table A.2 in Appendix)—where 17 new government medical colleges have been added between 2019 and 2021—revealed that the state had an overall vacancy rate of 30% in government colleges, with the rate in some being as high as 45.5%.

The high levels of teaching faculty vacancy in public medical colleges were also caused by the administrative complexities of hiring permanent faculty in government colleges, characterised by elaborate and long recruitment cycles, leaving little room for decisions motivated by the pragmatic concerns of the college. A Parliamentary Standing Committee on AIIMS Delhi emphasised the need for permanent appointments, observing that AIIMS had repeatedly attempted to make contract appointments of faculty members, even when the selection process for regular appointments was underway (Sharma, 2015). There were also instances in AIIMS-like institutions (ALIs) elsewhere, in which faculty appointments were delayed because of failure to follow the appropriate procedures for the release of advertisements.[16]

Besides the need for structural reforms in recruitment procedures of teachers, there is also the need for greater integration of technology in the current curriculum structure to ensure optimal utilisation of teachers and other scarce clinical material. This may help to address gaps in teaching and bring in efficiencies. The Skills lab, for example, has been mandated by the government in new Minimum Standard Requirements 2020 regulations to enhance the standards of clinical training. The Skills lab will contain simulation-based cadavers and other related technological inventions. In order to facilitate its uniform and speedy adoption across all medical colleges, the skills lab needs to be funded either partially or completely by the government, across both public and private sector.

Data furnished by the government in response to Lok Sabha questions was compared against the AISHE numbers (See Table A.18 in the Appendix), to track progress in filling teaching faculty vacancies. Two aspects pertaining to the sanctioned positions and vacancies stand out:

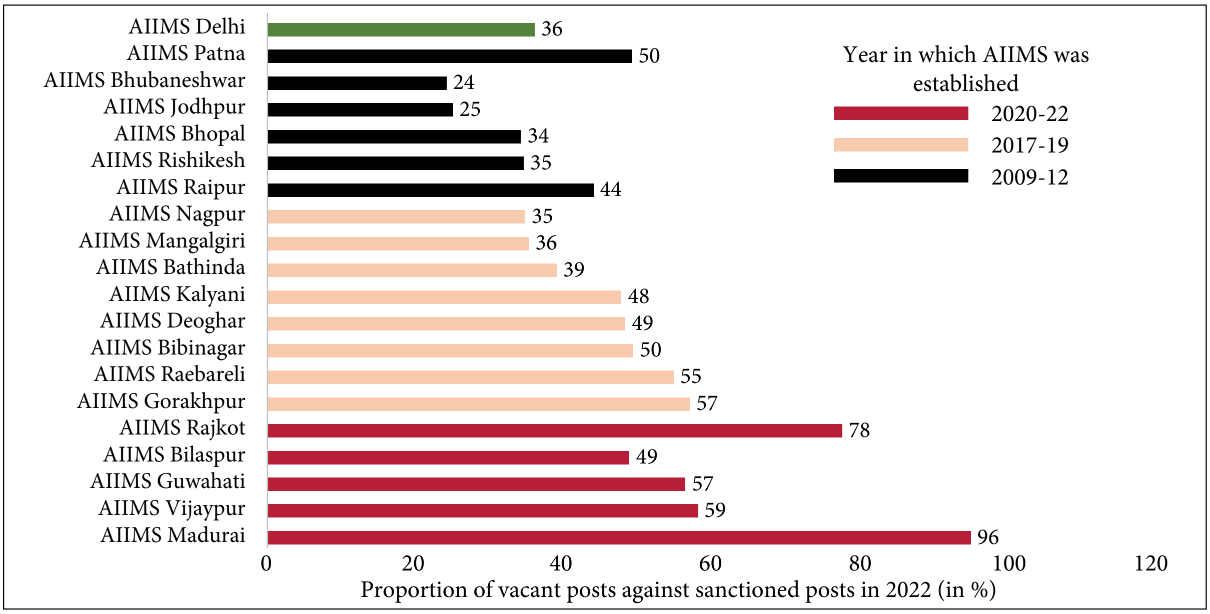
1. Between 2019–20 and 2022, select AIIMS institutes have seen a decrease in the number of sanctioned posts: from 379 to 305 for AIIMS Bhubaneshwar, from 398 to 205 for AIIMS Jodhpur, from 339 to 305 for AIIMS Rishikesh, and from 339 to 305 for AIIMS Raipur.[17] The downward revision in the sanctioned strength warrants deeper examination, especially as the seat capacity for these institutions has not seen a similar contraction. Between 2020-2022, all the aforementioned colleges have increased seat capacity from 105 MBBS seats to 125.

2. AIIMS Rishikesh and AIIMS Delhi saw an increase in the teaching faculty vacancy rate between 2020 and 2022.

[16] For instance, AIIMS Patna, which first became operational in 2012 and fully functional in 2018, released fresh advertisements for 173 posts in August 2022. The institute cancelled the previous two recruitment advertisements released in October 2021 and February 2022, because these did not follow the reservation roster protocol, and certain positions were downgraded without citing valid reasons for the same. The senior faculty positions (i.e., Professor) were not advertised despite vacancies, and the advertisements were released for the junior positions (i.e., Assistant Professor) instead. There were also inconsistencies in the eligibility criteria for recruitment for the position of Professor, with some departments requiring a DM (PG degree in medicine in the concerned super-specialty subject), while others did not have this requirement (Kumar, 2022)

[17] AIIMS Delhi and AIIMS Mangalagiri reported an increase in sanctioned strength, which is more plausible given that more teaching faculty would need to be hired to cater to the expanded seat capacity.

Figure 12. Shortage of teaching faculty in newly created AIIMS (2022)



Source: Source: GOI (2022b)

Note: AIIMS Madurai and AIIMS Delhi records are not mentioned in the latest question answered in the Lok Sabha.

Table 6. Student-teacher ratio in newly created AIIMS (2022)

State	Name of Institution	Student-teacher ratio
Tamil Nadu	AIIMS Madurai	4.17:1
Gujarat	AIIMS Rajkot	3.5:1
Jammu & Kashmir	AIIMS Vijaypur	2.37:1
Uttar Pradesh	AIIMS Gorakhpur	5.4:1
Assam	AIIMS Guwahati	2.7:1
Uttar Pradesh	AIIMS Raebareli	4.13:1
Telangana	AIIMS Bibinagar	5:01
Bihar	AIIMS Patna	4.5:1
Himachal Pradesh	AIIMS Bilaspur	2:01
Jharkhand	AIIMS Deoghar	4:01
West Bengal	AIIMS Kalyani	3.14:1
Chhattisgarh	AIIMS Raipur	5.29:1
Punjab	AIIMS Bathinda	3:01
Delhi	AIIMS Delhi	NA
Andhra Pradesh	AIIMS Mangalagiri	2.94:1
Maharashtra	AIIMS Nagpur	4:01
Uttarakhand	AIIMS Rishikesh	3.4:1
Madhya Pradesh	AIIMS Bhopal	3.3:1
Rajasthan	AIIMS Jodhpur	2.97:1
Odisha	AIIMS Bhubaneswar	2.34:1

Source: GOI (2022b)

Note: AIIMS Delhi records are not mentioned in the latest question answered by Lok Sabha.

In the case of private medical colleges, posts were reported as being completely filled, and in some cases, the number of teachers was greater than the sanctioned strength, according to the AISHE 2019–20 survey (Ministry of Education, 2020). [18] Given that private colleges face the risk of de-recognition if they do not have sufficient teaching capacity, they may have a more acute need to maintain lower vacancy rates and decrease staff shortage.[19] The de-recognition risk, even for one academic year, means one year of being unable to admit a fresh batch of students, which entails a sizeable loss of revenue to the medical college. Hence, these colleges face pressure to comply with the teaching faculty and other related requirements.

Thus, even as the government has made rapid strides in the creation of physical infrastructure under the PMSSY, the shortage of human resources, especially teaching faculty,[20] has become a major hurdle in addressing the short supply of doctors. The high student-teacher ratio in the newly created ALIs, against the current GoI norm of 3:1, has overburdened the existing resources and also has a bearing on the course offering (see Table 8).

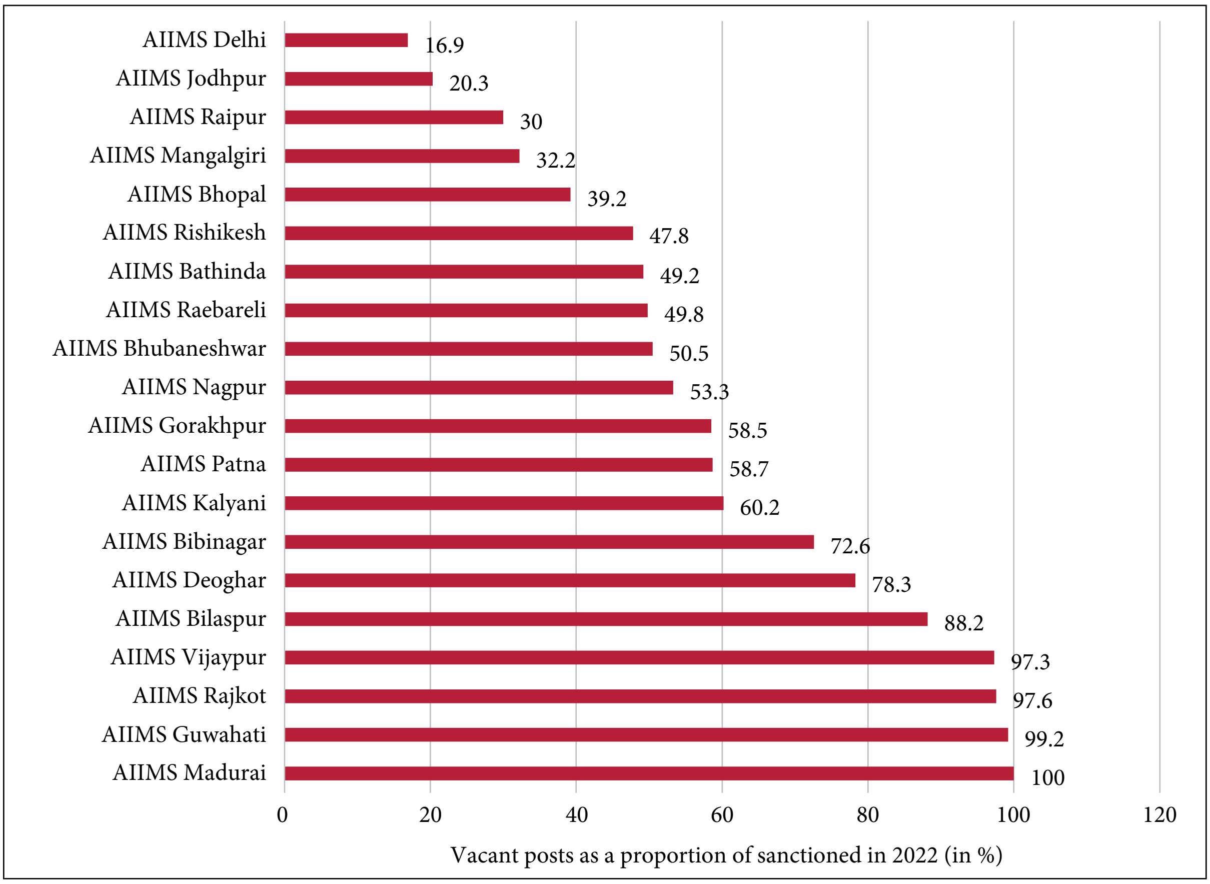
Besides the teaching faculty shortage, the mounting shortage of non-faculty members, junior residents and senior residents, who comprise the important ancillary staff required for the functioning of medical colleges, is an equal concern (See Figure 13 and Tables A.9 and A.10 in the Appendix). The non-faculty staff includes nurses, operation theatre (OT) technicians, laboratory personnel, and administrative and scientific officers. The data on junior and senior residents also provides insight on the expected inflow into teaching, as it is mandatory to complete at least one year as a senior resident to be eligible to become an Assistant Professor. However, it has been found that residents often quit their positions to prepare for entrance exams (Jha, 2017); issuing of fresh advertisements to fill these positions results in a prolonged shortage of these resources.

[18] The BLDE University, Bijapur (Karnataka) had hired 33 more faculty members than its sanctioned strength. Similarly, the DY Patil Educational Society Kolhapur (Maharashtra) hired 13 more than the sanctioned strength, and Geetanjali University (Rajasthan) hired 183 more than its sanctioned strength (Ministry of Education, 2020).

[19] The numbers mentioned in the AISHE survey (2019–20) are self-reported by respective institutes and have to be considered with a healthy bit of scepticism; there have been routine newspaper reports about private medical colleges managing to get the “requisite” number of teachers specifically for inspection (Telangana Today, 2022). The public sector has also routinely “transferred” teachers across colleges, to address the shortage of teachers at the time of inspection (Dabhi, 2022; TNN, 2023).

