

# SPATIAL DISTRIBUTION PATTERN OF ACADEMIC DENTAL INSTITUTES IN INDIAN STATES AND THE COMPARISON WITH POPULATION PATTERN-A TREND ANALYSIS

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## ABSTRACT

**Aim:** To juxtapose the dental educational institutes, population distribution and analyze India's dental educational system's changing trends.

**Methodology:** The current data was obtained from the website of the dental council of India, Central Bureau of Health Intelligence and the Ministry of Health and family welfare and further data regarding the number of dental institutions, number of seats in under graduation and post-graduation course. India is geographically grouped into six zones, namely North, South, East, West, Central, Northeast, which were entered in Excel for descriptive analysis.

**Results:** There are currently 318 dental colleges in India granting degrees in dentistry. In India, among 268 postgraduate colleges, 230 dental colleges are in the private sector (86%) and 38 dental colleges in the government sector (14%).

**Conclusion:** - The study concluded that there is a lack of allocation resulting in an increasing spurt of dental colleges in India.

**Keywords:** - Dental workforce, Current Trends, Dentist to population ratio.

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## INTRODUCTION

The behemoth progress of dental education in India has reached incredible heights towards advancement in every aspect. Dental education in India has achieved a significant landmark and also received phenomenal recognition over the years. It was established 91 years ago when the first dental college began in Calcutta, introduced by Dr Rafiuddin Ahmed in 1920.<sup>[1]</sup> However, in the present circumstances, 318 dental colleges exist in our country, producing over 25,000 dentists each year.<sup>[2]</sup> There was a phased augmentation in Dental Institutions and Manpower which was racked up a saturation point in modern times. India's population was projected close to 1.380 billion or 1,380 million or 138.9 crore people in 2020. There are 71.7crore males and 66.3 core females living in India. India is the 2<sup>nd</sup> most populated country in the world behind China.<sup>[3]</sup> It is now estimated that by 2027, India will be most likely to overtake China to become the most populous country in the world, with 1.47 billion people.<sup>[4]</sup>

The dental education system in India is different from other countries. The undergraduates pass through 4 years of dental course and one year of compulsory internship to be conferred with a graduate degree in dentistry (Bachelor in Dental Surgery, BDS) and to be certified as a practising dentist by the Dental Council of India (DCI),<sup>[5]</sup> postgraduate training includes residency programmes of 3 years duration, culmination in MDS(Master of Dental Surgery).

India is regarded as the medical capital of the world. So, the other hand, dentistry has also been unconventional in the country where people congregate to matriculate the latest techniques experiment for their practice.<sup>[6]</sup> This research attempts to describe the current situation in India concerning dental educational institutions, comparative analysis of dental educational institutes versus population distribution, sector-based dental workforce trends, Trends in the establishment of dental colleges, Postgraduate positions and their impact, Dentist population ratio, public and private participation in Dental education, comparison of undergraduate and postgraduate college. As the population had grown exponentially, this paper surveys whether dental manpower has also been well fledged in equivalent to meets the needs and constraints of the population or not.<sup>[7]</sup> It also

provides an explicit cut exploration of the distribution of dental manpower in India and its effect on its oral health. This paper's purview is to juxtapose the dental educational institutes and population distribution and analyze India's dental education system's changing trends.

## METHODOLOGY

This analysis was based on the negotiation of data available from public Indian agencies, including the Central Bureau of Health Intelligence (CBHI), Dental Council of (DCI) India and the Ministry of Health and Family Welfare. The data regarding dentists registered in various states' dental council across India was obtained from the Central Bureau of Health Intelligence (CBHI). CBHI (Central Bureau of Health Intelligence) established in 1961 is the Director-General of Health Services' health intelligence wing in the Ministry of Health and Family Welfare, GOI. Its vision proper to maintain a robust Health Management Information System in the entire country. Data regarding the number of dental educational institutions across India and dentist registered in the council was procured from the Dental Council of India database. Since the Dental Council of India is a statutory body constituted under the Dental Act of 1948 has multifarious information on dental institutions and the workforce in various states in India. It depicts the overview of the availability of trained and specialized dentists in the country. It also furnishes information regarding regional distribution and disparities.

