

# TRENDS IN THE GEOGRAPHIC DISTRIBUTION OF DENTISTS IN MALAYSIA FROM 2015 TO 2019.

Author  
**ZI SHAN LOW**

Jinjang Dental Clinic, General Oral Health Department, Jalan Jinjang Setia 3, Jinjang Utara, 52000 Kuala Lumpur, Federal Territories Kuala Lumpur  
+6017-2822139  
elora\_low@hotmail.com

## Abstract:

**Objective:** With the increase of dental institutions and number of dentists of dentists in Malaysia, this study aimed to investigate the distribution of population and dentists in each state and determine if there is an improvement in the geographical distribution of dentists in Malaysia from the year 2015 to 2019.

**Methods:** This study collected the population data from the Department of Statistics Malaysia and, the number of dentists in public and private sectors from the Malaysian Dental Council website. The population of dentists per 100,000 population and the increase in this number is calculated year by year for each state. Lorenz curves and Gini coefficients were used to assess the distribution of dentists from 2015 to 2019.

**Results:** The total population of Malaysia increased by 1.34 million while the total number of dentists increased from 6,348 to 10,801 from 2015 to 2019. The Gini coefficient in 2015 (0.211) is the lowest, and increased every year up to 2019.

**Conclusion:** It can be observed that there is an unequal distribution of dentists throughout Malaysia. This issue might continue to deteriorate with time if no action is taken by the policymakers.

**Clinical Significance:** The result of this study redounds to the benefits of dentists and policymakers. It provides insights on the geographical inequalities of dental care services in Malaysia and how it changes with time. Information presented could be of significant value in the initial stages of planning the location of dental clinics to improve public accessibility of oral healthcare in Malaysia.

**Keywords:** dentists, dental clinics, distribution, Malaysia, population

## Introduction:

When Malaysia gained its political independence in the 1975, there were 7 million population throughout the country, with only 20 dentists working in the public sector and around 50 working in the private sector. The majority of them were based in urban areas. <sup>[1]</sup> There was only one dental school in Malaysia until 1997, but Malaysia has strived to produce qualified dentists by rapidly increasing the number of dental schools to 13 by 2010. <sup>[2]</sup>

The Ministry of Health (MOH) Malaysia realized the surplus of dentists caused by the increase of dental schools in Malaysia and took action by shortening the duration of compulsory public service. 3 years of compulsory service was required from all graduates in 2001. This was shortened to 2 years in 2012 <sup>[3]</sup>, and latterly, to 1 year of public service <sup>[4]</sup>, due to an imbalance between graduate numbers and clinical facilities. Although the private sector is growing, the majority of dentists still work in the public sector. <sup>[5]</sup> To reduce the number of dentists in the public sector, the MOH Secretary-General issued a circular on 1<sup>st</sup> December 2016 regarding the Contract of Service for newly appointed dentists to undergo compulsory service. The Circular stated that the period of duty of a dental officer is one year, but the duration of the contract is 3 years.

In Japan, many dental students graduate from 29 dental universities and schools (colleges) every year and this causes a very significant impact on the number of dentists in prefectures with dental universities or schools. <sup>[6]</sup> To resolve the regional differences in dental health services, the Japanese government tried to set a mandatory postgraduate clinical training policy for dentists to normalize and correct the uneven regional distribution of dentists and dental clinics. <sup>[7]</sup>

Malaysia Health Minister Datuk Seri Dr Adham Baba reported that there were 11,059 dentists in public and private sectors as of June 2020, with the dentist-population ratio at 1:2,963.<sup>[8]</sup> On a side note, there were 1088 new dental registrants in 2019 while there were only 231 registrants in 2009.<sup>[9]</sup> The results of a study done by Bohari et. al<sup>[10]</sup>, showed that dentists are distributed relative to high population density and relative wealth, with dental services being more saturated in the major cities and along the coastlines.

