



Dentist Population Ratio of Bangalore City: Adequate or Inadequate-A Descriptive Study

Authors

Dr Dhanya.R¹, Dr Harikiran A.G², Dr Deepti Vadavi³

¹Sree Mookambika Institute of Dental Sciences, Padanilam welfare trust, Kanyakumari district, Kulasekharam, Tamilnadu

^{2,3}DAPM RV Dental College, JP Nagar 1st Phase, Bangalore, Karnataka

Corresponding Author

Dr Dhanya.R

Senior Lecturer, Sree Mookambika Institute of Dental Sciences, Padanilam welfare trust, Kulasekharam, Kanyakumari District, Tamilnadu

Email: drdhanyadev@gmail.com, Phone number: 8138884158

Abstract

Background: World Health Organization has raised the alarm that oral disease is one of the major public health problems. Current scenario indicates that the existing 180000 dentists are not sufficient to meet the oral health demands of population in India due to various reasons, one being misdistribution of dentists. Hence our study aims to estimate the Dentist Population ratio (DPR) of Bangalore City.

Methodology: The distribution of dentists in Bangalore City was estimated by calculating the Dentist Population Ratio. The number of dentists involved in private practice, govt. service and academics were calculated and compared with the population of Bangalore city. In order to look into the lacunae regarding the secondary data obtained from official sources, a mean correction factor was calculated from the manual survey in 8 wards of Bangalore City which were selected by random sampling.

Results: An official DPR of 1:2954 and corrected DPR of 1:1533 was estimated for Bangalore City. A total of 1843 dental clinics, 3687 dental practitioners, 28 government dentists, 1002 academicians were obtained after applying a mean correction factor of 2.6 and an average of 2 dentists per clinic.

Conclusion: The results of our study reveals that if any region in Bangalore City or Karnataka has a higher DPR than the WHO recommendation suffers from low availability of dentists, or reduced accessibility to dental services, it can be inferred that it is not due to a deficiency in the number of dentists, but due to a misdistribution of dental health care personnel.

Keywords: Misdistribution, Dentist Population Ratio, Oral Health, Dentists.

Introduction

Dentistry is one of those areas in health that has expanded the most in the recent years with the increase in the number of dental colleges all over the world. India is the largest producer of dental graduates with more than 25,000 new dental

graduates each year adding to the existing numbers of dentists. Correspondingly, the number of Dentists in the country has also increased from hundreds to now nearing 180,000.¹ There is about 3.5 times increase in the population since then and number of dentists has increased to more than

3000 times.¹ There is an ever increasing burden of oral diseases in India despite of 1.8 lakh dentists. This sheds light on the fact there is some limitation that needs to be sorted out to meet the oral health care needs of the population.

The distribution of dentists in relation to the population is dramatically different from the distribution of dentists recommended by WHO being 1:7500.² In Greece, dentist to population ratio show a trend from 1:1301 in 1982 to 1:987 in 1992 to 1:766 in 2007 and 1:582 in 2013.³ In Brazil, the dentist to population ratio was reported to be 1:874 in 2009.⁴ In Africa, the dentist-to-population ratio is approximately 1:150,000 against about 1:2,000 in most industrialized countries, which further highlights the global difference.⁵

The World Health Statistics 2004 show that in India the dentist to population ratio is 1:30000, 1:10,000 in urban areas and 1:150000 in rural areas.⁶ The dentist to population ratio has markedly improved from 1960s when it was 1:301,000.⁷ However, there is considerable variation in the distribution of dentists across various states. To date, the evidence to support this proposition has been limited, owing to a lack of reliable disaggregated data at the country level. Though there has been an increase in number of dental colleges, Dentist Population Ratio remains constant since 1990s. Hence it is the need of the hour to explore whether this DPR is due to lack in number of dentists serving the population or misdistribution of dentists.

Bangalore is one of the cities with the highest number of practicing dentists and 16 dental colleges. An estimation of Dentist Population Ratio is sure to inform the various stakeholders the questionable and unpredictable future of dentistry and to take positive steps in this regard. Hence this study aims to estimate the Dentist Population Ratio (DPR) in Bangalore City.

Materials and Methods

A descriptive study was conducted in Bangalore city for duration of one year from November 2014-2015.