The official website of DCI (Dental Council of India) provides a gateway of various dental institutions across India, providing a list of state-wise, undergraduate, postgraduate subject-wise data. The data regarding the number of dental colleges, number of seats in undergraduate and postgraduate courses was retrieved cautiously and entered into a Microsoft Excel spreadsheet for descriptive analysis. A thorough search was done on Google scholar, PubMed, Grey Literature, Embase, Science Direct to obtain other relevant data.

The Keywords 'Dental Manpower India', 'Current Trends India' were entered into the search engines, and the search period was customized from 1950 – August 2020. All relevant data were retrieved and scrutinized to procure relevant information. An appropriate descriptive analysis was used to determine the geographical distribution pattern and its impact on serving dental needs.

**Inclusion Criteria:** Data were collected from the Dental Council of India (DCI), Central Bureau of Health Intelligence (CBHI) and other databases. The data were retrieved from these databases using keywords such as 'Dental Manpower India', 'Current Trends India'. The articles published by various authors in the English Language were included.

**Exclusion Criteria:** Documents like Book Chapters, Letters, and Meeting Abstracts were excluded. Articles published after Aug 2020 was excluded. Articles that were published in native languages other than English were excluded.

## RESULTS

FIGURE 1: TRENDS IN THE ESTABLISHMENT OF DENTAL COLLEGES EXISTING IN INDIA

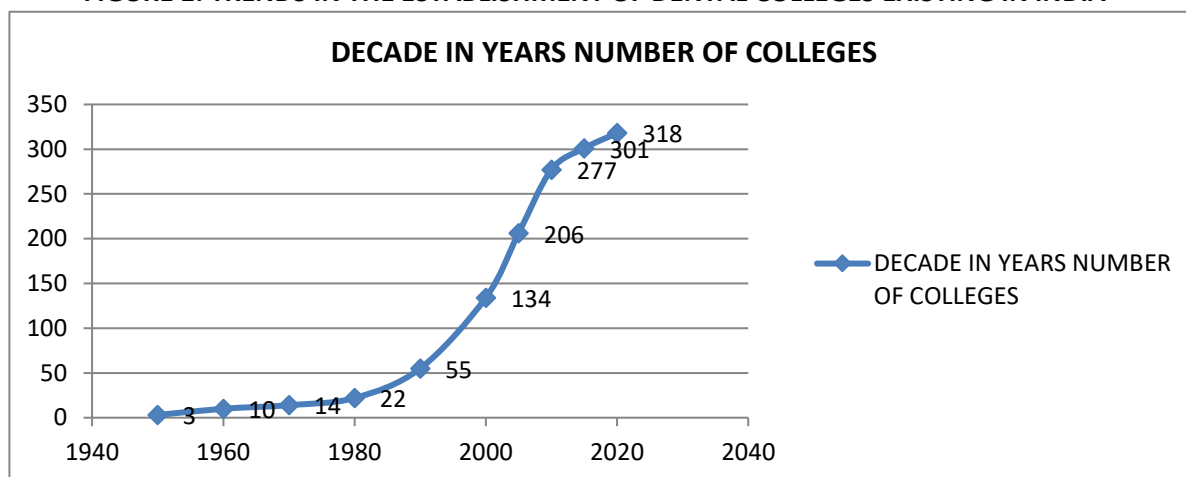


Figure 1 shows the growth trends of the establishment of dental educational institutes in concordance with time. In 1950, there were only three dental colleges in India. After independence, in the year 2000, there is an increase to 134 dental colleges. Subsequently analyzing the current data, there are 318 dental colleges in India within the year 2020. The growth of dental colleges led to an increase in the number of dental graduates per year.