Given the current organization and maldistribution of oral health care in Malaysia, it is crucial to analyze the changes in the geographic distribution of dental clinics across Malaysia from 2015 to 2019 to identify dental underserved areas. Besides, it would assist the stakeholders and responsible authorities in the planning for dental health service delivery efficiently.

**Methods and materials:**

All data were collected from open-access secondary data, therefore, no ethics approval was required. In this study, the population data in each state from 2015 to 2019 were retrieved from the Department of Statistics Malaysia.<sup>[11]</sup> The total number of dental practitioners with Annual Practicing Certificates (APC) by states from 2015 to 2019 were obtained from respective Annual Reports by Malaysian Dental Council.<sup>[2,9,12,13,14]</sup>

To describe the geographic distribution of dentists in Malaysia, the Lorenz curve and Gini coefficient were chosen. First, the number of dentists/100,000 population was calculated for each state. The density of dentists in each state was arranged in ascending order and the Lorenz curve was plotted with the cumulative population proportion (%) on the horizontal axis and cumulative proportion of dentists (%) on the vertical axis. If the dentists are equally distributed, the Lorenz curve will pass through the origin as a diagonal line; if the distribution is unequal, the curve will fall below the diagonal line.<sup>[15]</sup>

Gini coefficient defines the ratio of the area between the diagonal line with the curved line and the area under the diagonal line. The number of dentists/100,000 population was compared between states classified by population size. Trends and any changes from 2015 to 2019 were noted to investigate which areas are lacking of dentists.

Data analyses were performed with IBM SPSS version 27.0 and Microsoft Excel 365.

**Results**

**TABLE 1: The numbers of total population and dentists in each state in Malaysia from 2015-2019. Results are given for the total population and dentists in each state and each year.**

States	Population ('000) <sup>a</sup>					Overall dentists <sup>b</sup>				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
<b>Johore</b>	3,610.3	3,651.8	3,697.0	3,749.4	3,761.2	590	673	863	986	1100
<b>Kedah</b>	2,096.5	2,119.7	2,143.9	2,163.0	2,173.7	338	370	452	496	545
<b>Kelantan</b>	1,760.6	1,796.7	1,829.0	1,860.5	1,883.8	399	455	529	603	699
<b>Malacca</b>	889.0	901.1	913.1	922.4	928.4	201	246	343	392	431
<b>Negeri Sembilan</b>	1,088.8	1,099.3	1,114.0	1,122.9	1,126.2	283	282	367	444	524
<b>Pahang</b>	1,607.9	1,626.7	1,647.0	1,664.7	1,671.4	410	484	512	560	636
<b>Penang</b>	1,698.1	1,717.7	1,744.1	1,762.8	1,768.8	418	476	575	667	697
<b>Perak</b>	2,466.9	2,482.1	2,493.2	2,503.5	2,508.8	412	470	578	632	715
<b>Perlis</b>	248.5	251.0	252.0	253.5	254.0	79	99	119	146	161
<b>Selangor</b>	6,178.0	6,291.5	6,380.7	6,475.0	6,506.1	1115	1261	1549	1826	2,041
<b>Terengganu</b>	1,161.0	1,183.4	1,208.0	1,228.3	1,244.5	312	353	422	498	550
<b>Sabah</b>	3,720.5	3,802.8	3,855.9	3,898.4	3,904.4	391	414	437	463	530
<b>Sarawak</b>	2,701.5	2,738.7	2,766.3	2,791.7	2,806.0	397	455	516	529	558
<b>F.T Kuala Lumpur</b>	1,780.4	1,789.7	1,793.2	1,790.0	1,782.5	949	1044	1205	1309	1452
<b>F.T Labuan</b>	95.1	96.8	97.6	99.0	99.3	15	24	26	27	39
<b>F.T Putrajaya</b>	83.0	84.4	87.5	97.2	103.7	75	80	105	121	123
<b>Total</b>	31,186.1	31,633.4	32,022.5	32,382.3	32,522.8	6,348	7,186	8,598	9,699	10,801