[20] The shortage of teaching faculty is a structural issue of the Indian education system. Even the premier chain of engineering colleges in country, the Indian Institutes of Technology (IITs), face similar rates of teaching faculty vacancy, albeit for different reasons.

Figure 13. Non-faculty shortage in newly created AIIMS (2022)



Source: GoI (2022e)

In summary, the shortage in teaching faculty is a critical variable in the expansion of seats and quality of education imparted, primarily in public medical colleges. Several reforms have been undertaken, with some specifically targeting the newly created AIIMS. Yet, shortages persist, in part due to the bureaucratic challenges that cause recruitment delays and the lack of incentives that can motivate doctors to take on teaching assignments. In addition to faculty shortages, filling gaps in the availability of non-faculty members and the variety of ancillary staff remain an equal challenge.

3.3 Current Supply of Specialists and Causes of the Shortage

Even as the supply of MBBS doctors at the all-India level is now steadily moving closer to the WHO norm of 1 doctor per 1,000 population, the supply of specialists remains scarce. This is particularly concerning given that the disease burden related to six of the top ten causes of death cannot be treated by MBBS doctors alone, and requires the presence of specialists (See Table 7). Given the growing incidence of NCD burden (Dandona et al, 2017), the shortage of specialists is set to become more acute if these diseases are not managed at early stages. By 2019, about two-thirds of all deaths in India were attributed to NCDs (IHME, 2020).

Table 7. Leading causes of Death and Mapping with required Specialist

Leading Causes for Disability-Adjusted Life Years (DALYs) -2016	Contribution to DALYs (in %)	Treated by
Ischaemic heart disease	8.7	Cardiologist
Chronic obstructive pulmonary disease	4.8	Pulmonologist
Diarrhoeal diseases	4.6	Gastroenterologist
Lower respiratory infections	4.3	Pulmonologist
Stroke/Cerebrovascular diseases	3.5	Neurologist/Vascular Neurologist
Iron deficiency anaemia	3.5	Primary care/ Haematologist/ Gastroenterologist/ Paediatrician/ Gynaecologists/Obstetrician
Preterm birth complications	3.4	Neonatologist/Obstetrician/ Gynaecologist
Tuberculosis	3.2	Primary care/ Infectious Disease Doctor/ Pulmonologist
Sense organ diseases	2.9	Neurologist
Road injuries	2.9	Emergency Physician

Source: Dandona et al (2017)

Data on the shortage of specialist doctors is not available, but 2020–21 data for specialists' availability in community health centres (CHCs) highlights a shortfall of 79.9% of specialists, against the requisite norm as per Rural Health Statistics 2021-12(MoHFW, 2023). In 2021, of the total sanctioned posts for specialists as a whole, 67.8% were vacant at the CHC level. This shortfall has only widened over time (See Figure 14 and Table A.3 in the Appendix for state-wise data on the shortage of specialists). The gap in the number of sanctioned posts against requirement of the population points to the need to strengthen existing human resource planning policies in public hospitals. The requirement for specialists not keeping pace with the increasing demand (MoHFW, 2023) has translated into longer waiting times and delays in surgeries, especially in public hospitals.

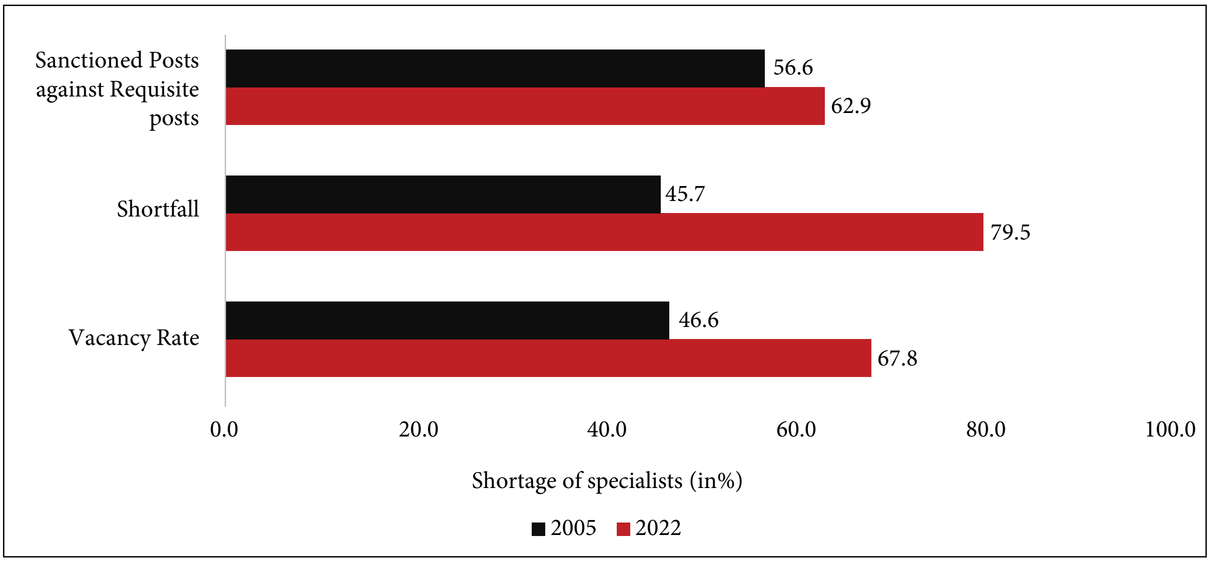
Table 8. Need and availability of specialists in India

Discipline	Practising specialists per million (2022)	Practising specialists per million in the US (2021)	Required number in India (Per million)	Current PG seats in India (2022)	Required PG seats in India	No. of years needed to achieve the required seats based on CAGR of expansion
Cardiology	10	67	65	818	3375	5.94
Chest Medicine	2	15	17	678	2,000	1.40
Neurology	2	42	38	666	2,000	3.94
Paediatrics	113	819	663	2,894	10,500	6.42
Endocrinology	1	25	20	191	1,100	7.82
Nephrology	2	35	29	230	2,150	13.74
Orthopaedic Surgery	9	56	57	2,616	3,300	1.00
General Surgery	2	75	74	3,982	10,000	6.50
Neurosurgery	3	17	16	1,537	800	NA

Source: GoI (2017); Indian numbers for specialists per million are the authors' compilation, based on multiple sources; US data on specialists is sourced from the Association of American Medical Colleges (2022).

Note: Child population (0–14 years of age in the case of India, 0–17 years of age in the case of the US) was taken into consideration for calculations related to paediatric doctors.

Figure 14. Shortage of Specialists at CHCs



Source: Rural Health Statistics, 2021–22

Note: 1. The term specialist here consists of surgeons, obstetricians and gynaecologists, physicians and paediatricians. 2. The all-India figures for shortfall and vacancy ignore the surplus, which might be recorded in select states and union territories. The state-wise vacancies for select states might be also exaggerated as their specialists operate from Sub-divisional (sub-district) hospitals and not from CHCs. 3. Shortfall refers to the number of specialists present against the requisite number, as defined by the Indian Public Health Standards norms. Vacancy is a shortage against the sanctioned posts.

In a GoI (2017) report, estimates were presented for the current availability of specialists and seats in those departments in India and the US in 2018, and the number of seats that should be targeted in India. We update those estimates by adding the current number of PG seats and specialists in the country (See Table 8). There is no comprehensive database available on the number of actively practising specialists in the country. We have collated the updated estimates using membership databases of respective disciplines and other related sources.

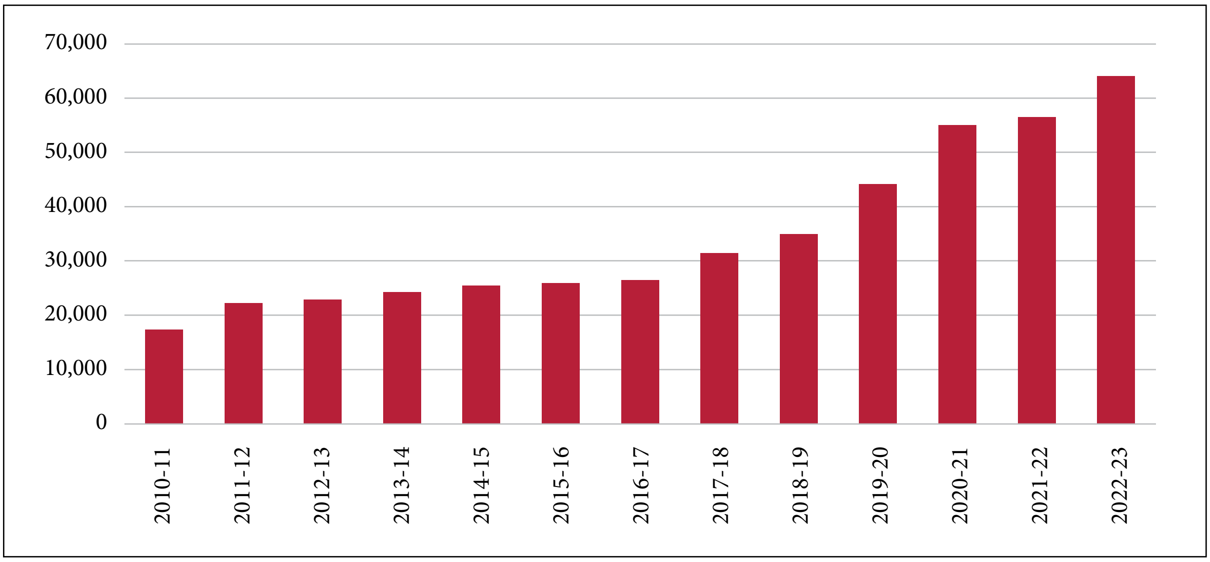
While the report has compared the Indian availability of specialists and seats to the US estimates, it is important to emphasise that 1) the requirement of specialists in India will differ from that of the US because of the differences in the rate of epidemiological transition between the two countries and 2) there is no broad consensus on the requisite number of specialists per 1,000, either in the literature or among practitioners. For most of the aforementioned diseases, part of the clinical management can be handled efficiently by general physicians. In India, the trend is one of preference for a specialist, even for basic healthcare needs, as evident from Makkar et al. (2003) and Unnikrishnan and Sharma (2018). This crowds out specialists' services for the patients who most acutely require them. A stronger primary healthcare system, integrated with higher levels of care, may enable better utilisation of scarce specialist resources.

Task shifting has been an area of discussion, but limitations are observed in the extent of task shifting, in a context where a clear delineation of responsibilities have not been codified by the NMC (Ravi et al, 2017), thus preventing MBBS doctors from treating some cases despite possessing the capability and resources to do so. Based on cross-country experiences, it has been observed that besides the regulatory environment, the fee structure (fee-for-service basis vs capitation model) and relative bargaining strength of various health workforce groups play an important role in determining the extent of task-shifting that is possible (De Maeseneer et al., 2019). The nature of task shifting required, that is, horizontal task-shifting (training an MBBS doctor to perform the tasks of an MD/MS), versus vertical task-shifting (training a nurse to perform the tasks of a doctor), also has a bearing on the success of task shifting, as former is easier to implement than latter (Munga et al, 2012).

In summary, the supply of specialists is a larger concern than the supply of doctors per se, given the increasing incidence of NCDs and the need for specialist care when considering six of the ten highest causes of deaths in India. Despite this, data on specialists' availability or gaps is not easily available. Based on availability within CHCs, the shortfall of specialists has widened considerably between 2005 and 2021, from 46% to 80%.

The production of specialists is driven by the number of medical colleges and PG seats, availability of teaching faculty, hospital support staff, and beds in teaching hospitals, as well as the number of seats available per specialty. However, only data on the number of PG seats is available, whereas disaggregated public-private and state-level data is not available for most of the time period of our analysis. At an aggregate level, the number of PG seats increased 3.7 times, from 17,294 in 2010–11 to 64,059 in 2022–23. Even if this was a substantial increase at an absolute level, on a relative basis, it has not been adequate when compared with international benchmarks (See Figure 15 and Tables A.8 and A.7 in the Appendix).