**FIGURE 2: PUBLIC AND PRIVATE DISTRIBUTION IN DENTAL EDUCATION**

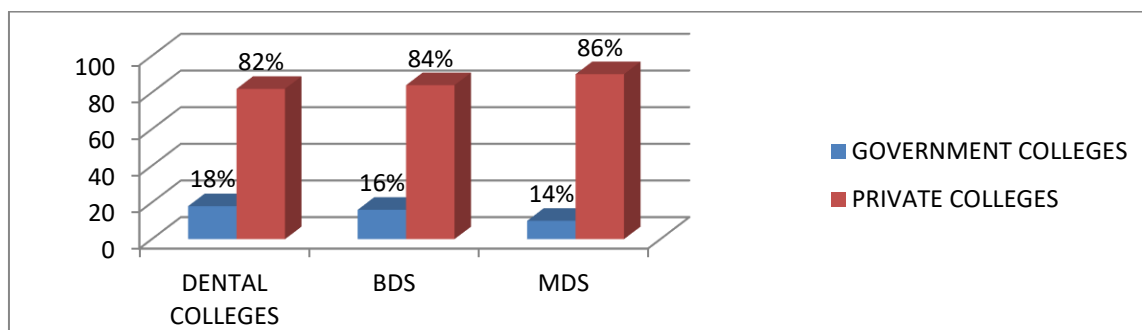


Figure 2 shows the government and private sector’s distribution in dental education along with the total number of positions in Under Graduation Bachelor of Dental Surgery (BDS) and Post-Graduation, Master of Dental Surgery (MDS). The current data shows that out of 318 dental colleges in India, 18% is government merit sector, and 82% of Dental Colleges are in private Dental Institutes, which are self-financing in nature.

**TABLE 1: DISTRIBUTION OF POSTGRADUATE POSITIONS IN INDIA**

Department	Government	Private
Orthodontics	89 (10%)	796(90%)
Periodontics	107(13%)	746(87%)
Conservative Dentistry	118(13%)	812(87%)
Oral Surgery	114(16%)	586(84%)
Prosthodontics	112(12%)	793(88%)
Public Health Dentistry	20(9%)	214(91%)
Pedodontics	59(9%)	590(91%)
Oral Medicine	68(13%)	442(87%)
Oral Pathology	75(14%)	473(86%)

Table 1 shows the distribution of postgraduate positions in India. This table depicts nine dentistry branches with the highest of 16% through the branch of oral surgery in the Government sector and 91% by dint of the branch of Public Health Dentistry and pedodontics in the Private sector.

**FIGURE 3: PERCENTAGE OF DISTRIBUTION ON POSTGRADUATE POSITIONS IN INDIA.**

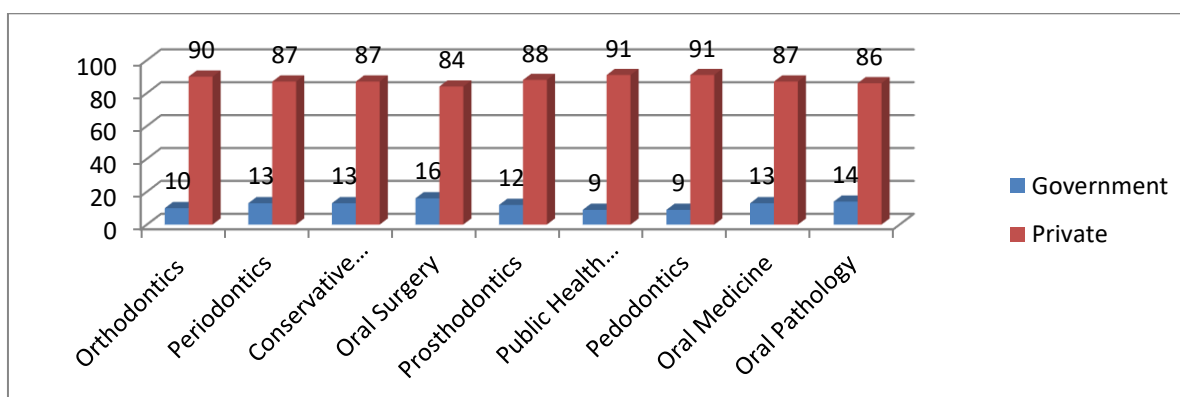


Figure 3 shows the comparison of postgraduate positions offered by the government and private sectors in India. Among the total number of 268 MDS positions, 14% of positions are offered by the Government sector, and the private sector offers 86%. In comparing postgraduate positions in government to the private sector among the nine branches of dentistry in India, the branch of oral surgery clocks in with a relatively higher percentage (16%) of positions in the government sector than the private sector. The branch of Public Health Dentistry and pedodontics relatively higher percentage (91%) of positions in the private sector with the least (9%) in the Government sector.

