

# THE ASSOCIATION OF SOCIODEMOGRAPHIC FACTORS AND DENTAL CARIES AMONG SECONDARY SCHOOL CHILDREN IN JEMPOL DISTRICT OF NEGERI SEMBILAN, MALAYSIA

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## Abstract

There is a slow trend in caries improvement among school children in Malaysia. This study aimed to analyse the association between gender, ethnicity and location of residence with dental caries occurrence among the secondary school children receiving incremental dental care in Jempol, Negeri Sembilan. This 4-year retrospective cohort study consisted of all secondary school children in Jempol initially aged 13-year-old in 2013 who were treated under the School Dental Service. Bivariate logistic regression was performed to analyse the association between gender, ethnicity, and location of residence with dental caries occurrence. The sample consisted of 942 school children. Results showed a significant association between dental caries occurrence with gender and ethnicity. However, it was not significantly associated with location of residence. Females were 1.39 times more likely to develop new caries than males. Compared to the Indian ethnic group, the odds of developing new caries were 2.54 times higher for Malay (95% CI: 1.65-3.92) and 1.32 times higher for Chinese school children (95% CI: 0.77-2.26). The findings of this study can be used to identify the risk group early in life and tailored oral health services can be delivered according to their needs.

**Keywords:** Caries Prevention, Dental Caries, Incremental Dental Care, Oral Health Problem, School Children

## Introduction

Dental caries, also known as tooth decay, is the diseased state of the tooth due to the destruction of hard tissue by acid production from the bacterial metabolism of sugars. Caries of permanent teeth is the most common oral disease, affecting nearly 3.5 billion people worldwide (1). Although dental caries carry meagre mortality rates, the treatment and management of caries require significant financial investments, making it a burden on both individuals and healthcare systems (2). The most recent Malaysian oral health program report showed that 41.1% of 16-year-olds have caries with a mean Decayed, Missing and Filled Teeth (DMFT) Index of 1.38 in 2020 (3).

As schools are the ideal platform for providing dental care to many children, the School Dental Service (SDS) was introduced in Malaysia to deliver optimal dental care to this population using the Incremental Dental Care Approach (4). In Malaysia, free annual dental check-ups and

treatment are comprehensively given to children attending government primary and secondary schools to achieve orally fit status before leaving school. At the beginning of each school year, consent from legal guardians is obtained before any examination or treatment. The SDS comprises several components; promotive, preventive, and curative. Dental teams are mobilized to each school where services include oral health education (OHE), preventive treatments (fluoride varnish, fissure sealants), and curative treatments (scaling and polishing, restoration of carious teeth) are delivered.

The Incremental Dental Care approach has made remarkable progress in delivering dental care to school-aged children. Even so, there is a slow trend in caries improvement among secondary school children in Malaysia since 2016, where the percentage of caries-free individuals increased only by 1% each year (3). This warrants a look into other factors that would contribute to the development of dental caries in this population. As caries is a multifactorial

disease, it has been reported that the risk of developing caries is affected by certain sociodemographic factors such as age, gender, race and urbanization (5, 6). Research looking into the sociodemographic effects of dental caries development on secondary school children in Malaysia has yet to be discovered, especially in Jempol district Negeri Sembilan. Therefore, this study aimed to determine the association between gender, ethnicity, and location of residence with dental caries in Jempol district secondary school children.

## Methods

This retrospective cohort study was conducted on all school children aged 17 in 2017 attending all 14 government secondary schools in Jempol district, Negeri Sembilan. Using the school dental records obtained from the Incremental Dental Care Program, we have obtained patient records for 1,503 children aged 17 in 2017. Of the 1,503 dental records, 942 (62.7%) had complete five-year records from the year 2013 to 2017. Children on fixed orthodontic appliances and those with chronic illnesses such as asthma and epilepsy were excluded as they have other predisposing factors influencing dental caries development.

The children's sociodemographic information was collected, including gender, ethnicity, and location of residence. The three main ethnicities in Malaysia that were included in the study are Malay, Chinese and Indian. The location of residence was divided into two groups, urban

and rural. The subject's name was not disclosed to maintain confidentiality. Caries experience was recorded using the World Health Organization (WHO, 1997) diagnostic criteria for caries measured by the Decayed, Missing and Filled Teeth (DMFT) index. DMFT index in the year 2013 and 2017 were collected.

Statistical analysis was carried out using IBM SPSS Statistic version 22. Nonparametric Mann-Whitney tests were used to compare differences in the dependent variable between gender and location of residence, while the Kruskal-Wallis test was used to compare differences across ethnicities. Bivariate logistic regression was performed to determine the association between dental caries occurrence with gender, ethnicity, and location of residence. The dependent variable development of dental caries was measured by an increase in DMFT from baseline (2013) and after 4 years (2017): caries development = 1, no caries development = 0. Significant level was at  $p < 0.05$ . Results were expressed as odds ratios with an associated 95% confidence interval.