Figure 15. Yearly trends in postgraduate seats



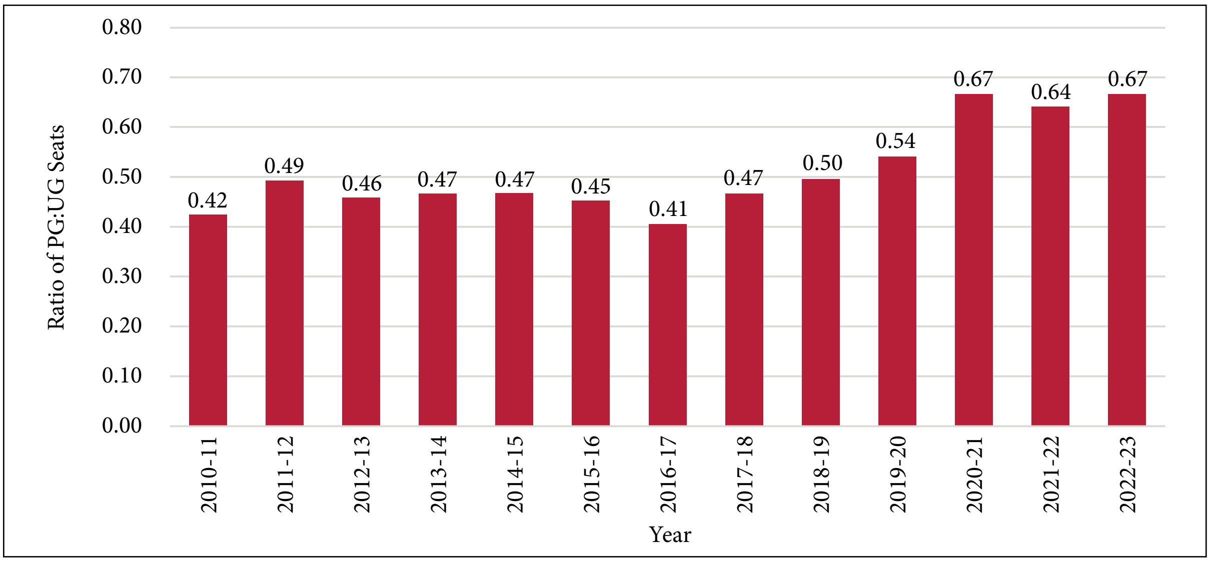
Source: India Stat and MoHFW annual Report, Rajya Sabha Question

Note: Postgraduate college data and seat break-up across public and private colleges are not available in the public domain for all the years.

An important metric to evaluate the production of specialists is the number of seats available at the PG level, relative to the number of MBBS seats (See Figure 16). This not only has a bearing on the availability of specialists in the country but also on students choosing to pursue an MBBS degree.[21] The PG to UG ratio of public and private medical colleges is skewed, with the public sector disproportionately contributing to PG seat expansion (See Figure 17). The norms for setting up courses for MD/MS degree are stringent and require large financial investments. This has led to private colleges preferring to add seats for the Diplomate of National Board (DNB) course over other PG seats. The 2022–23 PG to UG ratio for private medical colleges was 0.44, and 0.59 for public medical colleges, reiterating the important role of the public sector in contributing to the specialists' pool in the country. Even in the decades during which the number of private colleges increased rapidly, their contribution to the PG seat pool was limited. The adverse PG to UG ratio, in general, and more so for the private sector, points to the need to change the current incentive structure in order to encourage greater private sector participation. Further, wide inter-state differences were observed in the PG to UG ratio, which has a bearing on the availability of higher education in a student's home state (see Table A.4 in the Appendix).

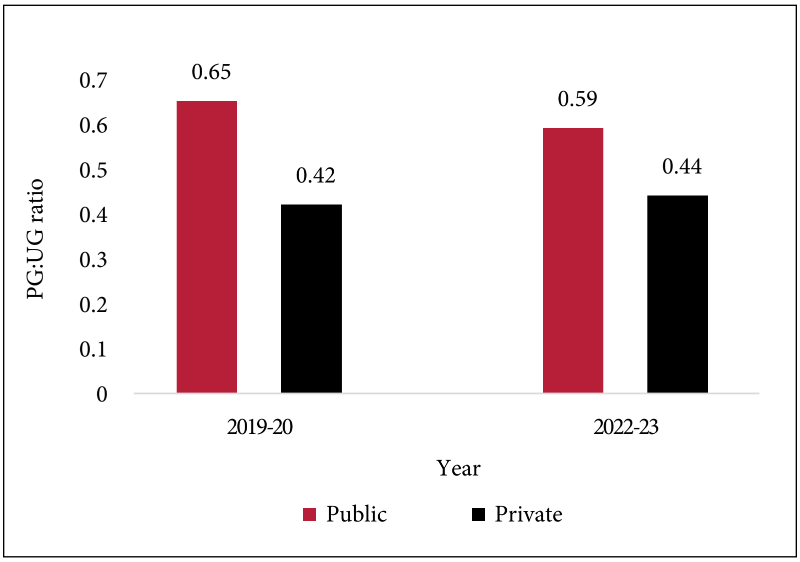
[21] Given the explicit preference for specialists in the Indian context and their high remuneration vis-à-vis general practitioners, most aspirants aim for a specialist degree, and the limited availability of seats at the PG level influence the decision to become a doctor in the first place.

Figure 16. PG–UG Seat ratio in India between 2010 and 2022



Source: Authors' calculation based on seat data in IndiaStat and Lok Sabha Questions

Figure 17. PG-UG ratio across public and private colleges between 2019 and 2022



Source: Authors' calculations based on Tables A.6 and A.7 in the Appendix

Table 9. Cross-country ratio of PG–UG seats

Country	PG-UG Ratio	Year
United States	1.85	2018–19
United Kingdom	5.98	2020–21 and 2021–22
China	1.01	2018
India	0.67	2022–23

Source: IndiaStat, AAMC

India's PG to UG ratio of less than one, and its inability to make rapid strides in expanding the same reveals one of the key barriers on the input side, and the resulting shortage of specialists in the country (See Table 11). Developed countries like the US and UK have built a much higher seat capacity at the PG level, given its importance in attending to a more complex disease burden, as these countries navigate their demographic transition. The slowing down of improvement in the PG to UG ratio in the last three years (See Figure 16) also reflects that, ironically, the bulk of seat capacity expansion has taken place at the UG level, even as India claims to have achieved the WHO norm of one doctor per 1,000 population (GoI, 2022a). The PG:UG ratio, in fact, is only likely to worsen once we account for the high incidence of vacant PG seats in recent times.

Alongside the overall shortage of PG seats, a significant number of PG seats, 4,614 (or 10.5%), of the total PG seats pool,[22] went vacant in 2019–20. This reflects that the overall increase in PG seats was partly led by the increase in those seats that have been historically characterised by low demand and limited interest among students, due to the limited rate of return on these courses (Hemant, 2022a). These typically include non-clinical and pre-clinical seats such as pharmacology, anatomy, physiology, biochemistry, and microbiology. The seats remained vacant even after the qualifying percentile was lowered (PTI, 2019b). The change in the admission rules by the Medical Counselling Committee in December 2021, which prevented the surrender of the seats not mopped up in the All-India Quota,[23] even after four rounds, to respective state governments, is also believed to have contributed to high seat vacancy (Bhandary, 2022). Earlier, seats that had not been filled under the All-India quota were transferred to the respective state governments as part of the state quota for their counselling process[24]. This is especially true for Tamil Nadu, Karnataka and Maharashtra, which have a higher number of government medical colleges. A detailed breakup of the departments and sectors (public vs private) that have seen an increase in medical seats is currently not available.

In summary, for both UG and PG courses, the greater contribution was made by public colleges. While India's PG to UG seat ratio has improved, it remains low in comparison with other countries. The stagnation in this ratio over the last few years suggests that higher seat expansion has taken place at the UG level in recent times. Adding to the concern is the PG seat expansion in areas of low demand.

3.4 Government Initiatives to Address the Shortage of Doctors and Specialists

Over the years, several committee recommendations and policy interventions (See Figure 18) have aimed to address some of the challenges of medical education, including the availability and distribution of medical colleges, augmenting of seat capacity, shortage of specialists, quality of education, and institutional mechanisms governing the medical education system in the country. The recent initiatives have focused on the following:

- Increasing infrastructure in underserved areas by setting up more government medical colleges.
- The launch of the Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) in 2006, with the aim of setting up AIIMS-like institutions in every state.
- Upgradation of central and state government medical colleges to increase the number of MBBS seats.

[22] The number of vacant PG seats in 2020–21 was 1,425 (2.6%), and 4,614 (7.2%) in 2022–23 (PTI, 2022a).
[23] The All-India Quota rounds are conducted to fill up 15% of seats in government and private medical colleges at the UG level, and 50% of government and private seats at the PG level.
[24] In one newspaper report, it was found that for Maharashtra, 295 PG seats for 2021–22 were vacant even after five rounds of seat allotments. Overall, about 10% of seats in government medical colleges and 22.8% of the total seats in private colleges remained vacant (HT, 2022).

- Revision of infrastructure requirements pertaining to land, staff, bed strength, equipment and other infrastructure, as part of the "Minimum Requirements for annual MBBS Admissions Regulations, 2020" to make the process of setting up a college more financially viable and incentivise the opening of more medical colleges (MoHFW, 2021). The maximum intake capacity at the MBBS level was revised from 150 to 250, and the student-teacher ratio and bed requirements were also rationalised, to expand seat capacity (See Table 10). From the 2018–19 academic session, the teacher-student ratio norms were changed at the PG level for all medical colleges; these were revised from 1:2 to 1:3 for professors and from 1:1 to 1:2 for assistant professors. The minimum bed requirement for a college with 150 seats was reduced from 750 prior to 2015, to 650 in 2015, and now 600 according to the latest standards. This had implications for faculty and resident requirements as well (MoHFW, 2021).
- Compulsory rural service to address the skew in doctor distribution.
- Realignment of roles to free up existing doctors through task shifting and creation of new cadres (multipurpose health workers and health assistants). Two-year diploma courses that can be pursued immediately after MBBS were launched in eight disciplines,[25] with the aim of addressing the shortfall of specialists, especially in remote areas.
- Revision of the curriculum and standardising of medical education across the country.
- The transition of the Indian Medical Council (IMC) to the National Medical Commission aimed at improving accountability and expanding the governance mandate to include fees in private colleges, EXIT tests, and compliance with the outlined ethical code of conduct.

As a result, the number of public and private medical colleges increased. However, due to the implementational challenges related to the pace of infrastructure development and escalation of costs, a large number of colleges remain non-functional.

The upgradation of the district hospitals into medical colleges is also a welcome move; a well-functioning hospital, with adequate patient base has far-reaching implications on the nature of clinical experience received and the quality of the pedagogy. Typically, it takes about two to three years for a greenfield hospital to become a full-functioning hospital and have the critical mass of patients across all specialties. The setting up of the hospital in itself is a substantial cost, which entails huge capital and operating cost, before its even functional.

Setting up the AIIMS has been a key policy intervention, but while infrastructure was created, enough attention has not been provided to the input required to running them. Of the 18 functional AIIMS, as many as 11 have a more than 40% shortage of teaching faculty, skewing the teacher-student ratio to as high as 1:5.4, against the norm of 1:2 and 1:3 (GoI, 2022b). Given the sharp rise in the number of medical colleges, attempts have been made to address the faculty shortage, through increasing the retirement age for teaching faculty, calling back retired faculty from armed forces colleges, and improving administration (speedy recruitment, revision of upper age limit, deputation, visiting faculty, inter-department sharing of faculty) for the newly created AIIMS.

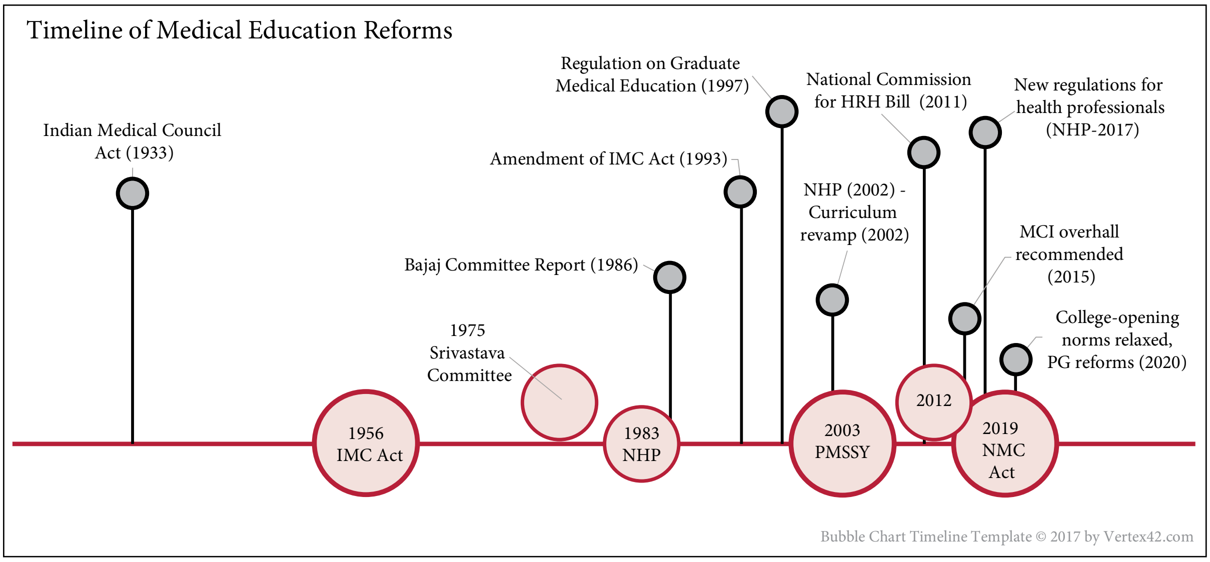
Cost overruns have also been common, ranging from Rs 332 crores in 2006 to Rs 900 crores in 2011 (Planning Commission, 2011), as the requirement of specialists and super-specialists were not accounted for earlier. With states being entrusted with the bulk of implementation responsibilities, the performance of the infrastructure developed varies significantly across states; this reflects the variable administrative and institutional capacities across states.