**Table 2: DENTIST POPULATION RATIO IN INDIA**

<b>DENTAL COLLEGES</b>	:	<b>318</b>
<b>TOTAL NO OF DENTISTS</b>	:	<b>2,78,076</b>
<b>AREA IN SQ KMS</b>	:	<b>3,287 million km2</b>
<b>TOTAL POPULATION</b>	:	<b>138.9 CRORES</b>
<b>DENTIST POPULATION RATIO</b>	:	<b>1:4975</b>

Table 2 describes that India's population increases every year and is compared with the dental workforce. In India, the final projected population is calculated as 138.9 crores. The total number of registered dentists in India as of August 2020 is 2,78,076. Therefore, the current status of the estimated dentist population ratio of India is 1:4975.

**TABLE 3: DENTAL EDUCATIONAL INSTITUTIONS**

Zones	State/UT	Area (Sq KM)	Population Distribution	Total No. of Colleges	Percentage of State Distribution of Colleges	Percentage of State Distribution of Populations	No.of Under Graduate Colleges	No. of Post Graduate Colleges
NORTH	Jammu & Kashmir (UT -1)	55,538	13,606,320	3	22% (69)	25%	3	2
	Himachal Pradesh	55,673	7,451,955	5			5	4
	Punjab	50,362	30,141,373	15			15	12
	Uttarkhand	53,483	11,250,858	2			2	2
	Uttara Pradesh	240,928	237,882,725	27			26	25
	Haryana	44,212	28,204,692	11			11	10
	Chandigarh (UT – 2)	114	1,158,473	1			1	1
	Delhi (NCT)	1483	18,710,922	5			3	3
SOUTH	Andaman & Nicobar (UT – 3)	8,249	417,036		42% (135)	20%		
	Andhra Pradesh	162,970	53,903,393	16			16	15
	Karnataka	191,791	67,562,686	48			47	40
	Kerala	38,852	35,699,443	26			26	19
	Lakshadweep (UT-4)	32	73,183					

	Puducherry (UT-5)	490	1,413,542	4			4	4
	Tamilnadu	130,060	77,841,267	29			29	26
	Telangana	112,077	39,362,732	12			12	12
EAST	Bihar	94,163	124,799,926	5	6% (19)	22%	5	4
	Odisha	155,707	46,356,334	4			4	3
	Jharkhand	79,716	38,593,948	4			4	3
	West Bengal	88,752,	99,609,303	6			6	3
WEST	Goa	3,702	1,586,250	1	22% (69)	20%	1	1
	Gujarat	196,244	63,872,399	13			13	12
	Maharashtra	307,713	123,144,223	38			37	34
	Daman & Diu (UT – 6)	603	615,724	1			1	
	Dadra&Nagar Haveli (UT-7)	603	615,724					
	Rajasthan	342,239	81,032,689	16			16	13
CENTRAL	Chattisgarh	135,192	29,436,231	6	6% (21)	9%	6	6
	Madhya Pradesh	308,252	85,358,965	15			15	13
NORTH EAST	Arunachal Pradesh	83,743	1,570,458		2% (5)	4%		
	Assam	78,438	35,607,039	3			3	1
	Manipur	22,327	3,091,545	2			2	0
	Meghalaya	22,429	3,366,710					
	Mizoram	21,081	1,239,244					
	Nagaland	16,579	2,249,695					
	Sikkim	7,096	690,251					
	Tripura	10,486	4,169,794					
<b>TOTAL</b>			<b>138 .9CRORES</b>	<b>318</b>	<b>100%</b>	<b>100%</b>	<b>313</b>	<b>268</b>

