

Current distribution of medical colleges in India and its potential predictors: A public domain data audit

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ABSTRACT

Background: A teaching hospital or medical college may help provide better health care delivery to the people of the vicinity. Hence, building new medical colleges and upgrading existing hospitals to teaching hospitals are being implemented in India. **Objective:** This study aimed to observe the current distribution of medical colleges in Indian states and find correlation with area, population, and net state domestic product (NSDP). **Methods:** We collected data from public domain websites provided by government agencies. The State-wise number of government and private medical colleges and their annual intake were obtained from the National Medical Commission website. The state-wise number of medical colleges, geographical area, and population were calculated as the percentage of total Indian colleges, area, and population, respectively. Spearman's correlation was calculated to find any correlation of colleges and annual intake versus parameters such as area, population, and NSDP. **Results:** India has a total of 612 [321 (52.45%) government-run and 291 (47.55%) private] medical colleges. Tamil Nadu (70), Uttar Pradesh (67), Karnataka (63), Maharashtra (62), and Telangana (34) are the top five states with 296 (48.37%) medical colleges. States and union territories such as Karnataka, Kerala, Maharashtra, Puducherry, Tamil Nadu, and Telangana have higher medical colleges, and states such as Assam, Bihar, Odisha, Madhya Pradesh, Rajasthan, and Uttar Pradesh have lower medical colleges when compared with their population percentages. There was significant positive correlation of number of medical colleges with area ($r_s = 0.769$, $P < 0.0001$), population ($r_s = 0.91$, $P < 0.0001$), and NSDP ($r_s = 0.91$, $P < 0.0001$). **Conclusion:** The current distribution of medical colleges in India is clustered over some states. Although geographical area and population are major predictors of medical colleges in Indian states, a more population-based balanced distribution of medical colleges would help distribute quality health care to the majority of the population.

Keywords: Government, health care, India, medical college, public sector, teaching hospitals

Introduction

The hospitals and other health facilities along with their trained manpower make a health system to provide health-related services to the population of a particular area. In India, the health facilities are operated by both the government and private organizations. As all the medical colleges are attached to a tertiary care hospital, medical colleges are also run by

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both the government and private organizations. For the proper functioning of a health care system, sufficient numbers of physicians, nurses, pharmacists, social workers, and community workers are required. A medical college can teach and train physicians, nurses, and paramedical staff as their core curricular functions along with training social and community level health workers.^[1] In addition, medical institutions help in conducting research for a better future.

To date (July 30, 2022), there are a total of 612 medical colleges in India that have the capability of educating 91,927 medical graduates in a year. Hence, India is heading toward producing a huge number of medical graduates that would surely increase the doctor–population ratio further. The World Health Organization suggested that the doctor–population ratio has already been achieved by India in 2018.^[2] However, two aspects are being criticized – the unequal growth of institutions and the inadequate quality of medical education. The unequal distribution of medical colleges may be because of several factors such as feasibility, fund, land acquisition, political factors, interest from private players, and so on.^[3] For producing a huge number of doctors, many a time, both the government and private organizations may provide sub-standard infrastructure and lower numbers of manpower to the medical colleges.^[4]

A study by Sabde *et al.*^[5] found that a higher medical college density and a higher number of medical student intakes per year may help decrease the maternal mortality rate, which is one of the most important health care delivery indicators. Hence, it is obvious that although the colleges may have lower than adequate manpower and infrastructure and limited research facilities, upgrading or building a hospital with a teaching facility would help build a positive impact on public health.

In this context, we conducted this study to find the percentages of medical colleges according to Indian states and the relation with percentage of population, percentage of area, net state domestic product (NSDP), literacy rate, and maternal mortality rate (MMR). The finding of the study would add updates to the current knowledge of distribution of medical colleges in India according to the factors of interest.

Materials and Methods

This was a cross-sectional observational study involving the collection and analysis of data available from public domain websites. No sensitive information was collected or disseminated in this research article. Hence, ethical clearance is not necessary for this study.