**Abbreviations:** F.T, Federal Territory

\* Source: Department of Statistics Malaysia

\$ Source: Malaysia Dental Council

There are 13 states and 3 federal territories in Malaysia. The total population and number of dentists in each state of Malaysia from the year 2015 to 2019 were shown in *Table 1*. Within 5 years, the population of Malaysia increased by 4.29%. The state with the highest population for 5 years consecutively is Selangor, followed by Sabah and Johore. Perlis, the smallest and least populated state in Malaysia (excluding the federal territories), had its population size increased by 5,500 to 254,000 in 5 years interval. Kuala Lumpur was the most populated federal territories in Malaysia.

There was an increment of about 891 dentists per year with a total increase of 4,453 dentists in 5 years' time. Selangor was the state with the most dentist, accounting for about 17.6-18.9% of the nationwide dentists. Federal territory Kuala Lumpur had the second-highest number of dentists. There were 949 dentists in 2015 and it increased by 503 to 1452 dentists in 2019, an increase of over 53%. Johor had about half the number of dentist in Kuala Lumpur. Labuan was the state with the least number of dentists in 2015, but there was a 160% increase in 2019 (*Table 1*).

**TABLE 2: Distribution of dentists per 100,000 population classified by each state in Malaysia and their differences each year from 2015-2019**

States	Number of Dentist per 100,000 Population ('000)					Increasing number of dentists per 100,000 population			
	2015	2016	2017	2018	2019	2015-2016	2016-2017	2017-2018	2018-2019
Johore	16.34	18.43	23.34	26.30	29.25	2.09	4.91	2.95	2.95
Kedah	16.12	17.46	21.08	22.93	25.07	1.33	3.63	1.85	2.14
Kelantan	22.66	25.32	28.92	32.41	37.11	2.66	3.60	3.49	4.70
Malacca	22.61	27.30	37.56	42.50	46.42	4.69	10.26	4.93	3.93
Negeri Sembilan	25.99	25.65	32.94	39.54	46.53	-0.34	7.29	6.60	6.99
Pahang	25.50	29.75	31.09	33.64	38.05	4.25	1.33	2.55	4.41
Penang	24.62	27.71	32.97	37.84	39.41	3.1	5.26	4.87	1.57
Perak	16.70	18.94	23.18	25.24	28.50	2.23	4.25	2.06	3.26
Perlis	31.79	39.44	47.22	57.59	63.39	7.65	7.78	10.37	5.79
Selangor	18.05	20.04	24.28	28.20	31.37	2.00	4.23	3.92	3.17
Terengganu	26.87	29.83	34.93	40.54	44.19	2.96	5.10	5.61	3.65
Sabah	10.51	10.89	11.33	11.88	13.57	0.38	0.45	0.54	1.70
Sarawak	14.70	16.61	18.65	18.95	19.89	1.92	2.04	0.30	0.94
F.T Kuala Lumpur	53.50	58.33	67.20	73.13	81.46	5.03	8.86	5.93	8.33
F.T Labuan	15.77	24.79	26.64	27.27	39.27	9.02	1.85	0.63	12.00
F.T Putrajaya	90.36	94.79	120.0	124.49	118.61	4.43	25.21	4.49	-5.87
<b>Total</b>	20.47	22.72	26.85	29.95	33.21	2.25	4.13	3.10	3.26
<b>Mean ± S.D</b>	26.99 ± 19.59	30.33 ± 20.37	36.33 ± 25.73	40.15 ± 26.94	43.88 ± 25.78	-	-	-	-
<b>C.V (%)</b>	72.57	67.17	70.83	67.10	58.75	-	-	-	-

**Abbreviations:** F.T, Federal Territory; S.D, Standard deviation; CV, coefficient of variance.

There was an increase of 2.5 dentists per 100,000 population every year from 2015 to 2019, as shown in Table 2. Similarly, the number of people served by each dentist decreased from 4913 in 2015 to 3011 in 2019. Meanwhile, the number of dentists per 100,000 population increased the most, by 25.21 from 2016 to 2017 in Federal Territory Putrajaya. On contrary, the number of dentists per 100,000 population decreased by 0.34 in Negeri Sembilan from 2015 to 2016. Another decrease is observed in Federal Territory Putrajaya (5.87) from the year 2018 to 2019.