Table 3 shows the geographical pattern and distribution of dental educational institutes in India. India has been divided into North, South, East, West, Central, North East Zones. There are 29 States, and 7 Union Territories are included under these zones. Each States and Union Territories depicts the Area in sq. km, population distribution, the total number of colleges, percentage of state distribution of colleges, percentage of state distribution of population, No. of undergraduate and postgraduate colleges in figures. There are a 138 crore population distribution in India. The total number of dental colleges in India: 318. A total number of undergraduate colleges (BDS): 313. The total number of postgraduate colleges (MDS): 268.

**Table 4: DISTRIBUTION OF ONLY POSTGRADUATE COLLEGES IN INDIA**

Sl. No.	Name of the State	Name of the College
1.	Uttarpradesh	U.P. Rural Institute of Medical Science and Research, Saifai (Govt.)

2.	Karnataka	Air Force Institute of Dental Sciences Bangalore (Govt.)
3.	Maharashtra	Armed Forces Medical College, Pune-1 (Govt.)
4.	Delhi	1. Army Hospital (Research and Referral), Delhi (Govt.) 2. University College of Medical Sciences, Dilshad Garden (Govt.)

Table – 4 shows the distribution of only postgraduate colleges in India. There are 318 dental colleges in India, of which 313 colleges have both undergraduate and postgraduate courses. Five colleges have only postgraduate (MDS) courses whereas no undergraduate courses (BDS) in these colleges.

**FIGURE 4: COMPARATIVE ANALYSIS OF DENTAL EDUCATIONAL INSTITUTES VERSUS POPULATION DISTRIBUTION IN INDIA**

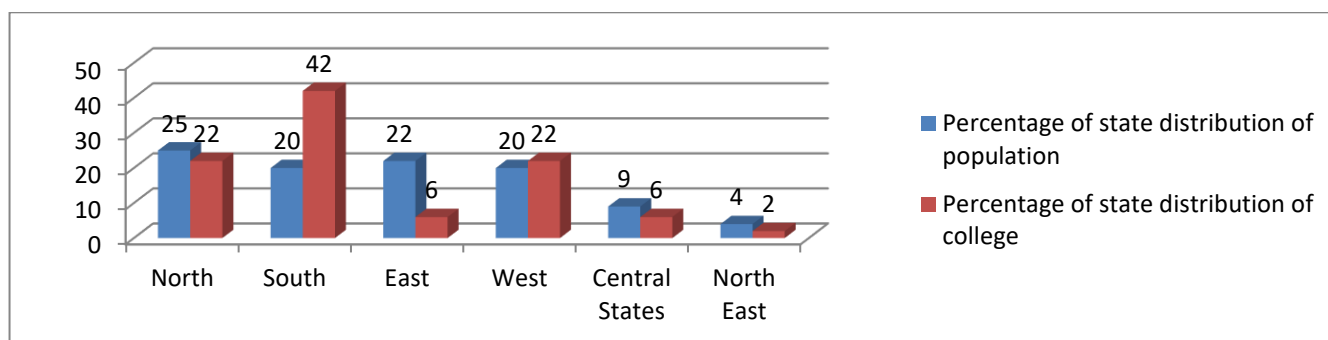


Figure 4 shows the Comparative Analysis of Dental Educational Institutes contrasted with Population Distribution in India. The scenario seems to be uneven due to the vast unfair distribution of colleges within each zone. This analysis depicts that the North East Zone with only (2%) dental institute especially shows lack of several colleges followed by Central Zone (6%) and East Zone (6%). On the contrary, the South Zone is distributed with an abundance of dental institutes (42%). North Zone comprises 6 States and 2 Union Territories with a total population of 25% and 22% of dental educational institutes. South Zone comprises 5 States and 3 Union Territories with a total population of 20% and has 42% of dental educational institutes. East Zone comprises 4 States with a total population of 22% and has only 6% of dental educational institutes. West Zone comprises 4 States and 2 Union Territories with a total population of 20% and 22% of dental educational institutes. Central Zone comprises 2 States with a total population of 9% and only 6% of dental educational institutes. North East Zone comprises 8 States with a total population of 4% and has only 2% dental educational institutes.