The study was conducted in July 2022, and the data were collected within a span of 5 days – July 25 to July 30, 2022. We collected data from available government agencies that provide the data on public domain websites. The numbers of total colleges, colleges managed by government or

government-sponsored societies or trusts, private firms, private educational trusts, and private society were obtained from the National Medical Commission (NMC) website (www.nmc.org.in).^[6] The area, population, rural and urban population, and literacy rate were obtained from the Ministry of Statistics and Program Implementation (www.mospi.gov.in).^[7] The per capita NSDP was obtained from the Reserve Bank of India (www.rbi.org.in).^[8] The MMR was obtained from the Press Information Bureau (www.pib.gov.in).^[9]

Statistical analysis

Data were presented with numbers, percentages, median, and inter-quartile ranges. The normality of the data was tested by Shapiro–Wilk test. As the data were not following a normal distribution, non-parametric tests were used in inferential statistics.^[10] For expressing the percentage of a variable in a state, the number was divided by the national total and expressed as a percentage. Spearman’s correlation coefficient was calculated for finding a correlation between two continuous variables. We used Microsoft Excel 2010 and GraphPad Prism 6.01 for statistical calculations. We used a free spreadsheet template (obtained from www.indzara.com) for generating the Indian state-wise heat map presented in this article. For all statistical tests, a *P* value <0.05 was considered statistically significant.

Results

India has a total of 612 medical colleges including All India Institute of Medical Sciences. Among the colleges, 321 (52.45%) are run by the government or government-sponsored trust or society and 291 (47.55%) colleges are managed by private agencies including educational trusts and societies. Indian states have a median of 10 (Q1–Q3 = 1.5–29) medical colleges with 8 (Q1–Q3 = 1–13.5) government and 4 (Q1–Q3 = 0.5–12) private colleges. Indian state-wise distribution of government-run and private medical colleges is shown in Figure 1.

Among the 28 Indian states, all states excluding Nagaland have at least one teaching hospital. Among the eight union territories, Lakshadweep does not have a medical college, and data for Ladakh are to be updated as previously Ladakh was with Jammu and Kashmir. To date (July 30, 2022), the data for Ladakh are not available on the NMC website. The top five states, namely, Tamil Nadu (70), Uttar Pradesh (67), Karnataka (63), Maharashtra (62), and Telangana (34) have 296 (48.37%) medical colleges. State-wise distribution of medical colleges is shown in an Indian map in Figure 2.

The top five states having government-run medical colleges are Tamil Nadu (38), Uttar Pradesh (35), Maharashtra (29), Karnataka (20), and West Bengal (20). These five states have a total of 142 (44.24%) government medical colleges. In comparison, the top five states with private medical colleges are Karnataka (43), Maharashtra (33), Tamil Nadu (32), Uttar Pradesh (32), and Telangana (23). They have 56.01% of the national share of private medical colleges.