Source of Data: Secondary Data regarding the Population and Dentists were obtained from the following sources:

Population: Details of the wards including the demographic characteristics (total population), area covered and other ward related information were obtained from Bruhat Bangalore Mahanagara Palike [BBMP]-online source: Ward wise information system for citizens awareness [URL:<http://www.vigeyegpms.in/bbmp/?module=public&action=wardinfo&wardid=195>]

Dentists:

Details of Dental Clinics and Private Practitioners:

Clinic Establishment Centre Registry (BBMP-Health and Sanitation Department in Bangalore governance observatory), Waste management agency in Bangalore-Maridi Eco, State Pollution Control Board

Details of Dentists working in Government Sector:

Directorate of Medical Education, Govt. of Karnataka

Details of Academicians:

16 Dental Colleges in Bangalore

Estimation of Dentist Population Ratio

Total number of dentists of Bangalore city involved in service delivery sector comprising of dental private practitioners, government dentists and academicians and Zone-wise and ward-wise population of Bangalore City was calculated from the sources as mentioned above. Secondary Data obtained from the various information sources may not be adequate to accurately estimate DPR owing to a number of reasons:

1. The existing list of Dental Clinics may not be comprehensible.
2. New Clinics might have opened/renewal of clinic registration might not have been done.

3. Unregistered Dental Clinics

Bangalore city is divided into 8 zones, according to the geographic stratification of revenue department of BBMP, which forms the sampling frame of this study. 198 wards exist in the Bangalore Corporation within the city limit. A manual survey was conducted in 8 randomly selected wards, 1 each from 8 zones of Bangalore City. Using this information, a correction factor was calculated. Correction Factor(CF) is a mathematical adjustment made to a calculation to account for any discrepancy between the observed and actual values, or any deviations in either the sample or method of measurement. From the data obtained from these 8 wards, the mean number of dentists per dental clinic was calculated.

DPR using data from official sources was calculated as Total number of dentists in Bangalore City/Total population of Bangalore City. Using the correction factors calculated from respective zones, zone-wise corrected DPR was calculated.

The mean correction factor for Bangalore city was calculated from the correction factors obtained for 8 zones, proportionately taken with respect to the total number of registered dental clinics in each zone. Using this mean correction factor, a corrected DPR of Bangalore City was estimated. The association of DPR with socioeconomic status, area covered by ward and market demand for dental services was analyzed using Chi-square test.

Ethical clearance has been obtained to conduct the study from the institutional ethical review board (DAPM RV Dental College) [IRB No: 044/Vol-1/2013].

Results

A pilot study was conducted in JP nagar ward to check for any discrepancy between the number of dental clinics from official data and true number of dental clinics. Pilot study revealed that true number of dental clinics in JP nagar ward was 3.3 times the number of registered clinics obtained from official sources.

Since the discrepancy between the official data and true number of dental clinics was found to be high, manual survey was done in randomly selected 8 wards, 1 each from 8 zones of Bangalore City.

The Ward-wise distribution of dental clinics in 8 randomly selected wards of Bangalore City was calculated (Table 1)

Correction factor was calculated as the ratio between the true number of dental clinics as per the manual survey and number of registered dental clinics according to official sources. From the data obtained from these 8 wards, it was found that most of the dental clinics had only 2 permanent dentists, the rest being visiting dentists who were academicians or those owning their own dental clinic. Only few dental clinics had 1 or 3 permanent dentists. So an average of 2 dentists per dental clinic was taken and number of academicians (AC) obtained from different dental colleges in respective zones was separately added to the list. The number of government dentists (GD) practicing in those zones, obtained from DME was also added to complete the list. Thus the list of total number of dentists in all 8 zones of Bangalore City was prepared. Thus the Zone-wise DPR was calculated (Table 2 and 3)

DPR of Bangalore City

The mean correction factor for Bangalore city was calculated from the correction factors obtained for 8 zones, proportionately taken with respect to the total number of registered dental clinics in each zone. The mean correction factor thus calculated was found to be 2.6. The total number of registered dental clinics in Bangalore as per the official data was 709 with an average of 2 permanent dentists per clinic. The total number of academicians of Bangalore city obtained from different dental colleges was 1002 and the total number of government dentists obtained from DME was 28. The population of Bangalore city obtained from official sources was found to be 7230555. The DPR of Bangalore City was calculated as follows and depicted in Table 4