**FIGURE 5: GRAPH DEPICTING UNDERGRADUATE (BDS) AND POSTGRADUATE (MDS) COLLEGES IN INDIA**

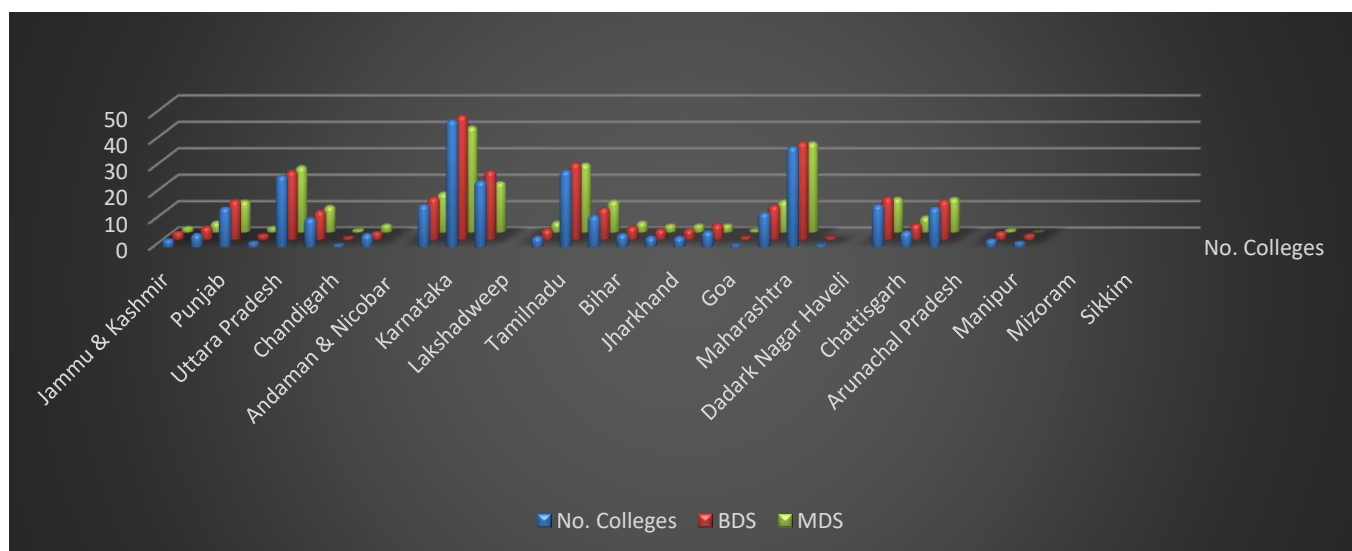


Figure 5 depicts undergraduate and postgraduate colleges in India. The Dental Council of India's current data depicts that the Total no of dental colleges in India 318.Total no of undergraduate colleges in India 313.Total no of postgraduate colleges in India 268