[25] Anaesthesia, Gynaecology & Obstetrics, Paediatrics, ENT, Ophthalmology, Family Medicine, Tuberculosis and Chest Diseases, and Medical Radiodiagnosis.

The increase in PG medical seats has largely been a result of the rationalisation of the teacher-student ratio and the increase in the number of available teaching faculty, as individuals holding a diploma degree were permitted to teach, contrary to the earlier criteria that required them to possess MS, MD or DNB qualifications in order to teach in medical colleges. The change in the student-teacher ratio can also have a bearing on the quality of education, although no empirical analysis has been carried out in this regard. Similarly, the recently introduced District Residency program improves the availability of the doctors at the district hospitals. The program mandates that PG students spend three months in District Hospital in either the second or third year of their college. Given that the program consists of multiple stakeholders, the medical college, the state health department overseeing the district hospitals and the NMC, it necessitates inter-departmental co-ordination to facilitate smooth functioning of the program.

In summary (See Table 11), while concerns pertaining to the shortage of doctors in India as a whole are less acute, the solutions to address the rural–urban and inter-state disparities in the availability of health workforce have not been very effective. Even in the context of addressing the shortage of specialists, progress has been slow. The alternative PG-level courses (CPS, DNB, PGDCC) have not received uniform recognition across states or consistent recognition over time. In the case of task shifting, the lack of clarity from the MCI regarding the permitted set of procedures for every degree recipient has had far-reaching implications in terms of the patients who can be treated by MBBS doctors (Ravi et al, 2017). The stance on the role of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) doctors and their integration into the mainstream healthcare system has also been fraught with challenges, with opposition from allopathic doctors. Thus, they have been operating as a separate, parallel system, governed by an altogether different ministry (MoHFW, 2022a).

Figure 18. Timeline of Medical Education Reforms



Source: Authors' visualisation based on review of policy documents

Table 10. Rationalisation of bed and faculty requirements in a college with 150 seats

Year	Bed requirement	Faculty Requirement	
		Faculty	Residents
Before 2015	750	152	115
2015	650	132	85
2020 (New standards)	600	116	76

Source: MoHFW (2021)

Table 11. Categorisation of government measures to address the shortage of doctors and specialists

Key Problems	Regulatory reform	Financing	Infrastructure Development	Other Initiatives
1. Low production of doctors (per 100,000)	1.Relaxation in teacher-student ratio, land, beds and other infra requirements 2. Increase in max. intake - 150 to 250 3. NMC replacing MCI	Reservation of seats in private colleges at govt college rates (not uniformly implemented)	PMSSY launched in 2006, upgradation of district hospitals to govt medical colleges	NEET & NExT
2. Distribution of Seats and availability of newly added doctors	1. UG state quota – 85% 2. Service bonds		Setting up medical colleges in underserved areas	
3. Shortage of specialists	1. DNB equivalent of MD/MS 2. CPS recognised 3. District hospital residency 4. Expedited timeline for MBBS colleges applying for PG			Introduction of PG Family Medicine, Launch of two-year diploma courses in eight, high-priority subjects
4. Low Private sector participation		Viability-gap funding for PPP projects increased		
5. Availability of data	NMC announced UID for each doctor			

Source: Various GoI documents

3.5 Alternative Measures to Address the Shortage of Specialists

Over the years, besides seat expansion, the government has also designed a number of alternative programmes to address the shortage of specialists. However, the absence of uniform acceptance across states and internal inconsistencies within the erstwhile Medical Council of India and National Medical Commission in recognising the legitimacy of these courses has created a lot of confusion, as will be seen in the following instances. The students graduating from these courses often face differential treatment during government recruitment processes, despite possessing the requisite skillset. We discuss each of these courses in terms of the gaps they address and the regulatory stance towards them.

3.5.1 Diplomate of National Board

The government introduced the Diplomate of National Board (DNB) course in 1975 to address the shortage of doctors and teaching faculty. While MD/ MS and DNB training is largely similar across three years, the apex authority in charge of the functioning of the DNB is the National Board of Examination, which is an autonomous body under the MoHFW, whereas MD/MS degrees are awarded by the respective medical college and/or affiliated university. While the MD/MS degrees have a relatively greater focus on research-related aspects, the DNB focuses more on practical training aspects. Currently, the DNB contributes 12,648 seats to the PG seat pool (19.7% of the total) across 80 disciplines. The private sector has been actively encouraged by the government to introduce the DNB courses because of the lower requirements for starting the course vis-à-vis MD/MS. Students of this course also benefit from the speciality training of a private hospital with a legacy in that particular speciality. The private sector in turn has actively participated in the expansion of DNB seats, and currently contributes 67% of the total DNB seat pool (MoHFW, 2022d).

While various notifications by the government have recognised the equivalence between a DNB and MD/MS, in practice, graduates of the former have repeatedly faced exclusionary discrimination in hiring as teachers and doctors in government hospitals. Bhattachaarya et al. (2020) provide a detailed timeline of the phases of equivalence and non-equivalence between a DNB and MD/MS since the former's inception. The other key discrimination faced by DNB graduates pertains to the vast discrepancy between the pass percentages of the MD/MS and DNB candidates. While the MD/MS have a success rate of 80%–90%, for select specialities, the DNB pass percentage is much lower, at about 40% (Nagarajan, 2021).

3.5.2 College of Physicians and Surgeons

The College of Physicians and Surgeons (CPS) offers a two-year diploma course that was launched to address the shortage of specialists in rural areas, where MD/MS/DM/MCh courses are not available. The key subjects covered under the course are obstetrics and gynaecology (OBGY), paediatrics, ophthalmology, orthopaedics and anaesthesia. The course is run by an autonomous body headquartered in Mumbai. It is now no longer recognised by the government of Maharashtra. This course was originally initiated in 1913 by the British government to create a cadre of intermediate specialists. While its history dates back to the pre-independence period, the legitimacy granted to the degree in the form of recognition by the NMC is fairly recent. The MCI recognised the CPS Diplomas in October 2017 and then de-recognised other CPS degrees only four months later (MD Bureau, 2022). These courses were recognised again only after intervention by the MoHFW (Thakur, 2018; MoHFW, 2022b). The recognition of the CPS degree will also address the shortage of specialists in government hospitals at no additional cost, as these same doctors are currently admitted to government hospitals as MBBS doctors (GoI, 2019). It will also result in 164,000 doctors being recognised as intermediate specialists. The role of these doctors in reducing the maternal mortality rate (MMR) in Maharashtra has been documented (GoI, 2017) and recognised by the government as well, as about 45% of the specialists in the Maharashtra public health service hold

CPS diplomas. However, the degree is not yet recognised by all state medical councils. As of date, the CPS diploma is recognised by Government of Maharashtra, Gujarat, Rajasthan, Dadra Nagar and Haveli, West Bengal, Tamil Nadu, Punjab and Odisha.[26]

3.5.3 Postgraduate Diploma in Clinical Cardiology (PGDCC)

The postgraduate diploma in clinical cardiology (PGDCC) was initiated in 2006 to develop a cadre of non-interventional cardiologists and address the shortage of cardiologists to a certain extent. The course entailed two-year, full-time extensive training in leading cardiac hospitals in the country. The course admission was granted through an all-India entrance exam conducted across 77 tertiary care hospitals, including many government medical colleges. This course was conducted alongside the DM and DNB cardiology programme, and also involved sharing of faculty between these two courses; as such, it was not a typical distance learning course offered under the Indira Gandhi National Open University (IGNOU) structure.

However, the degree was de-recognised in 2020, resulting in many MBBS doctors (1,700 doctors) losing their specialist status. All students who received their diplomas between 2006 and 2013 lost their specialist status (ironically, the course was inaugurated by the then-Health Minister in 2006), even as the 1992 University Grants Commission (UGC) order recognised the equivalence between an IGNOU degree and a regular college degree (Singhania, 2020).

Countering the narrative presented by students and states, the MCI held that the course started by IGNOU was fraught with "blatant violation" of the extant rules and regulations pertaining to medical education in the country. The IGNOU, reportedly, had also not sought an NOC from the MCI before starting the course. While the matter had been appealed to the NMC and MoHFW, the former subsequently announced in its Draft Postgraduate Medical Education Regulations 2021 that no new PG diploma courses would be permitted from the year 2021 onwards (MD Bureau, 2020; Misra, 2021)

3.5.4 Family Medicine/Family Physician

Another programme that is being considered by the government to address the shortage of specialists is PG in family medicine. The government's stance on family medicine is that it is a move away from specialisation and super-specialisation (MoHFW, 2020). This course will first be introduced in six recently functional AIIMS and, depending on the response, will be extended to other colleges as well. The course focuses on general medicine, basic surgery, gynaecology, paediatrics, etc. The acquaintance with the family's medical history will provide better insight into hereditary issues, and shift the burden of attending to ailments like diabetes, hypertension, minor gastric problems, and paediatric issues away from specialists (PTI, 2022b).

Andhra Pradesh has also introduced a family physician concept at the sub-centre level on a trial-run basis (GoI, 2022d). The concept of family medicine has been fairly popular in the US and UK, where 50% of the PG residency seats are in family medicine. The training of General Practitioner doctors in UK is akin to the MBBS + Family Medicine program in India. In India, regulatory barriers have prevented the mainstreaming of family medicine (Kumar, 2014).

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[26] It is also recognised by the Malaysian government as at being par with a university degree. The Fellow CPS degree (anaesthesia) is also recognised by Royal College of Anaesthesia, England, and the holder is eligible to apply for the Medical Training Initiative in the UK, which provides international medical graduates with comprehensive training and experience of working in the National Health Service (NHS).

4. Insights from Global Practices

One of the major reforms utilised by developed countries to address doctor shortage involves attracting doctors from abroad through relaxed immigration restrictions, the promise of better working conditions and higher standards of living. India has been among the leading exporters of health workforce to the developed world. We discuss viable initiatives for developing countries like India to address its doctor shortage and distributional concerns. These policy initiatives address the following specific concerns:

- Optimising usage of scarce resources
- Improving limited seat capacity
- Addressing distributional concerns pertaining to rural-urban disparities
- Improved accountability of the health workforce with respect to addressing population needs
- Improving the return on investment for doctors to address the trade-off of practising in public versus private sector

One of the key initiatives introduced to ensure optimal utilisation of scarce resources includes task shifting. While some countries have focused on shifting duties to the existing workforce, others have created a separate cadre of workers. For instance, a cross-country comparison of the doctor–population ratio (See Table 12) reveals that both Thailand and India have the same doctor-population ratio.[27] However, Thailand outperforms India in a number of health outcome indicators. This is partly to do with the fact that the nurse-doctor ratio in Thailand at 3.4 is much higher than for India ratio of 2 (OECD, 2020), which enables significant task-shifting and efficient utilisation of the limited resources in the case of Thailand (Pagaiya, 2009). Brazil and USA have created a separate cadre of workers that take over some of the routine tasks of doctors and nurses. The transfer of these duties has occurred at differing degrees across different countries. For instance, in 1965, the US introduced a separate cadre called "physician assistants" against the backdrop of a shortage of primary-care providers;[28] since then, physician assistants have become an integral part of the US health workforce. The presence of physician assistants frees up the doctor's time spent per patient, especially in areas with limited availability of doctors, and also ensures the provision of the basic first point of care across more remote areas as well. The lower entry barriers (no requirement for a bachelor's degree in some instances), entry salary higher than that of even MD doctors and prescribing rights across 47 US states, have made the role of physician assistants an attractive proposition to individuals (Hutchinson et al, 2001). Such a separate cadre seems relevant for rural and remote areas in India as well, especially where the doctors can be accessed less frequently (Al Shamsi, 2017).

[27] Here we are comparing the reported estimates of India with Thailand, the effective doctor-population ratio in India is 0.6 to 0.7.

[28] The conclusion of the Vietnam war had also freed up a section of the war workforce that was involved in providing medical care but was not "qualified" per se (Hutchinson et al, 2001).

Table 12. Doctor-population ratio across countries

Country	Doctor-population ratio (per 1,000)	Year of reporting
Cuba	8.40	2018
United Kingdom	5.80	2019
Mexico	4.80	2018
Germany	4.30	2018
United States	2.60	2018
Japan	2.50	2018
Brazil	2.30	2019
China	2.00	2017
Turkey	1.80	2018
Sri Lanka	1.20	2019
Thailand	0.90	2019
India	0.90	2019
Bangladesh	0.60	2019

Source: World Bank (2022)

Note: The reported numbers may or may not be reflective of the actual availability of doctors, as the reporting standards vary widely across these countries. This ratio does not include traditional healers and medical practitioners of other alternative systems of medicine.