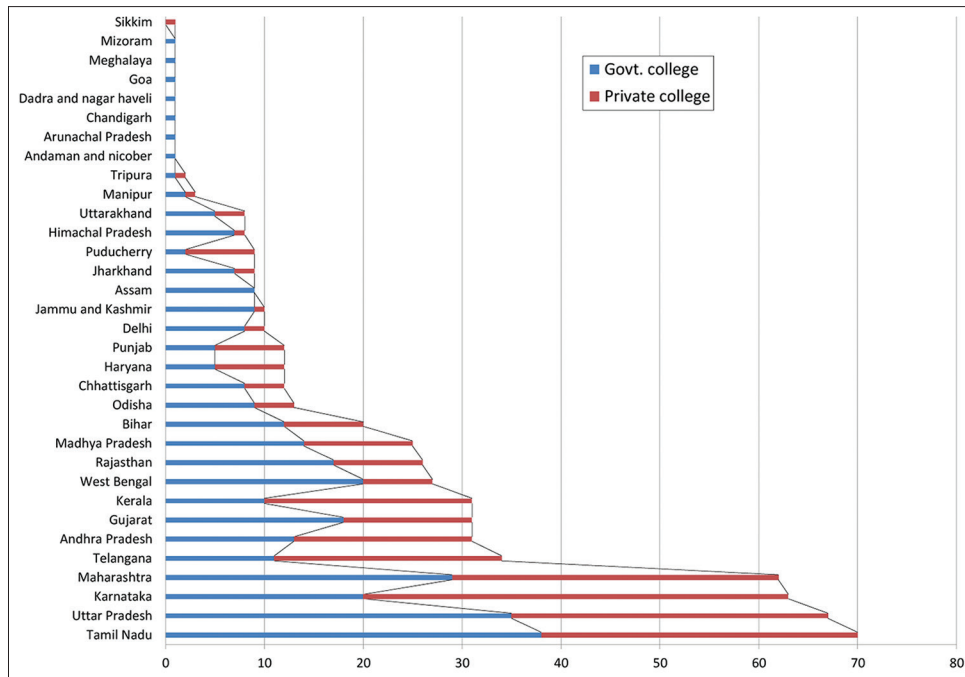


Figure 1: State-wise number of government-run and private medical colleges in India (data as on July 30, 2022)

The state-wise percentage of the population and the percentage of medical colleges are shown in Figure 3. The top five states that have higher population percentages (in comparison to the percentage of medical colleges) are Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, and Rajasthan. States such as Tamil Nadu, Karnataka, Telangana, Kerala, and Puducherry have a higher percentage of medical colleges than population percentages. There was a positive correlation of 0.91 (95% CI: 0.82–0.97) between the percentage of the population and medical colleges, $P < 0.0001$.

The state-wise percentage of the area and the percentage of medical colleges are shown in Figure 4. The top five states with a higher percentage (in comparison with the percentage of area) of medical colleges are Tamil Nadu, Karnataka, Kerala, Uttar Pradesh, and Telangana. States such as Rajasthan, Madhya Pradesh, Odisha, Arunachal Pradesh, and Chhattisgarh are the top five states which are having higher areas but a lower number of medical colleges. There was a positive correlation of 0.769 (95% CI: 0.57–0.88) between the percentage of the area and medical colleges, $P < 0.0001$.

The correlation of the number of medical colleges and the number of annual student intake versus area, total population, urban population percentage, rural population percentage, population density, NSDP, literacy, and MMR are shown in Table 1. The overall number of medical colleges was positively correlated with the area, population, and NSDP. There was a negative correlation of number of medical colleges with the literacy rate of the state. The annual intake was positively correlated with the area, population, population density, and NSDP.

Discussion

India had a steep rise in the number of medical colleges in the past decade with a steeper peak in recent 2–3 years. In 2019, there were a total of 494 medical colleges. In 2022 (July), the number increased to 612 medical colleges including AIIMS. Hence, in the past 3 years, India had built new medical colleges with approximately 24% growth.^[5] However, the distribution is not uniformly planned or executed in all the states and union territories. There may be several potential underlying factors for this.^[11] Along with building new medical colleges, the Indian government has stressed upgrading tertiary care hospitals to teaching hospitals. Hence, in many a place, it is not possible to upgrade the hospitals to medical colleges within a short time.^[12] The number of private medical colleges is also increasing day by day because of the higher demand for this professional course and the perceived scope of jobs among the aspirants. However, quality education is frequently not provided by private medical colleges. The major reason for building a private medical college is to “sell” the medical education. Hence, profit is an important aspect of private institutions, and the owner would try to cut the cost for a higher profit.^[13] The previous Medical Council of India and the current NMC are trying to implement several quality checks and are coming up with strict regulations from their end to increase the quality of education in India.^[14]

Building new college or upgrading tertiary care hospitals to teaching hospitals should always be planned according to geographical area and population. Although we found that the number of medical institutions and the annual intake of all the medical colleges in the states were positively correlated with the