**FIGURE 6: DISTRIBUTION OF SECTOR BASED DENTAL MANPOWER TRENDS IN INDIA**

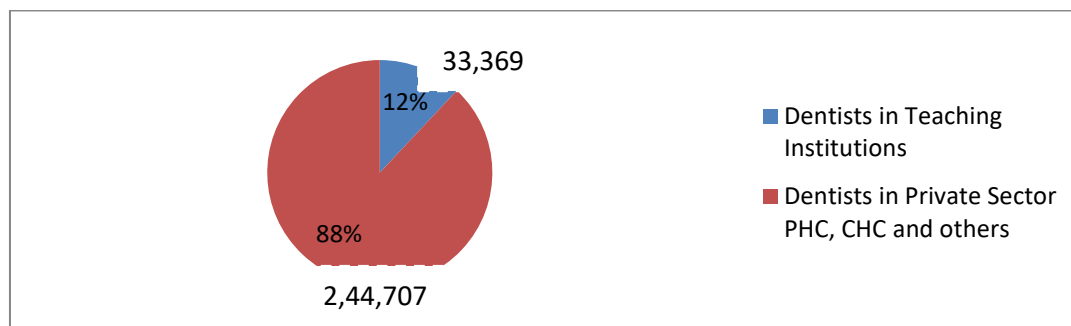


Figure 6 shows Sector-based Dental Manpower Trends in India. As per the latest data as of August. 2020, the total number of dentists registered by the Dental Council of India (DCI) – 2,78,076. The Dentists in Teaching Institutions is 12% (33,369) Dentists in the private sector, PHC, CHC and other sectors – 88% (2,44,707).

## DISCUSSION

Dentistry had expanded exponentially in India. Notably, in the last 15 years, there had been a significant expansion of several dental colleges and many people who had joined the dental profession. The principal concern for both professionals and the population were the quality of training and probable shrinking of jobs for dentists because of dentists' excessive production and market saturation.<sup>[8]</sup> Dental education in India was formally established in 1920 when Dr Rafiuddin Ahmed established the first Dental College in Kolkata. In 1966, the first private dental institution was established. Soon after this period, there was blooming in numbers of dental colleges: After independence in the year 1950, there were only three dental colleges in India. There was step by step progression in the establishment of dental colleges; In 1960, it became ten dental colleges; in 1970, 14 dental colleges; in 1980, 22 dental colleges. A double-fold increase was seen in the year 1990, with 55 dental colleges in India. In the 50 years after independence, there was a spike in establishing dental colleges with 134 dental colleges in India. The reason for capricious trends in the growth of dental colleges is that the government is open to private. This attributed to the self-financing approach that envisioned to cater to the ever-growing population's health needs.<sup>[9]</sup> The current data were retrieved from the Dental Council of India (DCI) showed that there were 318 dental colleges in India. Two hundred sixty-two belong to the private sector, and 56 were government-owned. While the Indian population is increasing by 1.31% per year, the number of dentists' growth is approximately 8% annually. India exceeds the USA, Brazil and all of Europe in dental colleges.<sup>[10, 11]</sup>

The growth was not uniform in the government and private sectors. By analyzing the scenario of undergraduate and postgraduate positions available, both in the government and private sector, out of 318 dental colleges, there were 262 dental colleges in the private sector ( 82%) and 56 dental colleges in the government sector ( 18%) in India. In BDS positions, out of 313 BDS positions, there were 262 dental colleges in the private sector (84%) and 51 dental colleges in the government sector (16%) in India. In MDS positions, out of 268 MDS positions, there were 230 dental colleges in the private sector (86%) and 38 dental colleges in the government sector (14%) in India. This depicts the unevenness of the dental institutes among the government and private sectors. There were an equal distribution of Government and Private dental institutes in West Bengal. In Delhi, all dental institutes were under the Government sector.

Privatization, in general, has been known to increase the gap between rich and poor. As there is a substantial difference in the fee structure of government and private sector in dental educational institutions, the students of middle and low socioeconomic groups become unaffordable in pursuing dentistry. This excessive privatization has undermined oral healthcare services and further limited access by the underprivileged<sup>(12, 13)</sup>. However, for monetary reasons, dentists tend to cluster in cities or large towns rather than establishing dental practices in rural areas<sup>(14)</sup>. Compared to most countries, the dental post- graduation sustains to be the costliest.<sup>(15)</sup>

The students pursuing a Bachelor degree fail to pursue a master degree due to the inordinate fee, which has created a scenario that some dentists intend to seek alternate professions.<sup>[16]</sup> According to various branches in dentistry, also there lies discrepancy. In collation among the nine dentistry branches in India, the branch of oral surgery was recorded with a relatively higher percentage (16%) of positions with the Government sector, followed by the oral pathology with 14% of positions in the Government sector. The branch of public health dentistry and pedodontics has the least only 9% in the Government sector with an upper hand of 91% in the private sector. The orthodontics department closely follows this, with 10% in the government sector and 90% in the private sector.