Similarly, as part of its Family Health Program (*Programa Saúde da Família*) introduced in 1994, Brazil transferred greater responsibilities to Community Health Workers (CHWs). By focusing on early diagnosis, ensuring medication adherence, and promoting healthy lifestyle choices as part of home visits, CHWs helped to address both the acute and steadily rising chronic disease burden. They have also proved to be valuable sources of information, providing continuously updated population registers by ensuring that disease surveillance is population-based and not merely based on who interfaces with formal healthcare services. While India has created a similar cadre in the form of the Accredited Social Health Activist (ASHA) and Auxiliary Nurse and Midwife (ANM) workers, the current workload and remuneration structure, and absence of strong family medicine-focused training has hindered the reaping of similar results.

The focus on improving seat capacities in existing colleges has largely been observed in the case of developed countries that have introduced this intervention with limited success. Canada, UK and Australia have utilised this strategy to address the shortage of doctors, but only to a limited extent, as the human resources required for such expansion, including not just teachers but nurses and other hospital support staff, do not increase at the same rate.

The distributional concerns pertaining to rural–urban disparities in the availability of health infrastructure and workforce have, in fact, been creatively addressed by different countries, through a mix of incentives and regulation. Some countries have focused on setting up colleges in rural and remote areas, giving a strong preference to residents of those regions at the enrolment stage.[29] For

[29] Kapadia and McGrath (2011) explain the need to distinguish between the two core concerns of whether there are fewer applications from rural areas or applicants just receive fewer offers. They found that in context of Alberta, rural applicants formed a lower proportion of the total pool of applicants in comparison to their population.

instance, in the US in 1974, the Thomas Jefferson University introduced the Physician Shortage Area Program to address the issues of shortage and retention pertaining to rural family physicians in the state of Pennsylvania. Among other criteria, the programme listed the experience of growing up in a rural area and intention to continue practising family medicine in the rural area there, as one of the determinants of enrolment. The programme was able to contribute to 12% of the entire family physicians' pool in Pennsylvania, and the long-term retention of these graduates in rural family medicine was more than 70% after 20–25 years (Rabinowitz et al., 2022). The widely successful programme expanded to the state of Delaware as well, and included any specialty necessitated in the rural areas and small towns as part of its course offering (Rabinowitz, 2011). In a similar vein, in the early 2000s, Canadian medical schools introduced "distributed medical education centres," which involved opening rural/satellite campuses, and initial studies confirm the positive impact of these colleges on the retention of the workforce in rural areas (Islam, 2014). This policy was introduced in developed countries after the realisation that the migrants from abroad were proving to be only temporary solutions to the workforce shortage in rural areas, as they would exit rural and remote areas as soon as their mandatory service period ended (Audas, 2005).

Other countries have improved the attractiveness of practising in rural areas and public facilities by introducing a range of financial incentives. For instance, in 2022, the Australian government announced the waiver of the debt taken under its Higher Education Loan Program (HELP) for students who agree to do service in "remote" areas for as long as half the time it took them to get their degree. For those who agree to work in "large, medium or small rural towns," this duration would be the full time taken to obtain their degree. As part of the programme, they are expected to dedicate at least 24 hours per week to the service. This was applicable to both doctors and nurses (Marchant, 2022). Turkey provides bonuses and higher salaries to its practitioners in rural areas, but so far, this reform has received mixed success. Turkey's other key reform which has helped the country in ensuring higher retention of doctors in public hospitals is the introduction of the performance-based payment system that has resulted in the number of part-time practising physicians declining to eight per cent in 2010, from a peak of 89 per cent in 2002. (Ministry of Health General Directorate of Personnel, 2011 as cited in Tatar et al., 2011). The low salaries, high workload, high opportunity cost of giving up private practice[30] and poor working conditions in public hospitals in India necessitate reforms in recruitment structures, as pointed out in previous sections, as well as re-designing of financial incentives to make these jobs more desirable. The feedback data on the service in public hospitals, collected through the Mera Aspataal application, provides a ready source of information to assess doctors' performances on select metrics and reward them accordingly.

Some developed countries have utilised regulation to address the distributional inequities in the health workforce. For instance, in Germany, Norway and some provinces in Canada, restrictions are placed on the geographical areas where a doctor can practice, by taking into consideration the extant supply of doctors in that region. In Germany, self-employed doctors are not allowed to set up practice and serve public patients in a catchment area that is considered "overserved" based on the patient-to-doctor ratio. Among developing countries, regulation has focused on introducing bonds for compulsory service in rural areas and in government facilities. Turkey, like India, has a compulsory rural service component that is uniformly implemented for 1–2 years, depending on the branch of medical residency and the region in question (Tatar et al, 2011). The bond conditions in India are at the discretion of the state government, with wide differences in terms of the year of compulsory service expected, which is separate for UG and PG degrees. The state-wise variations in

[30] There is no uniformity among states with respect to allowing private practice for government doctors, and the rules are further complicated by different provisions for contractual doctors and permanent appointed doctors. The Central Health Service rules, 2014 mandates that doctors appointed under Central Health Service will not engage in any form of private practice and are entitled to a non-practicing allowance of 20% of basic pay subject to certain conditions (MoHFW, 2019).

bond conditions and penalties associated with breaching the same may also have disproportionately impacted the decision of students to choose their college in a given state.

Another solution emerging from the literature is reducing the time period required to become an independent medical practitioner, which can not only address the shortage of doctors in the short-term, but also reduce the opportunity cost of becoming a doctor. There are wide variations across countries regarding the point at which they are eligible to become part of the medical school and also the number of years of training they are expected to undergo before they can practice independently. In Britain, students can enter medical school at 18 years of age, based on their performance in secondary schools; in North American and some Australian schools (e.g., Queensland, Sydney and Flinders), students are required to be science graduates, while European schools (e.g., Belgium and Italy) operate on a free admissions policy, where selection into the programme is attained through attrition (Parsell and Bligh, 1995). In the case of India, given that age of entry is 17–18 years (after Class 12), the years of training are relatively lower than in developed countries, leaving little room for further rationalisation (See Table A.15 in Appendix for comparison).

5. Discussion and Policy Insights

Over the past decade, particularly in the past five years, India has made rapid strides in the expansion of seat capacity, and the public sector has outperformed the private sector in terms of increasing the number of medical seats and colleges available. A host of relaxations in infrastructure requirements were provided to attract greater private participation in setting up medical colleges. The government also ventured into public–private partnerships to increase the availability of medical colleges in underserved areas. The 2019 institutional reform of replacing the Medical Council of India with the National Medical Commission has led to relatively greater representation of different public stakeholders and a more comprehensive structure to govern the quality of various aspects of education provision.

As a result of these interventions, the country has witnessed an increase in the number of medical colleges and seats. Over the last decade, there has been a near doubling of colleges, from 335 in 2011 to 612 in 2023. The number of UG seats has also more than doubled over the same period, from 40,775 to 92,127 seats. Even more remarkable has been the rate of improvement availability of PG seats, which witnessed an almost four-fold increase over the last decade, from 17,294 seats in 2011 to 64,059 seats in 2023.

Despite these positive movements on several fronts, continuing and perhaps stronger policy attention is required in the following aspects: improving the functionality of colleges in the context of teaching and non-teaching faculty, increasing the number of seats (especially at the PG level) and seats per college; equitable distribution of seats and production of doctors across geographies and retention of doctors in underserved areas.

While teaching faculty shortages have been addressed through piecemeal reforms such as relaxing the age of retirement, allowing visiting faculty, etc., the key structural barrier of the disincentives of moving from practice to teaching has not been addressed effectively. The high vacancy in teaching positions, despite rationalisation in the teacher-student ratio and relaxation of a host of other norms, even in premier institutes like AIIMS Delhi, points to structural shortcomings in the current recruitment and compensation structure for teaching faculty in medical colleges. These include delays in appointing ad hoc teachers as permanent faculty, stringency in eligibility and promotion criterion, and lack of adherence to procedures for filling positions under reserved categories (Ananthakrishnan, 2007). The lack of recognition of teaching duties performed by specialists and general duty medical officers in their teaching departments and significant opportunity costs of giving up full-time practice disincentivise the shift to teaching.

The absence of both attractive monetary and non-monetary incentives (huge research grants, adequate lab equipment and dedicated time for research activities) has proven to be a major deterrent to attracting talent, especially in the more rewarding clinical departments. The government has allowed the recruitment of visiting faculty over and above the sanctioned posts, to improve the quality of training. However, such recruitment often substitutes rather than supplements the existing permanent faculty. There is also a need to provide more weightage to clinical experience of teachers, as the current recruitment process prefers a person with prior teaching experience, with everything else being constant.

The current focus of government reforms has been inadequate in addressing the faculty shortage issue, which has far-reaching implications on both, the future supply and quality of doctors. Ananthakrishnan (2007) observes that the teaching faculty requirements outlined by the NMC are minimum rather than "optimum requirements," necessary for the optimal functioning of a system. The existing requirements do not account for the sizeable time needed for research activities– an important output of any well-functioning medical education system. The shortage of faculty and requisite equipment also affects the research output (Jha, 2022). With respect to encouragement of greater research in the medical education space, there is a need to rethink the financing of the research. The current reliance has been on grants from various government departments, Department of Biotechnology (DBT), Department of Science and Technology (DST) and Indian Council of Medical Research (ICMR), but there is a need to consider long-term partnerships with the industry as well. This would enhance the availability of funding for research, and also will introduce greater dynamism in the overall curriculum and instruction space in the country. The integration of education, a well-functioning hospital and a vibrant research environment is crucial for delivering quality medical education in India.

Despite having the largest number of medical colleges in the world, India's seats per colleges is lower in comparison to Eastern Europe and China. Till recently, the requirements for setting up and expanding the MBBS seat capacity in medical colleges were found to have linearly expanded in accordance with seat capacity, thereby disincentivising expansion, particularly from the private sector. In the latest MSR 2023 guidelines government also explicitly capped the number of MBBS seats at 150 thereby increasing regulatory barriers to scaling of medical education and impacting the future availability of doctors. While government's rationale to cap the seats stems from maintaining the quality of education, there is room to scale further by leveraging technology, and keeping human resource requirements constant.

The expansion in seat capacity at PG level also has largely been an outcome of the relaxation in the teacher–student ratio norms as well as other norms for the operation of medical colleges without concomitant augmentation of human and physical infrastructure.Even where PG seats have been increased, this expansion has occurred in areas of low demand. The constraints to the expansion of high-demand seats, such as the availability of beds and faculty, persist, thereby widening the gap between the need and production of specialists.

While the emphasis on the DNB program is a positive step in tackling the shortage of specialists, there are concerns about how DNB is perceived in comparison to MD/MS degrees. Addressing these concerns is crucial to ensure that DNB holders can be effectively integrated as teaching faculty in medical colleges. Similarly, the optimal utilisation of existing workforce of specialists necessitates greater task shifting to both MBBS doctors and nurses.

While increasing the pool of specialists has been acknowledged as a policy priority, the optimal utilisation of the current health workforce is also a related priority. Despite the ability of general physicians to manage a large number of diseases or medical conditions, patients' preference for specialists crowds out specialist services for those actually in need (Makkar et al, 2003; Unnikrishnan and Sharma 2018). Thus, freeing up specialists' time such that they can attend to the tasks they have specialised in becomes a key priority. This can be done through shifting of tasks across the workforce, and implementing systems designed to gatekeep, in order to reduce the unnecessary load on specialists. A stronger primary healthcare system with stronger referral systems in place may also enable better utilisation of scarce specialist resources. As noted from the experiences of other countries, part of the clinical management of NCDs can be successfully achieved with the help of general physicians, nurses and community health workers. Separate cadres, such as those in the US, Thailand etc., have the potential to address both, the shortage and maldistribution of doctors. In fact, the National Medical Commission Act (2019), recommended the creation of a cadre of workers called Community Health Providers to facilitate task-shifting. These workers would be provided with a limited license to practice preventive and primary care at the mid-level. This cadre is currently operational in the Ayushman Bharat Health and Wellness Centres (AB-HWCs), and recommendations are underway to ensure its complete integration into the primary care team by establishing permanent positions (MoHFW, 2022c).

The distribution of doctors continues to be a challenge in underserved areas. Attempts have been made to address this by developing more colleges in these areas. However, trends in the intra-country migration of doctors point to structural constraints that inhibit equity in supply, despite attempts at balancing production. Pull and push factors, in the form of incentives and disincentives, need greater attention, with the overall aim to retain doctors in their state of education. Similarly, the recruitment timelines for doctors into public services need to be streamlined; the process currently takes a year on average and entails high financial opportunity costs[31]. The entire process needs to be decentralised, with the central government acting largely in an advisory and supervisory capacity.

This study also brought to light the need for more data collection and data reporting mechanisms. The breadth of the analysis in the current study was limited by the lack of data, especially at the PG level. State-wise data on the number of PG seats and colleges offering PG degrees, as well as speciality-wise data, is not available in the public domain in an easily accessible manner. We also observe that while there are multiple government initiatives that are collecting data on active health professionals (i.e., doctors), namely the Ayushman Bharat Digital Mission (ABDM) Health Professionals Registry[32] and National Health Resource Repository, none of this data is available in the public domain in a consolidated manner. Similarly, there is no single source in the public domain for data on the number of private hospitals, number of beds and specialities in each private hospital.