No:of registered dental clinics in Bangalore as obtained from Official Sources = 709

Estimated number of Dental Clinics in Bangalore after applying Correction Factor = $709 \times 2.6 = 1843$

Estimated total number of Dental Private Practitioners in Bangalore after applying Correction

Factor = $709 \times 2.6 \times 2 = 3687$

Estimated total no:of Dentists in Bangalore after applying Correction

Factor = $3687 + 28(\text{GD}) + 1002(\text{AC}) = 4717$

Hence Corrected DPR of Bangalore City was estimated as $4717 / 7230555 = 1:1533$

Association of various characteristics of wards on DPR

The different characteristics of ward that can be associated with Dentist Population Ratio are socioeconomic status, area covered and market demand for dental services. Wards have been categorized on the basis of socioeconomic status and area covered. Market demand for dental

services have been categorized on the basis of number of dental clinics functioning in each ward. Corrected DPR was used to determine these associations. DPR higher than 1:1500 was considered as high DPR, 1:1500-1:3000 as medium DPR and 1:3000 and below as low DPR. The socioeconomic status was significantly associated with DPR (p value-0.038). Proportion of wards with high DPR was significantly higher in wards with high and middle socioeconomic status compared to wards with low socioeconomic status.

Proportion of wards with high DPR was higher in wards covering 0.5-3 sq.kms as compared to those above 3sq.kms. But association was not found to be statistically significant(p value -0.076).

Market demand for dental services as assessed by number of dental clinics in the ward was found to have a statistically significant association with DPR (p value<0.001). Proportion of wards with high DPR was more in wards with higher market demand(Table 5)

Table 1 : Table Depicting ward-wise distribution of dental clinics in 8 randomly selected wards of Bangalore City

Sl No	Bangalore City Zone	Ward No	Ward Name	Number of Dental Clinics	
				Manual Survey	Official sources
	Bangalore South	153	Jayanagar	32	16
	Bangalore West	99	Rajaji Nagar	82	17
	Bangalore East	111	Shanthala Nagar	18	10
	Dasarahalli	15	T Dasarahalli	29	11
	Bommanahalli	193	Arakere	31	7
	Mahadevapura	52	KR puram	8	1
	Bytaranapura	4	Yelahanka Satellite	43	13
	RR Nagar	184	Uttarahalli	8	1

Table 2: Table Depicting zone-wise DPR of Bangalore City obtained from official sources

Sl No	Zones in Bangalore	No:of Dental Clinics	Dentists				Population	DPR from Official sources
			PP	GD	AC	Total		
	Bangalore South	364	728	5	667	1400	1582711	1:1131
	Bangalore West	90	180	4	110	294	1661753	1:5652
	Bangalore East	164	328	5	65	398	1877635	1:4718
	Dasarahalli	23	46	2	0	48	411056	1:8564
	Bomanahalli	36	72	3	58	133	431867	1:3247
	Mahadevapura	5	10	4	54	69	519663	1:7531
	Bytaranapura	17	34	3	0	37	461934	1:12485
	RR Nagar Zone	10	20	2	48	70	283936	1:4056
	Total	709	1418	28	1002	2448	7230555	1:2954

DC – Dental Clinics; PP- Private Practitioner; AC-Academician; GD- Government Dentist

Table 3 Table Depicting zone-wise corrected DPR of Bangalore City after applying the correction factor

Sl No	Zones in Bangalore	No:of Dental Clinics	CF	Dentists				Population	Corrected DPR
				PP	GD	AC	Total		
	Bangalore South	364	2	1456	5	667	2128	1582711	1:744
	BangaloreWest	90	4.8	864	4	110	978	1661753	1:1699
	Bangalore East	164	1.8	590	5	65	660	1877635	1:2845
	Dasarahalli	23	2.6	120	2	0	122	411056	1:3369
	Bomanahalli	36	4.4	317	3	58	378	431867	1:1143
	Mahadevapura	5	8	80	4	54	138	519663	1:3766
	Bytaranapura	17	3.3	112	3	0	115	461934	1:4017
	RR Nagar Zone	10	8	160	2	48	210	283936	1:1352
	Total	709	2.6	3687	28	1002	4717	7230555	1:1533