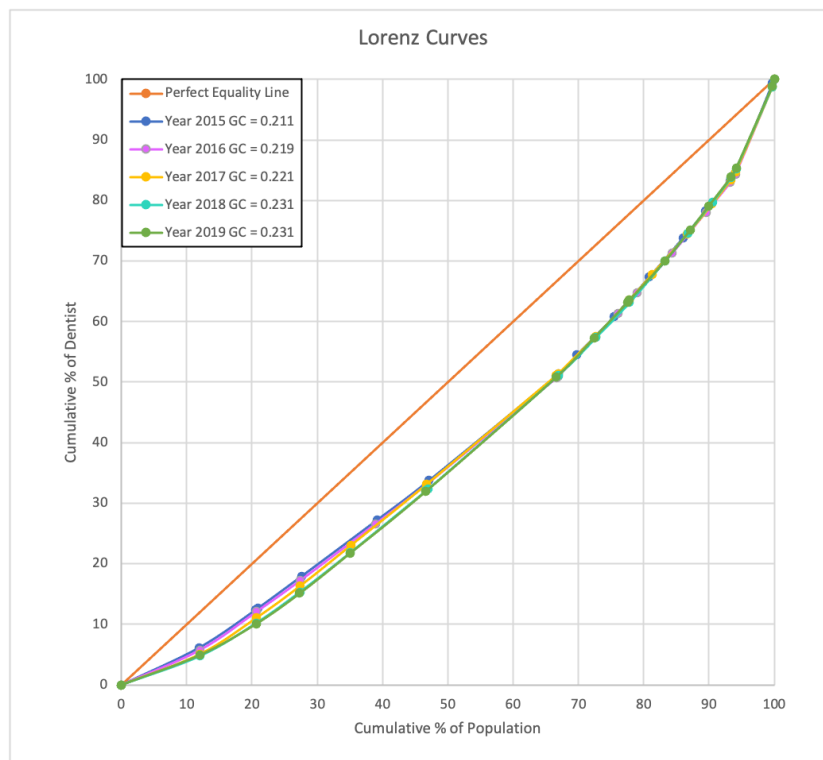
The coefficient of variance (CV) of the number of dentists per 100,000 population were the greatest in the year 2015, followed by 2017. The coefficient of variance in the year 2016 and 2018 were about the same, which were 67.1%. The lowest coefficient of variance is observed in the year 2019, which was 58.75% (Table 2).

**TABLE 3: Median number, 25<sup>th</sup> and 75<sup>th</sup> percentile of dentists per 100,000 population in states by size of population of states from 2015 to 2019 and the change in median between 2015 and 2019.**

Size of population of states	n	Median number of dentists in each state (25 <sup>th</sup> , 75 <sup>th</sup> percentiles)					Change in median between 2015 and 2019
		2015	2016	2017	2018	2019	
<b>Under 1,000,000</b>	4	27.2 (20.9,46.4)	33.4 (26.7,53.3)	42.4 (34.8,65.4)	50.0 (38.7,74.3)	54.9 (44.6,77.2)	27.7
<b>1,000,001 to 2,000,000</b>	6	25.8 (24.8,26.7)	28.7 (26.1,29.8)	33.0 (31.6,34.4)	38.7 (34.7,40.2)	41.8 (38.4,45.9)	16.0
<b>2,000,001 to 3,000,000</b>	3	16.1 (15.4,16.4)	17.46 (17.0,18.2)	21.1 (19.9,22.1)	22.9 (20.9,24.1)	25.1 (22.5,26.8)	9.0
<b>3,000,000 and over</b>	3	16.3 (13.4,17.2)	18.4 (14.7,19.2)	23.3 (17.3,23.8)	26.3 (19.1,27.2)	29.3 (21.4,30.3)	13.0

The median value and 25<sup>th</sup> and 75<sup>th</sup> percentiles of the number of dentists/100,000 population in each state classified by population size, from 2015 to 2019 is shown in Table 3. The highest change in the median between 2015 and 2019 is reported for states with a population of under 1,000,000, while the lowest change in the median was for states with the size of 2,000,001 to 3,000,000 population, which was 9.0.