## Results

A total of 942 school children were included in our sample with females accounting for more than half of the participants with 51.80% and males at 48.20% (Table 1).

The Malay ethnicity makes up the majority of the study population with 69.85%, followed by Chinese at 15.29% and Indians at 14.86%. About 61.25% came from urban areas of Jempol with the rest coming from rural areas

**Table 1:** Analysis of DMFT scores by gender, ethnicity and location of residence in 2013 and 2017

| Independent Variable         | n (%)        | 2013                        |                     | 2017           |                     |
|------------------------------|--------------|-----------------------------|---------------------|----------------|---------------------|
|                              |              | Mean (SD) DMFT <sup>1</sup> | p-value             | Mean (SD) DMFT | p-value             |
| <b>Gender</b>                |              |                             | 0.037 <sup>*a</sup> |                | 0.003 <sup>*a</sup> |
| Male                         | 454 (48.20)  | 0.45 (1.070)                |                     | 1.18 (2.075)   |                     |
| Female                       | 488 (51.80)  | 0.59 (1.156)                |                     | 1.56 (2.243)   |                     |
| <b>Ethnicity</b>             |              |                             | 0.161 <sup>b</sup>  |                | 0.001 <sup>*b</sup> |
| Malay                        | 658 (69.85)  | 0.53 (1.112)                |                     | 1.51 (2.241)   |                     |
| Chinese                      | 144 (15.29)  | 0.63 (1.373)                |                     | 1.31 (2.355)   |                     |
| Indian                       | 140 (14.86)  | 0.34 (0.783)                |                     | 0.82 (1.436)   |                     |
| <b>Location of Residence</b> |              |                             | 0.063 <sup>a</sup>  |                | 0.509 <sup>a</sup>  |
| Urban                        | 577 (61.25)  | 0.46 (1.037)                |                     | 1.35 (2.234)   |                     |
| Rural                        | 365 (38.75)  | 0.62 (1.227)                |                     | 1.42 (2.069)   |                     |
| <b>Overall</b>               | 942 (100.00) | 0.52 (1.117)                |                     | 1.38 (2.171)   |                     |

<sup>1</sup>DMFT = Decayed, Missing and Filled Teeth Index.

<sup>\*</sup> $p < 0.05$ .

<sup>a</sup>Mann-Whitney Test

<sup>b</sup>Kruskal-Wallis Test

(38.75%). Table 1 shows the mean DMFT index at baseline and after 4 years for different explanatory variables (gender, ethnicity, and location of residence). Dental

caries experience differs significantly among gender and ethnicity. Females were reported to have higher mean DMFT after 4 years compared to their male counterparts.

In terms of ethnicity, dental caries experience was worse in Malays compared to Chinese and Indians. There was no significant difference between the mean DMFT of children

from urban or rural areas. Overall, there was an increase in mean DMFT after 4 years.

Table 2 shows the results of bivariate logistic regression analysis of the association between gender, ethnicity,

**Table 2:** Odds ratio (OR) and 95% confidence interval (CI) for DMFT-related variables in 2013 and 2017 in the bivariate logistic regression analysis

| Independent Variable         | 2013            |                     |         | 2017 |             |         |
|------------------------------|-----------------|---------------------|---------|------|-------------|---------|
|                              | OR <sup>1</sup> | 95% CI <sup>2</sup> | p-value | OR   | 95% CI      | p-value |
| <b>Gender</b>                |                 |                     | 0.009*  |      |             | 0.016*  |
| Female                       | 1.43            | 1.09 – 1.86         |         | 1.39 | 1.06 – 1.83 |         |
| Male                         | 1.00            |                     |         | 1.00 |             |         |
| <b>Ethnicity</b>             |                 |                     | <0.001* |      |             | <0.001* |
| Malay                        | 2.36            | 1.55 – 3.61         |         | 2.54 | 1.65 – 3.92 |         |
| Chinese                      | 1.39            | 0.82 – 2.37         |         | 1.32 | 0.77 – 2.26 |         |
| Indian                       | 1.00            |                     |         | 1.00 |             |         |
| <b>Location of Residence</b> |                 |                     | 0.710   |      |             | 0.051   |
| Urban                        | 1.05            | 0.80 – 1.38         |         | 1.35 | 1.00 – 1.81 |         |
| Rural                        | 1.00            |                     |         | 1.00 |             |         |

<sup>1</sup>OR = odds ratio

<sup>2</sup>CI = confidence interval.