[31] As noted by a former senior bureaucrat

[32] Only doctors who consent to have their information publicly visible are listed on the website. There is no way to access even the masked data of doctors who do not consent to data-sharing.

Appendix

Table A.1. State-wise doctor-population ratio for 2019 (active workforce)

State	Doctor-population ratio (per 1,000) in 2019	Doctor-population ratio (per 1,000) in 2019	Doctor-population ratio (per 1,000) in 2019
	Allopathic Doctors	Allopathic Doctors + Dental surgeons	Allopathic doctors + Dental surgeons + AYUSH practitioners
Andhra Pradesh	1.42	1.71	1.77
Assam	0.56	0.63	0.68
Bihar	0.31	0.36	0.84
Chhattisgarh	0.27	0.37	0.55
Goa	2.02	2.73	3.46
Gujarat	0.82	1	1.5
Haryana	0.4	0.65	0.94
Himachal Pradesh	0.35	0.62	1.51
Jammu & Kashmir	0.92	1.16	1.36
Jharkhand	0.14	0.14	0.16
Karnataka	1.54	2.07	2.66
Kerala	1.5	1.98	2.5
Madhya Pradesh	0.39	0.47	0.82
Maharashtra	1.2	1.47	2.49
NCT of Delhi	1.01	1.62	1.95
Odisha	0.44	0.48	0.74
Punjab	1.36	1.78	2.19
Rajasthan	0.48	0.55	0.75
Tamil Nadu	1.53	1.8	2
Telangana	0.17	0.19	0.65
Tripura	0.39	0.43	0.53
Uttar Pradesh	0.29	0.36	0.66
Uttarakhand	0.64	0.78	1.12
West Bengal	0.61	0.66	1.01
Arunachal Pradesh	0.62	0.76	0.99
Nagaland	0.05	0.07	0.12
Mizoram*	0.07	NA	NA
Sikkim#	1.7	1.76	NA
India	0.74	0.91	1.29

Note: The numbers reported here are based on the MOHFW assumption that only 80% of the workforce is active.

**Data on dental surgeons is not available. There is no separate board/council for the registration of AYUSH practitioners in the state.*

#There is no separate board/council for the registration of AYUSH practitioners in the state.

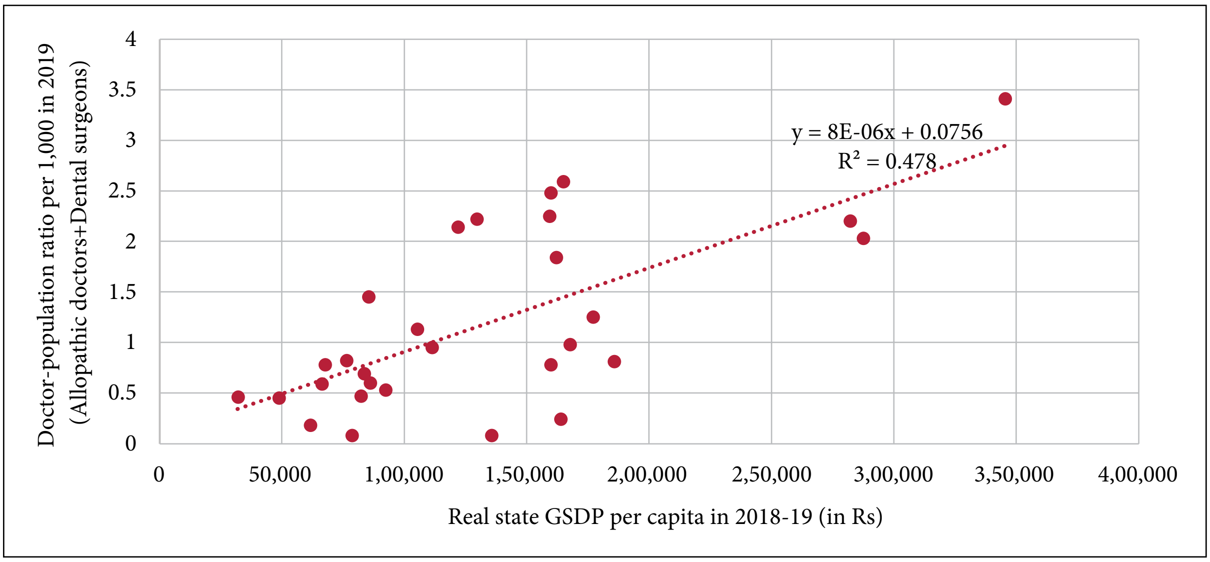
Source: CBHI (2021)

Table A.2: Status of teaching faculty vacancy in Uttar Pradesh (2022)

College Name	Type	Sanctioned Post	Filled Post		Total Filled Post	Posts filled through Adhoc appointment as a % of Total Sanctioned post	Number of Vacant Posts	Vacant seats % of Sanctioned post
			Permanent	Adhoc				
Kanpur Medical College	Professor	66	57	6	63	9.1	3	4.5
	Associate Professor	70	16	8	24	11.4	46	65.7
	Assistant Professor	132	62	38	100	28.8	32	24.2
	Total	**268**	**135**	**52**	**187**	**19.4**	**81**	**30.2**
Agra Medical College	Professor	55	57	10	67	18.2	0	0.0
	Associate Professor	79	22	15	37	19.0	42	53.2
	Assistant Professor	124	53	57	110	46.0	14	11.3
	Total	**258**	**132**	**82**	**214**	**31.8**	**44**	**21.7**
Meerut Medical College	Professor	48	21	10	31	20.8	17	35.4
	Associate Professor	61	21	17	38	27.9	23	37.7
	Assistant Professor	92	37	46	83	50.0	9	9.8
	Total	**201**	**79**	**73**	**152**	**36.3**	**49**	**24.4**
Gorakhpur Medical College	Professor	43	32	8	40	18.6	3	7.0
	Associate Professor	83	17	7	24	8.4	59	71.1
	Assistant Professor	131	27	49	76	37.4	55	42.0
	Total	**257**	**76**	**64**	**140**	**24.9**	**117**	**45.5**
Prayagraj Medical College	Professor	52	30	15	45	28.8	7	13.5
	Associate Professor	62	28	19	47	30.6	15	24.2
	Assistant Professor	111	63	28	91	25.2	20	18.0
	Total	**225**	**121**	**62**	**183**	**27.6**	**42**	**18.7**
Jhansi Medical College	Professor	37	12	6	18	16.2	19	51.4
	Associate Professor	52	21	7	28	13.5	24	46.2
	Assistant Professor	80	24	35	59	43.8	21	26.3
	Total	**169**	**57**	**48**	**105**	**28.4**	**64**	**37.9**
Ambedkar Nagar Medical College	Professor	24	5	3	8	12.5	16	66.7
	Associate Professor	29	9	4	13	13.8	16	55.2
	Assistant Professor	51	25	15	40	29.4	11	21.6
	Total	**104**	**39**	**22**	**61**	**21.2**	**43**	**41.3**
Kannauj Medical College	Professor	24	12	5	17	20.8	7	29.2
	Associate Professor	29	4	4	8	13.8	21	72.4
	Assistant Professor	54	33	19	52	35.2	2	3.7
	Total	**107**	**49**	**28**	**77**	**26.2**	**30**	**28.0**
Azamgarh Medical College	Professor	24	9	6	15	25.0	9	37.5
	Associate Professor	29	12	9	21	31.0	8	27.6
	Assistant Professor	45	33	12	45	26.7	0	0.0
	Total	**98**	**54**	**27**	**81**	**27.6**	**17**	**17.3**
Saharanpur Medical College	Professor	22	7	5	12	22.7	10	45.5
	Associate Professor	27	11	6	17	22.2	10	37.0
	Assistant Professor	46	36	4	40	8.7	6	13.0
	Total	**95**	**54**	**15**	**69**	**15.8**	**26**	**27.4**
Jalaun Medical College	Professor	23	5	2	7	8.7	16	69.6
	Associate Professor	30	6	6	12	20.0	18	60.0
	Assistant Professor	50	31	19	50	38.0	0	0.0
	Total	**103**	**42**	**27**	**69**	**26.2**	**34**	**33.0**
Bandha Medical College	Professor	20	13	2	15	10.0	5	25.0
	Associate Professor	31	8	6	14	19.4	17	54.8
	Assistant Professor	56	22	10	32	17.9	24	42.9
	Total	**107**	**43**	**18**	**61**	**16.8**	**46**	**43.0**
Badaun Medical College	Professor	20	2	6	8	30.0	12	60.0
	Associate Professor	29	2	6	8	20.7	21	72.4
	Assistant Professor	40	22	11	33	27.5	7	17.5
	Total	89	26	23	49	25.8	40	44.9
J.K. Cancer, Kanpur	Professor	2	2	0	2	0.0	0	0.0
	Associate Professor	6	5	2	7	33.3	0	0.0
	Assistant Professor	6	4	1	5	16.7	1	16.7
	Total	**14**	**11**	**3**	**14**	**21.4**	**0**	**7.1**
Heart care Institute, Kanpur	Professor	4	3	0	3	0.0	1	25.0
	Associate Professor	5	7	1	8	20.0	0	0.0
	Assistant Professor	25	8	8	16	32.0	9	36.0
	Total	34	18	9	27	26.5	7	29.4
Grand Total		**2129**	**936**	**553**	**1489**	**26.0**	**640**	**30.1**

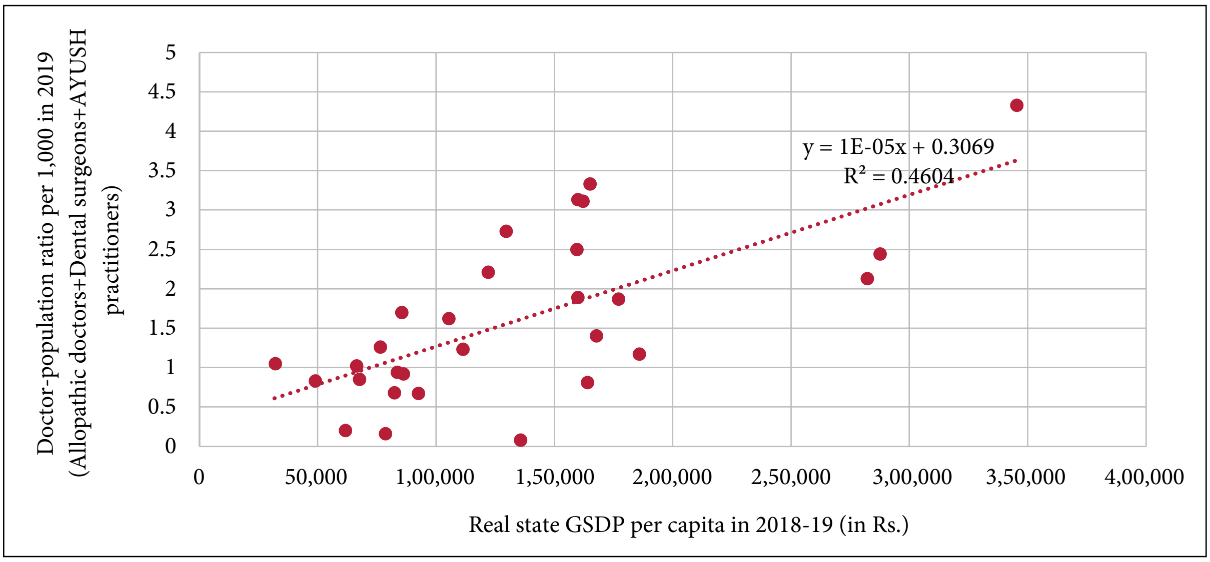
Source: Uttar Pradesh Directorate of Medical Education

Figure A.1. Relationship between real per capita GSDP and Allopathic Doctors+Dental Surgeons



Source: CMIE and CBHI (2021)

Figure A.2. Relationship between real per capita GSDP and Allopathic Doctors+Dental Surgeons + AYUSH practitioners



Source: CMIE and CBHI (2021)