DC – Dental Clinics; PP- Private Practitioner; AC-Academician; GD- Government Dentist;CF- Correction Factor

Table 4: Table Depicting DPR of Bangalore City

Sl No	Total number of dentists involved in service delivery					Total Population	Estimated DPR	
	DC		PP		AC	GD		
	Official	Corrected	Official	Corrected			Official	Corrected
1.	709	1843	1418	3687	1002	28	7230555	1:2954 1:1533

DC – Dental Clinics; PP- Private Practitioner; AC-Academician; GD- Government Dentist;CF- Correction Factor

Table 5: Table depicting the association of various characteristics of ward on DPR using Chi-square Test

Sl No	Characteristics of Ward	Corrected DPR				p-value
		High DPR(>1:1500)	Moderate DPR(1:1500 to 1:3000)	Low DPR (<1:3000)	Total	
	Socioeconomic Status					
	Low	2	3	5	10	0.038*
	Middle	11	5	1	17	
	High	24	5	10	39	
	Total	37	13	16	66	
	Area Covered Category(in sq.kms)					
	Low(0.5-3)	31	8	9	48	0.076
	Medium(3-6)	4	1	4	9	
	High(>6)	2	4	3	9	
	Total	37	13	16	66	
	Market Demand For Dental Services(No:of Dental Clinics)					
	Low (1-4)	24	13	16	53	0.000*
	Moderate(4-8)	9	0	0	9	
	High(>8)	4	0	0	4	
	Total	37	13	16	66	
P<0.05*- statisticallyv significant						

P<0.05*- statistically significant

Discussion

An efficient dental workforce planning should possess adequate number of dentists ensuring uniform distribution in different geographical areas to have access to oral health care for all. DPR has been widely accepted as a useful tool for comparison between various countries, especially in relation to availability and accessibility to health care services. Workforce requirement is simply based on the size of the

population, and desirable ratios are established on the basis of current situations, international comparison, recommended standards and extrapolation of past trends.⁸

Bangalore, a place where people from different parts of India come and settle, the population is varying and has different characteristics. Number of people migrating in and out of Bangalore varies with time. So the DPR cannot be a constant value

and would show small changes accordingly, thus having a dynamic nature.

Our study reported a DPR of 1:2954 which was calculated using data from official sources and a corrected DPR of 1:1533 was calculated using correction factor. This DPR was calculated after accounting for unregistered dental clinics which are not present in the official data. DPR estimation in Bangalore city which houses 16 dental colleges can create an evidence base in dental manpower planning, which can be used for policy decision-making to address mal-distribution by the government

There is a drastic increase in the number of dentists produced in India in the last 10 years owing to the establishment of many new dental colleges. Even if we take into consideration only the list of registered private dental clinics as available from official sources in Bangalore along with the academicians and government dentists, we get a DPR of 1:2954 which is nearly 2.54 times the WHO recommended DPR of 1:7500 and the corrected DPR of 1:1533 which accounts for the unregistered private dental clinics also is 4.9 times the WHO recommended DPR.

In 2004, Dentist-population ratio in India was 1:30,000 and had one dentist per 10000 people in urban areas and one dentist per 1.5 lakh people in the rural areas. However, the ratio suggested that there were still not enough number of dentists in India, but it was not the sole factor. There was one more factor which could not be ignored - the inequality in distribution of dentists.

It was suggested by a study emphasizing on increasing unemployment among dental graduates that government, ministry of education and other stakeholders should take initiatives in increasing job opportunities in rural areas that can aid in creating a balance in the concentration of dentists in urban and rural areas and to create new posts for dental graduates in government hospitals and in Primary Health Centre⁹.