**Fig. 1: Lorenz curves and Gini coefficients of dentists distribution in Malaysia from 2015 to 2019**



Abbreviation: GC, Gini coefficient

In relation to the geographic distribution of dentists in Malaysia, Gini coefficient in 2015 (0.211) was the lowest, and increased to 0.219 in 2016. There was an increase of 0.002 in Gini coefficient from 2016 to 2017. The Gini coefficients of 2018 and 2019 were about the same, which were 0.231. (Figure 1)

### **Discussion**

This survey shows that the number of dentists in Malaysia increased gradually year by year from 2015 to 2019. According to the statistics done by Malaysian Dental Council, the number of 'active' dental practitioners was 3,567 in 2009 with a population of 28.08 million. Hence, the number of people served by each dentist was 7872, in other words, 12.7 dentists to serve a population of 100,000. 10 years later, in 2019, Malaysia had a population of 32.52 million but the number of dentists increased to 10,817 in 2019, an increase of over 202%. The ratio became 33.3 dentists to 100,000 people in 2019, which meant that the number of people served by each dentist was 3006. The problem on a surplus of dentists was more serious in Taiwan wherein 2019, each dentist was to serve 1560 people, about twice lesser than in Malaysia. In Japan, the number of dentists per 100,000 population was 74.0 even in 2006. Hence, a surplus of dentists is a worldwide problem in the current era.

It was in 1972 that the Faculty of Dentistry was established in the University of Malaya, with its first intake of 32 students. The subsequent establishment of more dental schools helped to address the projected target of 1 dentist for every 4,000 citizens by 2020.<sup>[16]</sup> In fact, this projected target has been reached in 2017, which is 3 years earlier than targeted. The supply of dentists has already exceeded the originally estimated demand.

According to a study done by Tom K et. al, financial rewards, interaction with patients who need help, interest in dentistry, and easy employment were the main reasons for a local university, AIMST's dental students to choose dentistry as a career.<sup>[17]</sup> The department of dentistry in each university became a popular department. Not only from local dental institutions, there are many dental graduates from recognized foreign countries, such as Egypt, India, Indonesia, Jordan, United Arab Republic and more. Among these countries, Egypt's dental graduates were about 10% out of the new registrants in 2019.<sup>[9]</sup> The dentist manpower cultivated by the 13 dental schools in Malaysia is sufficient to meet the current demand.

The Ministry of Higher Education (MOHE) and the Ministry of Health (MOH) should work together to implement a policy that can reduce the number of dental graduates each year in Malaysia by perhaps limiting the number of students which a university can enrol in dentistry program or avoid giving additional license to universities to establish dental program in Malaysia.

The country is now facing an uneven geographical distribution of dentists. In 2019, the concentration of dentists was mainly in F.T Kuala Lumpur and Selangor accounting for 32.33% of the total dentists in Malaysia. In the same year, the number of dentists per 100,000 population in the F.T Kuala Lumpur and Selangor (112.83) was 3.4 times the national value (33.21). Similarly, the number of dentists per 100,000 population in the Taiwan municipalities (74.65) was 1.16 times the national value (64.09) in 2019.<sup>[18]</sup> This data shows that there is an unequal distribution of dentists in Malaysia, with dentists mainly distributed in the urban areas.