Table A.3. State-wise availability of specialists in CHCs in rural areas

	2005	2005	2005	2022	2022	2022
State	Sanctioned as a proportion of required (in %)	Shortfall against required (in %)	Vacancy as a proportion of sanctioned posts (in %)	Sanctioned as a proportion of required (in %)	Shortfall against required (in %)	Vacancy as a proportion of sanctioned posts (in %)
Andhra Pradesh	61.9	65.9	44.8	73.4	52.5	35.3
Arunachal Pradesh	3.2	100.0	100.0	NA	95.2	NA
Assam	NA	NA	NA	38.8	74.0	33.0
Bihar	NA	NA	NA	119.1	70.1	74.9
Chhattisgarh	100.0	96.1	96.1	92.2	90.1	89.3
Goa	70.0	65.0	50.0	91.7	91.7	90.9
Gujarat	29.5	91.5	71.3	29.9	90.8	69.1
Haryana	100.0	83.0	83.0	26.4	93.6	75.7
Himachal Pradesh	NA	NA	NA	NA	95.2	NA
Jharkhand	NA	NA	NA	100.0	69.7	69.7
Karnataka	83.0	32.0	18.0	63.3	63.9	43.0
Kerala	100.0	80.7	80.7	5.9	94.3	4.0
Madhya Pradesh	27.6	94.7	80.6	89.8	95.0	94.5
Maharashtra	130.0	28.1	44.7	44.1	69.4	30.8
Manipur	62.5	70.3	52.5	100.0	43.8	43.8
Meghalaya	1.0	99.0	0.0	4.5	95.5	0.0
Mizoram	0.0	100.0	Zero positions were sanctioned	0.0	100.0	Zero positions were sanctioned
Nagaland	0.0	100.0	Zero positions were sanctioned	NA	90.2	NA
Odisha	53.7	NA	NA	100.3	79.7	79.8
Punjab	84.7	51.3	42.5	96.2	74.8	73.8
Rajasthan	62.2	55.4	28.4	63.1	78.7	66.2
Sikkim	100.0	75.0	75.0	0.0	100.0	Zero positions were sanctioned
Tamil Nadu	34.3	65.7	0.0	21.9	83.8	26.1
Telangana	NA	NA	NA	100.0	12.5	12.5
Tripura	5.0	95.0	0.0	NA	96.4	NA
Uttarakhand	92.6	59.7	56.4	77.9	82.7	77.8
Uttar Pradesh	NA	NA	NA	88.8	72.3	68.8
West Bengal	81.6	65.0	57.1	20.8	93.0	66.4
A&N Islands	75.0	100.0	100.0	100.0	75.0	75.0
Chandigarh	100.0	0.0	0.0	N App	N App	N App
D & N Haveli	50.0	50.0	0.0	0.0	100.0	Zero positions were sanctioned
Daman & Diu	0.0	100.0	Zero positions were sanctioned	0.0	100.0	Zero positions were sanctioned
Delhi	0.0	0.0	0.0	N App	N App	N App
Jammu & Kashmir	98.6	49.3	48.6	101.8	43.3	44.3
Ladakh	NA	NA	NA	96.4	57.1	55.6
Lakshadweep	0.0	100.0	Zero positions were sanctioned	66.7	33.3	0.0
Puducherry	25.0	62.5	In Position>Sanctioned	0.0	100.0	0.0
India	56.6	45.7	46.7	62.9	79.5	67.8

Note: NA is Not Available, N App is Not Applicable

Source: Rural Health Statistics 2021-22

Table A.4. State-wise PG-UG Ratio (2019–20)

State	PG–UG Ratio (Total)	PG–UG Ratio (Public)	PG–UG Ratio (Private)
Andaman and Nicobar Islands	0	0	0
Andhra Pradesh	0.46	0.44	0.47
Arunachal Pradesh	0.00	0.00	No private sector and no PG
Assam	0.78	0.78	No private sector and no PG
Bihar	0.52	0.60	0.36
Chandigarh	3.71	3.71	No private sector
Chhattisgarh	0.17	0.24	0.06
Dadra and Nagar Haveli	0.00	0.00	No private sector and no PG
Delhi	2.07	2.40	0.25
Goa	0.66	0.66	No private sector
Gujarat	0.39	0.47	0.24
Haryana	0.34	0.45	0.26
Himachal Pradesh	0.36	0.31	0.61
Jammu and Kashmir	0.58	0.59	0.47
Jharkhand	0.32	0.32	No private sector
Karnataka	0.57	0.49	0.61
Kerala	0.37	0.67	0.22
Madhya Pradesh	0.43	0.43	0.43
Maharashtra	0.56	0.65	0.48
Manipur	0.93	0.93	No private sector
Meghalaya	0.58	0.58	No private sector
Mizoram	0.00	0.00	No private sector and no PG
Odisha	0.48	0.47	0.51
Puducherry	0.64	1.82	0.46
Punjab	0.61	0.66	0.57
Rajasthan	0.47	0.52	0.39
Sikkim	0.22	No public sector	0.22
Tamil Nadu	0.58	0.66	0.50
Telangana	0.44	0.60	0.36
Tripura	0.37	0.63	0.05
Uttar Pradesh	0.37	0.50	0.27
Uttarakhand	0.42	0.21	0.72
West Bengal	0.45	0.54	0.15
INI`s*	2.42	2.42	NA
India	**0.54**	**0.65**	**0.42**

Note: The cells highlighted are those states that have PG–UG ratio higher than the all-India average.

Source: Authors' calculations based on data sourced from IndiaStat and Lok Sabha Questions

Table A.5. Rate of Expansion of doctor-population ratio (1980–2019)

State	Rate of expansion of doctor-population ratio (per 1,000) between 1980 to 2019
Andhra Pradesh	4.33
Assam	1.73
Bihar	1.54
Chhattisgarh	71.42
Goa	7.39
Gujarat	2.46
Haryana	61.12
Himachal Pradesh	20.94
Jammu & Kashmir	2.70
Jharkhand	54.35
Karnataka	3.68
Kerala	4.22
Madhya Pradesh	6.99
Maharashtra	2.37
NCT of Delhi	37.27
Odisha	1.85
Punjab	1.39
Rajasthan	2.45
Tamil Nadu	3.01
Telangana	3.30
Tripura	7.96
Uttar Pradesh	1.75
Uttarakhand	18.10
West Bengal	1.29
Arunachal Pradesh	6.85
Nagaland	6.42
Mizoram	18.41
Sikkim	4.47
India	**2.37**

Note: The start date is not the same for all, as many states were formed later than 1980, and many did not have a state medical council since the beginning.

Source: National Health Profile (Various years)

Table A.6. Trends in seat capacity and expansion of colleges (UG)

	Public		Private		Total	
Year	Seat Capacity	Number of Colleges	Seat Capacity	Number of Colleges	Seat Capacity	Number of Colleges
2010–11	18,315	150	22,460	185	40,775	335
2011–12	21,690	164	23,410	192	45,100	356
2012–13	24,040	176	25,785	205	49,825	381
2013–14	NA	NA	NA	NA	51,979	387
2014–15	25,743	189	28,605	215	54,348	404
2015–16	27,143	200	29,995	222	57,138	422
2016–17	29,093	212	36,090	260	65,183	472
2017–18	31,312	227	36,040	252	67,352	479
2018–19	33,472	245	36,940	257	70,412	502
2019–20	42,729	278	38,840	263	81,569	541
2020–21	43,435	289	39,840	269	83,275	558
2021–22	46,380	313	41,740	283	88,120	596
2022–23	48,212	322	43,915	290	92,127	612

Source: IndiaStat and Lok Sabha Questions

Table A.7. Trends in seat capacity (PG)

Year	Seat Capacity
2010–11	17,294
2011–12	22,194
2012–13	22,850
2013–14	24,242
2014–15	25,416
2015–16	25,850
2016–17	26,450
2017–18	31,415
2018–19	34,926
2019–20	44,136
2020–21	55,495
2021–22	60,202
2022–23	64,059

Source: IndiaStat and Lok Sabha Questions

Table A.8. Cross-country data on the number of medical graduates per 100,000

Country	Number of medical graduates per 100,000	Year of Reporting
India	4.1	2021
Israel	6.9	2020
Japan	7.2	2021
South Korea	7.2	2020
Canada	7.6	2021
USA	8.5	2021
Chile	9.1	2020
France	10.0	2019
New Zealand	10.4	2020
Poland	10.6	2018
Norway	10.9	2020
Iceland	11.4	2020
Mexico	11.6	2020
Colombia	11.7	2020
Estonia	11.8	2021
Germany	12.0	2020
Finland	12.2	2020
Switzerland	12.9	2020
Great Britain	13.1	2021
Greece	13.5	2019
Sweden	13.6	2020
Spain	13.9	2020
Turkey	14.3	2020
Netherlands	14.3	2020
Austria	14.4	2020
Australia	14.9	2020
Hungary	15.7	2020
Portugal	15.7	2020
Belgium	16.4	2021
Czech Republic	16.6	2020
Italy	18.7	2020
Slovak Republic	19.3	2020
Lithuania	21.0	2020
Denmark	21.2	2019
Latvia	22.6	2021
Ireland	25.4	2020

Source: OECD Health Statistics (2021)

Table A.9: Availability of Junior Residents in ALIs in 2022

State	Name of Institution	Sanctioned strength	In position	Vacancy (%)
Madhya Pradesh	All India Institute of Medical Sciences, Bhopal	351	257	26.8
Maharashtra	All India Institute of Medical Science Nagpur	50	48	4
Odisha	All India Institute of Medical Sciences, Bhubaneswar	351	258	26.5
Rajasthan	All India Institute of Medical Sciences, Jodhpur	351	436	0
Uttarakhand	All India Institute of Medical Sciences, Rishikesh	351	351	0
Andhra Pradesh	All India Institute of Medical Sciences, Mangalagiri	50	36	28
Bihar	All India Institute of Medical Sciences, Patna	351	317	9.7
Chhattisgarh	All India Institute of Medical Sciences, Raipur	351	309	12.0
Jharkhand	All India Institute of Medical Sciences, Deoghar	40	22	45
Delhi	All India Institute of Medical Sciences, Delhi	1,428	1,133	20.7
West Bengal	All India Institute of Medical Sciences, Kalyani	50	50	0
Uttar Pradesh	All India Institute of Medical Sciences, Gorakhpur	50	45	10
Punjab	All India Institute of Medical Sciences, Bathinda	50	46	8
Himachal Pradesh	All India Institute of Medical Sciences, Bilaspur	40	15	62.5
Assam	All India Institute of Medical Sciences, Guwahati	40	-	100
Telangana	All India Institute of Medical Sciences, Bibinagar	50	33	34
Gujarat	All India Institute of Medical Sciences, Rajkot	40	25	37.5
Jammu and Kashmir	All India Institute of Medical Sciences, Vijaypur	40	-	100
Uttar Pradesh	All India Institute of Medical Sciences, Raebareli	16	14	12.5
Tamil Nadu	All India Institute of Medical Sciences, Madurai	16	-	100

Source: Lok Sabha Questions

Table A.10. Availability of Senior Residents in ALIs in 2022

State	Name of Institution	Sanctioned strength	In position	Vacancy (%)
Madhya Pradesh	All India Institute of Medical Sciences, Bhopal	377	127	66.3
Maharashtra	All India Institute of Medical Science Nagpur	50	60	0
Odisha	All India Institute of Medical Sciences, Bhubaneswar	377	215	43.0
Rajasthan	All India Institute of Medical Sciences, Jodhpur	377	334	11.4
Uttarakhand	All India Institute of Medical Sciences, Rishikesh	377	275	27.1
Andhra Pradesh	All India Institute of Medical Sciences, Mangalagiri	50	42	16
Bihar	All India Institute of Medical Sciences, Patna	377	216	42.7
Chhattisgarh	All India Institute of Medical Sciences, Raipur	377	172	54.4
Jharkhand	All India Institute of Medical Sciences, Deoghar	40	11	72.5
Delhi	All India Institute of Medical Sciences, Delhi	1,926	1,273	33.9
West Bengal	All India Institute of Medical Sciences, Kalyani	50	29	42
Uttar Pradesh	All India Institute of Medical Sciences, Gorakhpur	50	27	46
Punjab	All India Institute of Medical Sciences, Bathinda	50	44	12
Himachal Pradesh	All India Institute of Medical Sciences, Bilaspur	40	10	75
Assam	All India Institute of Medical Sciences, Guwahati	40	7	82.5
Telangana	All India Institute of Medical Sciences, Bibinagar	50	39	22
Gujarat	All India Institute of Medical Sciences, Rajkot	40	13	67.5
Jammu and Kashmir	All India Institute of Medical Sciences, Vijaypur	40	1	97.5
Uttar Pradesh	All India Institute of Medical Sciences, Raebareli	16	9	43.8
Tamil Nadu	All India Institute of Medical Sciences, Madurai	16	-	100