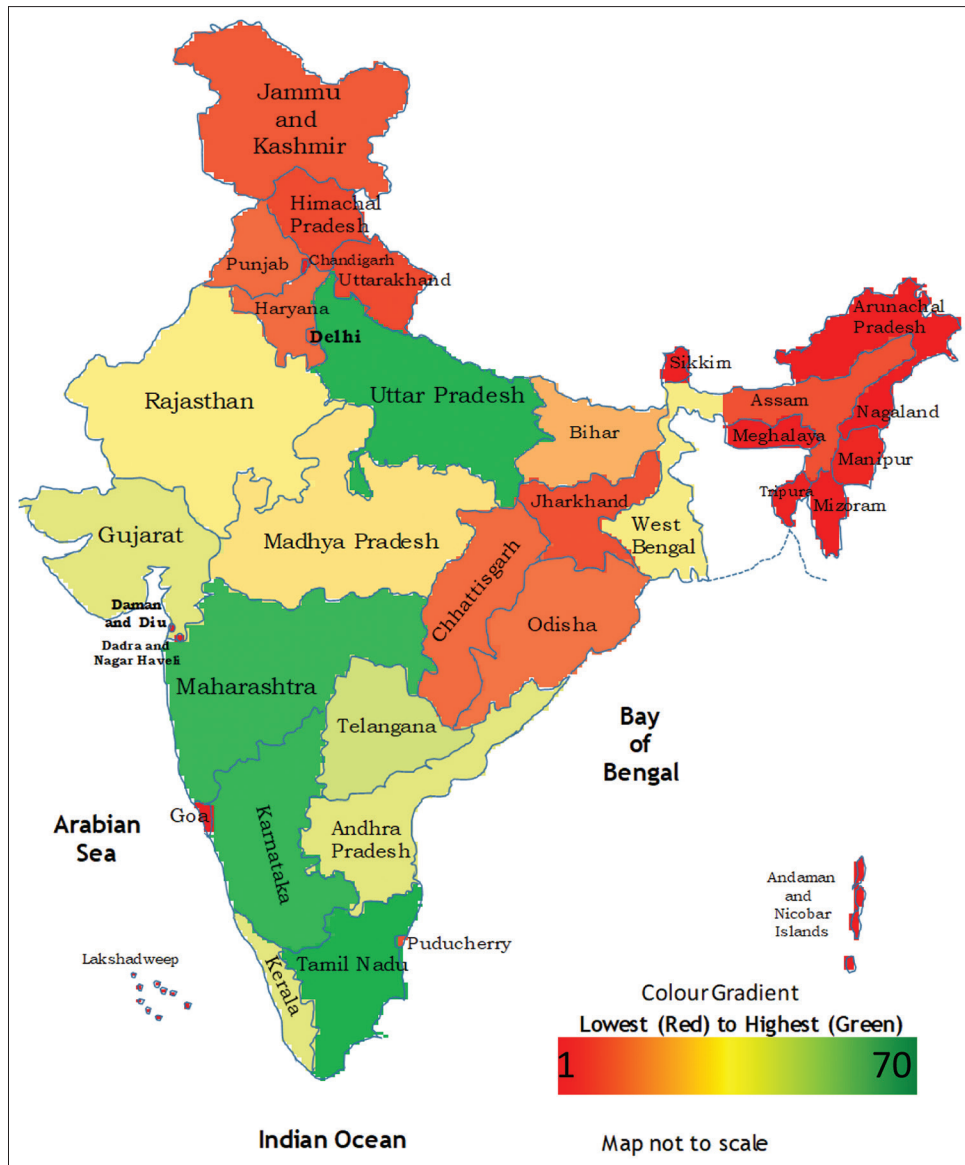


Figure 2: Indian state-wise distribution of medical colleges (data as on July 30, 2022)