Moreover, 7 out of 13 local dental institutions are located in Kuala Lumpur and Selangor. The presence of dental school has a certain effect on the number of dentists and new dental registrants in the area. Besides, since F.T Kuala Lumpur is the capital city of the country, it is also among the fastest-growing metropolitan regions in Southeast Asia. Since there is more population, more dentists are needed. According to the research done by F.C. Cheng et. al, municipalities have the advantages of good living functions and convenient transportation. Besides, urban residents are more capable to afford a high payment for oral care. Moreover, the shortening of duration of compulsory service caused mushrooming dental clinics in urban areas. All these reasons attract both new dental registrants and experienced dentists to settle down in the metropolitan areas, causing a serious urban-rural disparity in dentist manpower resources in Malaysia.<sup>[18]</sup>

The coefficient of variance (CV) of the number of dentists per 100,000 population were greatest in the year of 2015, which was 72.57%, followed by 70.83% in 2017. The higher the CV value, the greater is the dispersion of the parameter. A similar study was done in Japan in 2006, the number of dentists per 100,000 population in Japan was 74.0, and the CV was 10%.<sup>[19]</sup> From 2001 to 2019, the number of dentists per 100,000 population in Taiwan increased by 24.17, and the CV was around 50-53%.<sup>[12]</sup>

The Lorenz curve and Gini coefficient which are mainly used to represent economic inequality can be used to demonstrate unequal distribution in any system. Studies in Taiwan and Japan have used them to analyze the imbalance of geographical distribution of dentists and physicians.<sup>[15,18]</sup> The lowest Gini coefficient is reported in 2015 (0.211); while the highest in 2018 and 2019 (0.231). A higher Gini coefficient indicates a greater

disparity. This simply means that the imbalance distribution of dentists in Malaysia is getting greater year by year.

Despite that, this study has a few limitations. We analyzed the geographic distribution of dentists according to the population size of each state but there could be a possibility that some residents seek oral healthcare in neighboring states. It could be better if this study could consider other aspects of dental professional human resource needs, such as dental disease, service utilization by community and treatment needs. Spatial accessibility among patients would be very different as some would be staying much further away from a dentist, especially in the rural areas with smaller populations. Besides, the use of the dentist-to-population ratio to detect surplus or shortage of dentists have several deficiencies as it is insensitive to the complexity of the dental workforce planning process. It does not account for differing disease levels or levels of need in different populations and assumes that productivity of all dentists are the same. Other than that, the data related to the year 2020 could not be included in this study because the number of dentists practicing in each state is not updated in the Malaysian Dental Council website yet.

### **Conclusion**

It is observed that there is an unequal distribution of dentists in Malaysia. This issue might continue to deteriorate with time if no action is taken by the ministry. We consider that it is necessary to encourage dentists to work or open new dental clinics in rural areas to equalize the geographical distribution of dentists in Malaysia. Besides, policymakers should control the sudden growth of dentists who graduated from foreign institutions and consider that no additional local institutions should be added to the list to conduct a dental degree program anytime soon.

### **Acknowledgements**

The author is indebted to Miss Elicia Low (Data Analyst, National University of Singapore) and Mr Kian Tat Teoh for their insightful comments and careful reading of an earlier version of the manuscript.

### **Funding**

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

### **Conflicts of interest**

There are no conflicts of interest relating to this study and publication.