Source: Lok Sabha Questions

Table A.11. Trends in expenditure on medical education, training and research

Expenditure on medical education, training and research as a proportion of Total Public Health Expenditure (in %)	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Andhra Pradesh	11.62	10.99	9.53	12.23	8.58	8.28
Arunachal Pradesh	0.98	9.21	7.25	16.76	1.54	0.96
Assam	14.44	26.32	19.27	21.57	16.86	19.68
Bihar	16.46	20.91	20.21	21.86	15.84	14.29
Chhattisgarh	12.23	12.62	12.04	8.93	8.96	8.45
Goa	17.80	14.92	15.89	19.98	0.00	0.00
Gujarat	15.61	14.07	9.77	10.98	9.05	8.95
Haryana	22.22	29.37	26.79	23.18	24.23	24.93
Himachal Pradesh	21.53	28.89	29.67	32.56	24.84	25.70
Jammu and Kashmir	21.25	20.36	19.09	0.00	0.00	0.00
Jharkhand	9.96	16.04	21.95	16.23	9.07	8.73
Karnataka	27.04	24.70	24.76	27.10	28.22	30.59
Kerala	22.77	22.99	22.16	24.46	22.54	22.08
Madhya Pradesh	6.54	11.72	17.43	15.97	12.23	8.53
Maharashtra	11.32	12.03	10.41	13.01	13.16	10.80
Manipur	16.01	13.83	16.41	17.23	17.41	29.21
Meghalaya	0.63	0.77	0.83	1.61	0.67	0.97
Mizoram	2.14	3.39	16.99	8.29	9.12	7.38
Nagaland	0.99	0.70	11.09	0.69	0.70	0.41
Odisha	18.70	24.47	21.21	17.15	13.10	15.00
Punjab	10.08	9.44	11.33	10.00	8.12	6.84
Rajasthan	15.05	14.30	15.25	13.39	13.19	13.35
Sikkim	0.66	0.87	0.76	12.82	3.14	24.64
Tamil Nadu	10.58	11.32	11.28	11.67	13.00	22.93
Tripura	5.66	5.14	4.28	3.28	2.69	1.64
Uttarakhand	15.18	15.95	13.33	17.31	15.03	14.11
Uttar Pradesh	22.63	27.59	23.95	24.25	23.64	19.46
West Bengal	11.46	14.39	14.20	19.25	11.49	12.81
Telangana	7.79	5.89	6.02	7.38	9.57	9.97

Source: CAG Combined Finances

Table A.12. Seats per College: State-wise analysis (2022-23)

State	Seats per college (Total)	Seats per college (Public)	Seats per college (Private)
A & N Islands	100	100	0
Andhra Pradesh	172	191	158
Arunachal Pradesh	50	50	0
Assam	128	128	0
Bihar	121	126	113
Chandigarh	150	150	0
Chhattisgarh	130	121	150
Dadra and Nagar Haveli	150	150	0
Delhi	150	156	125
Goa	180	180	0
Gujarat	184	206	154
Haryana	138	142	136
Himachal Pradesh	115	110	150
Jammu and Kashmir	115	116	100
Jharkhand	103	97	125
Karnataka	161	150	167
Kerala	137	156	129
Madhya Pradesh	163	156	173
Maharashtra	160	166	154
Manipur	125	113	150
Meghalaya	50	50	0
Mizoram	100	100	0
Odisha	163	153	188
Puducherry	181	190	179
Punjab	146	160	136
Rajasthan	154	180	106
Sikkim	150	0	150
Tamil Nadu	153	138	172
Telangana	148	167	139
Tripura	113	125	100
Uttar Pradesh	135	123	148
Uttarakhand	144	140	150
West Bengal	156	161	143

Source: Authors' calculations based on data sourced from Lok Sabha Questions

Table A.13. State-wise bond conditions for PG Students, 2022

State	Bond Amount (in Rs)	Bond Duration (in years)
Andhra Pradesh*	3,00,000	-
Odisha	30,00,000	2
Assam	20,00,000	20
Bihar	25,00,000	3
Chhattisgarh	50,00,000	-
Goa	10,00,000	3
Gujarat	10,00,000	3
Haryana	7,50,000	-
Himachal Pradesh	25,00,000	5
Jharkhand	10,00,000	1
Karnataka	50,00,000	3
Kerala	50,00,000	1
Madhya Pradesh	10,00,000	1
Maharashtra	50,00,000	1
Manipur	7,00,000	1
Meghalaya	20,00,000	-
Odisha	30,00,000	2
Punjab	15,00,000	3
Rajasthan	25,00,000	5
Tamil Nadu	45,00,000	5
Tripura	25,00,000	-
Uttar Pradesh	40,00,000	2
Chandigarh	5,00,000	-
Delhi	10,00,000	-
Uttarakhand	2,50,00,000	2
West Bengal	30,00,000	3

Source: Edufever Staff (2023)

Note: In December 2022, it was stated that the Andhra Pradesh government had introduced one year of mandatory rural/government service for all PG/super-speciality students admitted in government medical colleges and Category A seats in private medical colleges, from the 2022–23 academic year onwards (GoI, 2022d)

Table A.14. State-wise bond conditions for UG Students, 2022

State	Bond Amount (in Rs)	Bond Duration (in years)
Andaman & Nicobar Islands	10,00,000	1
Arunachal Pradesh	Discretionary Bond. If selected for regular employment under the state government, then Rs. 10,00,000	3 (including one year in rural far-flung areas)
Andhra Pradesh	300,000 + 18% GST (admission bond if exits before last day of free exit)	NA
Odisha	-	-
Assam	30,00,000 (MBBS) 20,00,000 (BDS)	1-year rural service + 5 years of government service after completion of MBBS
Chhattisgarh	25,00,000 (Gen) 20,00,000 (Reserved)	2
Dadra and Nagar Haveli	10,00,000	2 years in Dadra Nagar Haveli or Daman & Diu
Goa	10,00,000 (Both admission and service bond)	1
Gujarat	GMERS (2 lakh) MP Shah (20 lakhs) 20,00,000 for those availing financial aid through state schemes (service bond)	1-year rural service
Haryana	10,00,000 (admission bond for all types) For private – 10,00,000 + Academic fee of session + 50% of the next academic session next fee	NA
Himachal Pradesh	10,00,000 plus tuition fee (Admission bond)	NA
Jharkhand	20,00,000 (Admission bond)	NA
Karnataka	NA	1-year compulsory rural service in a government hospital; temporary registration till completion of service
Kerala	10,00,000 (MBBS) 5,00,000 (BDS) (Admission Bond)	NA

Madhya Pradesh	10,00,000 (MBBS) 5,00,000 (BDS)	1-year compulsory rural service; 5-year compulsory rural service for students supported by CM Medhavi Vidyarthi Yojana
Maharashtra	10,00,000 (Govt or municipal college students) Full Fee + Interest (Govt-aided & private-aided medical colleges)	1 (Govt or municipal college students) MO in rural and tribal areas (fee reimbursement & scholarship support from Govt-aided & private-aided medical colleges)
Manipur	2,50,000 (After course commencement) 1,00,000 (Before course commencement)	NA
Meghalaya	30,00,000	5
Odisha	1,00,000 (Admission Bond)	NA
Punjab		
Rajasthan	5,00,000 (Admission and Service Bond) For select colleges, fees for all remaining semesters if they drop out	2
Tamil Nadu	5,00,000 (Service Bond) 1,00,000 or 10,00,000 (Based on admission cut-off date)	5 (Rural areas)
Tripura	20,00,000 (Service Bond/Admission Bond)	5
Uttar Pradesh	10,00,000 (Service Bond)	2
Telangana	300,000 (admission Bond)	NA
Faculty of Medical Sciences (Delhi)	300,000 (admission bond)	NA
Pondicherry	4,00,000 (Admission Bond) 20,000 (Forego caution deposit in case of withdrawal one day before counselling)	NA
Uttarakhand	1 crore	5 years of government service in Hilly regions for government medical college graduates
West Bengal	1,00,000 (Admission Bond)	NA
Armed Forces Medical College	61,00,000	Medical Officers in Armed Forces Medical College

Source: Chauhan (2022)

Table A.15. Number of Years to become a doctor

Country	Years of study before entry	Number of years to graduate	Number of years to become a specialist	Range	Total Number of Years
Germany	12	6.3	6	3–7	24.3
India	12	6	6.5	3.5–6.5	24.5
Italy	12	6.5	6	3–7	24.5
US	16	4	7	6	27
Canada	16	4	7	3–6	27
UK	12	5	10	3–10	27
Australia	16	5	9	4–9	30

Source: Authors' compilation based on multiple sources

Table A.16. Comparison of the relative share of states in UG seat pool with their relative share in the population

State	Relative share in total seats (in %) (2017–18)	State	Relative share in total seats (in %) (2022–23)	State	Relative share in total population (in%) (2022-23)
Karnataka	13.3	Tamil Nadu	11.7	Uttar Pradesh	17.0
Maharashtra	10.8	Karnataka	11.0	Bihar	9.1
Tamil Nadu	10.2	Maharashtra	10.8	Maharashtra	9.1
Uttar Pradesh	9.4	Uttar Pradesh	9.8	West Bengal	7.1
Andhra Pradesh	7.1	Gujarat	6.2	Madhya Pradesh	6.2
Kerala	6.2	Andhra Pradesh	5.8	Rajasthan	5.8
Gujarat	5.7	Telangana	5.5	Tamil Nadu	5.5
Telangana	5.6	Kerala	4.6	Gujarat	5.2
Rajasthan	4.1	West Bengal	4.6	Karnataka	4.9
Madhya Pradesh	4.0	Madhya Pradesh	4.4	Andhra Pradesh	3.8
West Bengal	4.0	Rajasthan	4.4	Odisha	3.3
Bihar	2.2	Bihar	2.6	Jharkhand	2.8
Haryana	2.2	Odisha	2.3	Telangana	2.7
Odisha	2.0	Punjab	1.9	Kerala	2.6

Puducherry	2.0	Haryana	1.8	Assam	2.6
Punjab	1.9	Puducherry	1.8	Punjab	2.2
Delhi	1.8	Chhattisgarh	1.7	Haryana	2.2
Chhattisgarh	1.8	Delhi	1.6	Chhattisgarh	2.2
Uttarakhand	1.3	Assam	1.3	Delhi	1.5
Assam	1.1	Uttarakhand	1.3	Jammu and Kashmir	1.0
Himachal Pradesh	1.0	Jammu and Kashmir	1.2	Uttarakhand	0.8
Jammu and Kashmir	0.7	Jharkhand	1.0	Himachal Pradesh	0.5
Jharkhand	0.5	Himachal Pradesh	1.0	Tripura	0.3
Manipur	0.3	Manipur	0.4	Meghalaya	0.2
Tripura	0.3	Tripura	0.2	Manipur	0.2
Goa	0.2	Goa	0.2	Nagaland	0.2
Andaman and Nicobar Islands	0.1	Chandigarh	0.2	Goa	0.1
Chandigarh	0.1	Dadra and Nagar Haveli	0.2	Arunachal Pradesh	0.1
Sikkim	0.1	Sikkim	0.2	Puducherry	0.1
Meghalaya	0.1	Andaman and Nicobar Islands	0.1	Mizoram	0.1
Arunachal Pradesh	0.0	Mizoram	0.1	Chandigarh	0.1
Dadra and Nagar Haveli	0.0	Arunachal Pradesh	0.1	Sikkim	0.05
Mizoram	0.0	Meghalaya	0.1	Dadra and Nagar Haveli	0.04
				Andaman and Nicobar Islands	0.03
				Daman and Diu	0.01
				Lakshadweep	0.005

Note: All three columns are arranged in descending order

Table A.17. State-wise vacancy in MBBS Seats (2019 and 2020)

	Vacant Seats	
State	2018–19	2019–20
Andaman Nicobar Islands	0	0
Andhra Pradesh	2	6
Arunachal Pradesh	0	0
Assam	1	1
Bihar	16	4
Chandigarh	2	1
Chhattisgarh	2	0
Dadra and Nagar Haveli	0	0
Delhi	4	2
Goa	0	0
Gujarat	0	5
Haryana	1	7
Himachal Pradesh	1	0
Jammu & Kashmir	3	55
Jharkhand	0	114
Karnataka	2	6
Kerala	1	1
Madhya Pradesh	149	2
Maharashtra	1	9
Manipur	0	1
Meghalaya	0	0
Mizoram	1	0
Orissa	2	21
Pondicherry	0	0
Punjab	3	1
Rajasthan	1	5
Sikkim	0	0
Tamil Nadu	0	10
Telangana	75	8
Tripura	2	1
Uttarakhand	3	0
Uttar Pradesh	1	4
West Bengal	1	9
TOTAL	274	273

Source: GoI (2021)

Table A.18. Self-reported shortage of teaching faculty in newly created AIIMS (2020)

State	Name of Institution	Sanctioned strength	In position	Vacancy (%)	Total UG Seats
Madhya Pradesh	AIIMS Bhopal	306	125	59.2	105
Maharashtra	AIIMS Nagpur	182	92	49.5	105
Odisha	AIIMS Bhubaneswar	379	226	40.4	105
Rajasthan	AIIMS Jodhpur	398	160	59.8	105
Uttarakhand	AIIMS Rishikesh	339	252	25.7	105
Andhra Pradesh	AIIMS Mangalagiri	140	73	47.9	50
Bihar	AIIMS Patna	311	110	64.6	105
Chhattisgarh	AIIMS Raipur	339	155	54.3	105
Jharkhand	AIIMS Deoghar	184	16	91.3	53
Delhi	AIIMS Delhi	1,076	775	27.9	227

Note: AIIMS Nagpur mentioned the number of sanctioned posts as 782, but we have rectified this after looking at the number of seats and data presented by GoI elsewhere.

Source: Ministry of Education (2020)

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