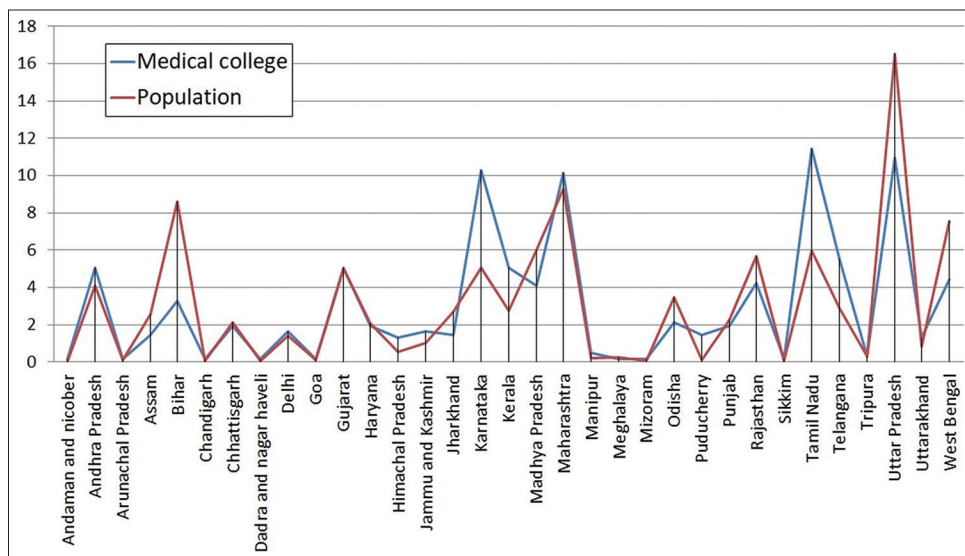


Figure 3: State-wise comparative percentage of medical colleges and population (data as on July 30, 2022)

area and total population, the perfect linear correlation is yet to achieve. However, it is found that the percentage of urban population and rural population is not determining the number of colleges. Now, medical colleges are being built in smaller cities and villages. However, still, there is a need for more teaching hospitals for a wider coverage to provide better health care to the rural population. States such as Rajasthan, Madhya Pradesh, Odisha, Arunachal Pradesh, and Chhattisgarh still need more medical colleges in remote or difficult regions. In addition, highly populous states such as Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, and Rajasthan further require medical colleges as the current number of medical colleges is not adequate to cater the patients with optimum service with limited infrastructure and manpower.^[15]

Each year, approximately 91,927 medical graduates would possess an undergraduate medical education degree and get their license after a rotatory internship. Despite this high number of trained doctors, medical colleges suffer from faculty and physician deficiency. It may be because of the lower absorption of medical graduates in the existing health care settings.^[16] On one hand, the healthcare setting is having a shortage of doctors, and on the other hand, a fair number of doctors remain jobless after becoming graduates. The craze for a super specialty has crippled the system of family medicine and the primary care system.^[17] However, it is high time to re-think about the number of doctors passing each year. After some years from now, severe job scarcity would be inevitable as the output would be higher than the absorption. In the coming days, the stakeholder may

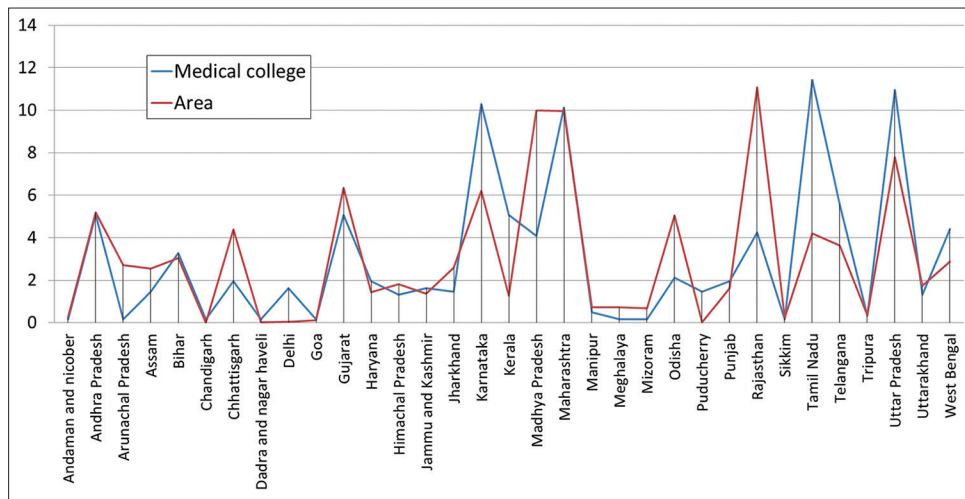


Figure 4: State-wise comparative percentage of medical colleges and area (data as on July 30, 2022)