The branch of prosthodontics accounts for 12% in the government sector and 88% in the private sector, followed by periodontics, conservative dentistry and oral medicine shared equally with 13% in the Government sector and 87% in the private sector. The branch of pedodontics and preventive dentistry has the least government positions in India, which is a significant concern as prevention is essential in oral health and care for children is imperative in the community.

The dentist population ratio in India was 1:30,000 in the year 2004. Ten years, the ratio became 1:10,000 in 2014.<sup>[17,18]</sup> Currently, the total population of India is 138 crores.<sup>[19]</sup> The total no. of registered dentist is 2,78,076. The dentist population ratio in India is 1:4975. This might be endorsed to the flourishing of dental colleges in India. Among the dental educational institutions, the highest of forty-eight dental colleges exist in Karnataka, whereas the single institute's services are unavailable in North-eastern states such as Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. There is a severe deficiency of dental colleges in India's North-eastern states, which were most adversely affected by the lack of dental professionals.

Similarly, union territories like Andaman and Nicobar, Lakshadweep in the South zone and Dadra and Nagar Haveli in the west zone is devoid of a single Dental Educational Institute. According to WHO, there should be one dentist for the 7500 population, wherein India, the data shows that there is one dentist for every 4975 population, which depicts the overproduction of dentistry that is currently alarming. Initiation of the bridging course that caters an opportunity to pursue MBBS in three years with the completion of Bachelor of Dental science by the Dental Council of India has disclosed various job opportunities which happen to revamp the oral health in rural areas by extending their postings.<sup>[20]</sup>

To the excess dentist practicing in comparison to population, the George Town University School of Dentistry in Washington was shut down in 1990, fearing a loss. This situation must be considered an alarming eye-opener as it is not far too long for the same scenario to be emanated here. Curbing the dental colleges in India could keep the dentist population ratio in control.<sup>[21]</sup> India was geographically grouped into North, South, East, West, Central and North East. By closely analyzing the results according to zones, there is an inequitable concentration of dental institutes in the state, which leads to essential disruption in dental infrastructure. There is the highest number of dental colleges (42%) for a population of (20%).

In contrast, the North-East zone has only (2%) of dental institutes to cater to (4%) of the population. The presence of densely populated colleges in cities poses a severe problem for students' dearth for students during the examination to perform the required clinical procedures. There also occurs an incidence of conflict of interest among colleges during public health outreach programs.

As dental education institutes mainly focus on research in other countries, dental institutes were the only hub for both research and treatment procedures in India. Many dental colleges emerged in India; there should be ample dentists' available throughout the country. However, there are growing concerns about market saturation and possible shrinkage of jobs in most urban cities in India. An intellectually stimulating environment for professional enrichment, lucrative working conditions and avenues for career growth should be provided to the young dentists.<sup>[22]</sup>

The challenges faced by dental professionals are grave. The current system prevailing will lead to disastrous consequences unless intervened with the emergency without negligence to save the profession's dignity. Medical (MBBS) bridging courses for the bachelor of dental surgery graduates is the need of the hour, and it should be granted at the earliest time possible, with the prerequisite bond to do compulsory rural service for five years which would be of generous fill up for the depth of medical services in rural areas.

## Limitations

Authentic government database with few accurate details on dentist working in the department of railways, public enterprises in India emanated a crisis that specific descriptive statistics concerning the data mentioned above cannot be retrieved. The unavailability of robust data on public domains restricts further conclusions.



## Conclusions

In the last 15 years, there has been a significant expansion in the number of dental colleges and the number of people who joined the dental profession. The current data on dental professionals and dental education in India shows that India has 318 dental colleges granting degrees in dentistry (262 private and 56 public). However, there is a lack of systematic planning and development of dental colleges in India, as evident by their uneven geographic distribution. Despite India being a nation with one of the most significant numbers of dental schools and the highest number of graduates annually, we believe that the situation does not appear to have improved most of the population's oral health. The substantial solution is by incorporation of dentists into primary health care systems that may help bridge the rural-urban gap in dental workforce distribution.

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