\*p < 0.05.

and location of residence with dental caries experience. Dental caries experience was associated with gender and ethnicity; however, it was not significantly associated with location of residence. It was noted that females were 1.39 times more likely to develop new dental caries, however, the odds ratio was small (95% CI: 1.06 – 1.83). Compared to the Indian ethnic group, the odds of developing new caries were higher in Malays (2.54 times).

## Discussion

This present study examined the association between different sociodemographic aspects and dental caries development involving quite a large sample size of 942 secondary school children from Malaysia where we found dental caries to be significantly associated with ethnicity. The three major ethnic groups in Malaysia, namely the Malays, Chinese, and Indians were studied and found that Malays to be 2.54 times more likely to develop new dental caries compared to Indians. Our results are in line with studies conducted in Singapore and Malaysia on toddlers, pre-schoolers, and school-going children where Indians had lower caries risk and rate compared to Chinese and Malays (7–9). Differences in health and disease in the context of race and ethnicity may influence parents' health seeking behaviour (10). Given the implementation of the school dental program, there would be no disparity in access to dental treatment for our study population. Strong cultural beliefs and practices may attribute to poor caries experience among the Malay community such as their perception towards dental health and high

intake of sweet desserts (11). In that sense, improving dental caries experience among children should be more directed towards the prevention of disease development. To improve the delivery of oral health education, a more focused approach with an in-depth cultural understanding of susceptible ethnicities is necessary to provide effective oral health promotion.

Current evidence demonstrates that dental caries experience is linked with location as it can contribute to improved access to dental services and oral health education in urban areas (12). Findings from this study were however contradictory as location of residence were not significantly associated with dental caries development. This unexpected finding would possibly be elucidated by localization of the study within Jempol, Negeri Sembilan where there is high accessibility to public healthcare centres. The 2019 Household Income and Basic Amenities Survey Report of Negeri Sembilan announced 90.2% of the population residing in Jempol live five kilometres away from the nearest government-subsidized healthcare facility with less than 4% having to travel more than nine kilometres (13). With rapid urbanization plans to bridge the urban-rural gap in the district, accessibility to dental care has improved and warrants investigation into other factors that affect dental caries experience. We suggest for future studies to look into aspects affecting dental caries among the rural and urban population such as dental clinic attendance, perceived state of dental health, and dental health awareness. With this knowledge, resources and efforts could redirect from mobilizing mobile dental

teams to deliver treatments to improving health-seeking behaviour which would eventually increase dental clinic attendance of high-risk populations.

This study showed that there is a significant association between gender and the development of dental caries. However, the odds of developing dental caries in females is very small and less than two folds compared to their male counterparts, rendering the two groups to have a similar risk. Although many studies have revealed females are at a higher risk for dental caries (14–16), our findings corroborate with previous research done on high school children in Vietnam and India (17, 18). Other factors might affect the pattern of dental caries in gender in our study population such as dietary habits. Nevertheless, more research is needed in that aspect to identify any modifying factors.

The strength of this study lies in the relatively large sample size of 942 participants who were followed up every year for four years. Nonetheless, some limitations still exist. Firstly, there were multiple examiners conducting the dental assessment during the past four years as each school would have a designated dental team from a nearby government clinic which would pose a problem with the validity of the data due to inter examiner reliability. Even so, dentists employed by the government have received similar undergraduate training from accredited universities in addition to compulsory one-year graduate training and used a standardized WHO criteria for caries detection. Next, to measure dental caries experiences, we adopted the DMFT index which does not consider early carious lesions or white spot lesions. The reason for choosing the DMFT index for caries experience is due to the reproducible nature of the index which would reduce variability between examiners.

### Conclusion

Conclusively, we found dental caries to be associated with ethnicity and gender but not location of residence in 13 to 17-year-old school children. The study found that Malays were 2.54 times more likely to develop dental caries compared to Indians. Therefore, there is a need to identify the high-risk group early in life and improve their oral healthcare with a culturally directed approach to intervention with close monitoring. Tailoring the health promotion programs to a specific culture could be done by addressing the beliefs and practices in their culture which would influence the outcome of their health behaviour. Dental health practitioners should be trained to understand the relevance of cultural factors that influence the acceptance to health promotion.

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### Competing interests

The authors have no conflicts of interest to declare.

### Ethical Clearance

This study protocol was reviewed and approved by National Medical Research Register, Ministry of Health Malaysia with approval number [NMRR-18-699-40440]. Data used was secondary and cumulative data from Health Information Management System, Ministry of Health Malaysia; hence, there is no written informed consent obtained from the participants in this study.

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