Table 1: Correlation of number of medical colleges and annual intake versus area, population, income, literacy, and MMR

| Category | Area | Overall population | Urban population | Rural population |
|--------------------|-----------------------------|-----------------------------|------------------------------|----------------------------|
| | | | | |
| Number of colleges | | | | |
| Overall | 0.769 (0.57-0.88), <0.0001* | 0.91 (0.82-0.97), <0.0001* | 0.002 (-0.35-0.35), 0.99 | -0.0002 (-0.35-0.35), 0.99 |
| Government | 0.818 (0.65-0.91), <0.0001* | 0.94 (0.88-0.97), <0.0001* | -0.087 (-0.43-0.27), 0.63 | 0.089 (-0.27-0.43), 0.62 |
| Private | 0.708 (0.47-0.85), <0.0001* | 0.829 (0.67-0.91), <0.0001* | 0.083 (-0.28-0.42), 0.64 | -0.08 (-0.42-0.28), 0.65 |
| Annual intake | | | | |
| Overall | 0.725 (0.49-0.86), <0.0001* | 0.884 (0.77-0.94), <0.0001* | 0.09 (-0.27-0.43), 0.62 | -0.088 (-0.43-0.27), 0.63 |
| Government | 0.77 (0.57-0.88), <0.0001* | 0.919 (0.84-0.96), <0.0001* | 0.01 (-0.34-0.36), 0.94 | -0.01 (-0.36-0.34), 0.95 |
| Private | 0.667 (0.41-0.83), <0.0001* | 0.792 (0.61-0.89), <0.0001* | 0.125 (-0.24-0.46), 0.49 | -0.123 (-0.46-0.24), 0.49 |
| Category | Population density | Per capita NSDP | Literacy rate | MMR |
| | | | | |
| Number of colleges | | | | |
| Overall | 0.328 (-0.03-0.61), 0.06 | 0.91 (0.82-0.96), <0.0001* | -0.347 (-0.62-0.007), 0.048* | -0.006 (-0.36-0.35), 0.97 |
| Government | 0.286 (-0.07-0.58), 0.11 | 0.898 (0.79-0.95), <0.0001* | -0.4 (-0.66 - -0.06), 0.02* | 0.08 (-0.28-0.42), 0.66 |
| Private | 0.296 (-0.06-0.59), 0.09 | 0.846 (0.7-0.92), <0.0001* | -0.257 (-0.56-0.11), 0.15 | -0.069 (-0.41-0.29), 0.69 |
| Annual intake | | | | |
| Overall | 0.381 (0.03-0.65), 0.029* | 0.914 (0.83-0.96), <0.0001* | -0.259 (-0.56-0.1), 0.14 | -0.002 (-0.35-0.35), 0.99 |
| Government | 0.35 (-0.002-0.63), 0.045* | 0.931 (0.86-0.97), <0.0001* | -0.316 (-0.6-0.04), 0.07 | 0.055 (-0.3-0.39), 0.76 |
| Private | 0.3 (-0.06-0.59), 0.09 | 0.827 (0.67-0.91), <0.0001* | -0.22 (-0.53-0.14), 0.22 | -0.095 (-0.43-0.27), 0.59 |

*Statistically significant P value of Spearman's correlation coefficient. r_s : Spearman's correlation coefficient, NSDP: Net State Domestic Product, MMR: Maternal Mortality rate

think about building colleges in rural areas with a lower number of students where limited faculty members can train them with quality education. This would solve the problems of availability of medical colleges in rural settings, can provide quality medical education, and can train a limited number of students from those areas.

This study has some limitations. The data were collected at a particular point in time. Hence, in a near future, the result may not be extrapolated. The data about the population, rural and urban percentage, NSDP, literacy, and MMR are of different times. However, we had no other option but to get updated data of a particular time. Hence, the study result would be interpreted with caution.

Conclusion

The distribution of medical colleges in India is not following a uniform distribution according to geographic area and population and is clustered over some states. Some states are having higher percentages of medical colleges, and some are having lower percentages when compared to the percentage of the population of the state. Hence, establishing medical colleges with population-based balanced distribution may be considered by the stakeholders. Special stress should be on the number of rural colleges, limited intake, providing quality medical education, and train undergraduates to become family medicine ready professionals.

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Conflicts of interest

There are no conflicts of interest.

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