The World Health Organization (WHO) provides no ideal or desirable statistics, since the distribution of dental health care personnel gets

strongly influenced by local factors such as socioeconomic status of the population, geopolitical factors as well as cultural and epidemiological characteristics.¹⁰

For example, in Iran, there were approximately 13,000 dentists nationwide. With a population of 71 million people, there was only one dentist for every 5,500 people. In Canada, with 32 million there were 18,287 dentists, or approximately one dentist for every 1,800 inhabitants. In Europe, the ratio was 1:1,561 inhabitants.⁴

Corrected DPR in Bangalore obtained in our study is similar to DPR of Australia (1:1680 in urban areas) and the United States of America (1:2000).⁵ Though we have 1 dentist for 1533 population, whether the oral health problems are adequately addressed in the city still remains a question. Though there are 1843 dental clinics, whether all the dental clinics report a net profit also remains doubtful. These queries indicate the need to foresee a probable distressing future of dentistry.

In India, Karnataka, Maharashtra and Kerala are the states with the highest concentration of dentists. The existing dentist-population ratio in Kerala was 1:3866 which was much above the ratio of 1:7,500 insisted by the World Health Organization. The DPR in Karnataka, Tamil Nadu dips to 1:3000. In Maharashtra DPR is 1:5978.¹¹

If any region in Bangalore City or Karnataka or any of these states which has a higher DPR than the recommendation suffers from low availability of dentists, or reduced accessibility to dental services, it can be inferred that it is not due to a deficiency in the number of dentists, but due to a misdistribution of dental health care personnel.

Conducting a manual survey without depending completely on the available official list was a strength of the study. Restricting the study to 8 wards owing to feasibility issues was a limitation of the study.

Conclusion

The available DPR of India is 1:30,000, 1:10,000 in urban areas and 1:250000 in rural areas. Our study revealed that in Bangalore City, DPR is

1:1533. Reported DPR of Karnataka state is 1:3000, much higher than WHO recommended figures. This clearly tells us that there is no deficiency in the number of dentists in the state and any failure to address the oral health challenges are due to other factors like misdistribution of dentists. The overall goal should be to ensure equitable access to oral care for all segments of the population while at the same time allowing for economically sustainable working conditions for dentists, both in public service and private practice. Thus it is important to conclude that manpower development as a concept and method should be able to take its rightful place as a tool for development in our country

Acknowledgements

Our sincere gratitude to the health officers in all the 8 zones of Bangalore City, staff in the directorate of medical education, Bangalore for rendering help during the data collection.

Conflict of Interest: Nil

Source of Funding: None

References

1. N.K A, Parmar R. Demographics and Current Scenario with respect to Dentists, Dental institutions and Dental Practices in India. Indian J Dent Sci. 2011;3(2):8–11.
2. Vundavalli S. Dental manpower planning in India: current scenario and future projections for the year 2020. Int Dent J. 2014;64(2):62–7.
3. Koletsi-Kounari H, Papaioannou W, Stefanotis T. Greece's High Dentist to Population Ratio: Comparisons, Causes, and Effects. J Dent Educ. 2011 Nov 1;75(11):1507–15.
4. Saliba NA, Moimaz SAS, Garbin CAS, Diniz DG. Dentistry in Brazil: Its History and Current Trends. J Dent Educ. 2009 Feb 1;73(2):225–31.

5. American Dental Education Association. Dentists and Demographics. 2008.
6. World Health Organisation. World Health Report 2004 Statistical Annex [Internet]. 2004. Available from: <http://www.who.int/whr/2004/annex/en/>
7. Tandon S. Challenges to the Oral Health Workforce in India. J Dent Educ. 2004;68(7):28–33.
8. Council on Clinical Affairs. Policy on Workforce Issues and Delivery of Oral Health Care Services in a Dental Home [Internet]. AAPD; 2014. Available from: http://www.aapd.org/media/policies_guide_lines/p_workforceissues.pdf
9. Dagli N, Dagli Rushabh. Increasing Unemployment among Indian Dental Graduates – High Time to Control Dental Manpower. J Int Oral Health [Internet]. 2015;7(3). Available from: http://www.ispcd.org/userfiles/rishabh/Editorial_V7I3March.pdf
10. Tennant M, Kruger E, Shiyha J. Dentist-to-population and practice-to-population ratios: in a shortage environment with gross mal-distribution what should rural and remote communities focus their attention on? Rural Remote Health [Internet]. 2013 Dec;13(4). Available from: <http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=2518>
11. Govt. of India. State wise number of Allopathic doctors, Dentists and Average population served in India. Indian Statistical Society; 2008.