### **References:**

1. Husna Abbas and Nooral Zeila Junid. *Through the Dental Mirror History of Dentistry in Malaysia*. Kuala Lumpur: Ministry of Health; 2001.
2. Malaysian Dental Council. *Malaysian Dental Council Annual Report 2015*. Available from: <http://mdc.moh.gov.my/uploads/mdcreport2015.pdf> [Accessed 3 Dec 2020].
3. Malaysian Dental Council. *Malaysian Dental Council Dental Bill 2012: Laws of Malaysia*. Putrajaya: Malaysian Dental Council; 2012.
4. Official Portal of Oral Health Program, Ministry of Health Malaysia. *Regulating the profession*. Available from: <http://ohd.moh.gov.my/index.php/en/allcategories-en-gb/2-uncategorised/120-regulating-the-profession#:~:text=In%202012%2C%20the%20Malaysian%20Dental,effective%20on%201%20July%202015> [Accessed 10 Jan 2021].
5. Che Musa MF, Bernabé E, Gallagher JE. The dental workforce in Malaysia: drivers for change from the perspectives of key stakeholders. *Int Dent J*. 2020; 70(5):360-373. Available from: <https://doi.org/10.1111/idj.12575>.
6. Okada M, Yamada Y, Okawa Y. An analysis of regional differences in dental care facilities and in dental care expenditure. Part 2. According to the presence/absence of a dental college. *Nihon Shika Iryou Kanri Gakkai Zasshi*. 2004; 38:310-320 [in Japanese].
7. Hirata SI, Hidaka K. Postgraduate clinical training program for dentists in Japan. *Dent Jpn*. 2006;42:191-194.

8. Nuradzimmah D, Arfa Y - *Msia Doctor-Population Ratio Stands at 1:454*. New Straits Times. Available from: <https://www.nst.com.my/news/nation/2020/08/613844/msia-doctor-population-ratio-stands-1-454#:~:text=KUALA%20LUMPUR%3A%20Malaysia's%20doctor%20to,51%2C912%20were%20under%20the%20ministry> [Accessed 21 Jan 2021].
9. Malaysian Dental Council. *Malaysia Dental Council Statistics 2019*. Available from: [http://mdc.moh.gov.my/uploads/mdc\\_statistic.pdf](http://mdc.moh.gov.my/uploads/mdc_statistic.pdf) [Accessed 15 Jan 2021]
10. Md Bohari NF, Kruger E, John J, Tennant M. Analysis of dental services distribution in Malaysia: a geographic information systems - based approach. *Int Dent J*. 2019; 69(3):223-9.
- [dataset] 11. Population Quick Info, Department of Statistics Malaysia, Putrajaya; 2020 <https://pqi.stats.gov.my>
12. Malaysian Dental Council. *Malaysian Dental Council Annual Report 2016*. Available from: <http://mdc.moh.gov.my/uploads/mdcreport2016.pdf> [Accessed 3 Dec 2020].
13. Malaysian Dental Council. *Malaysian Dental Council Annual Report 2017*. Available from: <http://mdc.moh.gov.my/uploads/mdcreport2017.pdf> [Accessed 3 Dec 2020].
14. Malaysian Dental Council. *Malaysian Dental Council Registrar's Report for 2018*. Available from: <http://mdc.moh.gov.my/uploads/janjun2019.pdf> [Accessed 3 Dec 2020].
15. Okawa, Y., & Hirata, S. Trends in the geographic distribution of dental clinics in Japan. *Community dental health*, 2014;31(1), 62–4.
16. Official Portal of Oral Health Program, Ministry of Health Malaysia: *Dental Manpower 5.1 Developing Competency and Proficiency of Dental Professionals*. Available from: <http://ohd.moh.gov.my/index.php/en/allcategories-en-gb/2-uncategorised/123-dental-manpower> [Accessed 5 Jan 2021].
17. Tom K, Gundavaru KC, Dicksit DD. Reasons for choosing dentistry as a career – survey of dental students in AIMST University. *Malaysian Dental Journal*. 2014; 36(1):1-4.
18. Cheng FC, Yu-Fong Chang J, Lin TC, Chang WC, Chang YT, Chiang CP, et al. Dentist manpower development and geographical distribution of dentists in Taiwan. *J Dent Sci*. 2020; 15(2):121-131.
19. Gotouda H, Kasai K, Kaneda T, Fukumoto M, Sasai H, Kobayashi S, Kanazawa E, Kawara M, Makimura M. Associations among distributions of dental postgraduate residents, dentists and clinical training facilities in Japan. *J Oral Sci*. 2009; 51(4):635-9.