

# Pattern of Distribution of Dental Caries in First and Second Primary Molars in Paediatric Dental Patients Attending Lagos State University Teaching Hospital.

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## ABSTRACT

**Objective:** The study determined the distribution pattern of dental caries among patients attending the paediatric dental clinic and evaluated the susceptibility of first and second primary molars to dental caries

**Methods:** This retrospective study was carried out using the dental records of patients who attended the Paediatric dental clinic, Lagos State University Teaching Hospital, Ikeja, Lagos, from January 2018 to May 2022. Demographic data, caries presentation, diagnosis and treatment were collected from patient records. Information about carious teeth, the arch location, and the tooth type was also recorded. Data were inputted and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 20 (IBM, Armonk, New York). Descriptive statistics were used to quantify age, gender, and carious teeth. Results were presented as tables and charts. Mean and Standard deviation were calculated.

**Results:** The prevalence of caries was 52.4% in a study population of 410 children. The most commonly affected arch was the mandible with 341 (54.8%) teeth. The lower right first primary molar accounted for 73 (11.7%) teeth, followed by the lower right second primary molar with 63 (10.1%) teeth. The commonest treatment done was extraction, carried out in 117 subjects

**Conclusion:** The pattern of presentation of caries was similar to other studies, with the molars in both arches being the most affected and the least affected being the mandibular anterior teeth. The first primary mandibular molar was the most susceptible tooth, followed by the second primary mandibular molar. This is a good indication for the provision of targeted preventive measures, such as placing fissure sealants as soon as they erupt

**Key words:** Caries susceptibility, Caries pattern, primary molars

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### INTRODUCTION

Dental caries is a multifactorial disease resulting from an alteration in the composition of the bacterial biofilm, leading to an imbalance between the demineralization and remineralization processes and manifested by the formation of carious lesions in primary and permanent dentitions.<sup>1</sup> An interplay between specific acidogenic bacteria in the dental plaque biofilm and fermentable carbohydrates leads to the production of organic acids and results in demineralization of the tooth structure, which, if progressive, proceeds to cavitation in the tooth.<sup>1</sup>

Dental caries in children is a public health problem in developed and developing countries.<sup>2, 3</sup> Its prevalence has been associated with risk factors and risk indicators such as ethnicity, socioeconomic status,<sup>4</sup> dietary pattern,<sup>2, 5, 6</sup> oral hygiene practices,<sup>2, 6, 7</sup> previous dental visits,<sup>2, 7</sup> and it also varies from country to country<sup>5</sup>, urban and rural settlements.<sup>8</sup> In some studies, boys are more affected than girls,<sup>2, 7, 9-12</sup> and while in others, girls are more affected than boys.<sup>6, 8, 13</sup> The prevalence of dental caries has been reported to be 59.5% in Kenya<sup>14</sup>, between 41.9%-44.4% in India,<sup>11, 15</sup> 13.7% in Japan,<sup>12</sup> 19% in Italy<sup>16</sup> and as high as 44.34% and 76% in Bangladesh<sup>10</sup> and Palestine<sup>17</sup> respectively. The prevalence of dental caries in Nigerian children has been reported to range between 4.7-42.5% across the country.<sup>3, 5, 7, 8, 13, 18, 19</sup> Various factors, however, affect the vulnerability of individuals and specific teeth to dental caries.

Susceptibility is the state of being predisposed to or sensitive to developing a certain disease.<sup>20</sup> The prevalence of dental caries not only varies with age, sex, socioeconomic status, food habits and oral hygiene practices but also within the oral cavity. A variation in susceptibility has been reported between the maxillary and the mandibular arch, different teeth within the arch and the different tooth surfaces.<sup>10</sup> Dental caries has a predilection for the pits, fissures, proximal and occlusal surfaces of teeth. Also, it has been found to follow a specific pattern, affecting the posterior teeth in both arches, with the least affected being the mandibular anterior teeth due to the protection by the tongue and the smooth surfaces that do not easily adhere to food debris.<sup>11</sup> In the primary dentition, the mandibular molars were the teeth most often affected, with a varying incidence between the first and second molars.<sup>11, 21, 22</sup> The pattern of dental caries also varies between the primary and permanent dentition.<sup>11, 13</sup>

No two teeth are equally affected by dental caries; it is, therefore, important to know the relative caries

susceptibility of various teeth in the dentition.<sup>23</sup> This is crucial in facilitating the initiation of preventive measures in caries management, thereby halting the caries process, reducing the potential stress and disease burden for children and their families and managing the costs of health care services.<sup>23</sup> Several efforts aimed at increasing oral health awareness and implementing early preventive programmes employ a generalized direct/indirect preventive approach which has been reported with varying successes.<sup>5, 6, 8, 18</sup> Such programmes include dissemination of caries prevention messages during ante-natal and immunization clinics, regular school visits, advocating the use of fluoridated paste, water fluoridation, professional fluoride application.<sup>5, 6, 8, 18</sup> As suggested by several authors, a targeted or focused preventive approach through fissure sealants could be employed aimed at the most susceptible teeth.<sup>10, 18, 22, 24</sup> This could save lots of money for the healthcare system by reducing the prevalence of caries. This study aimed to determine the distribution pattern of dental caries among patients attending the paediatric dental clinic and to evaluate the susceptibility of first and second primary molars to dental caries.

### METHODOLOGY

#### Ethical Clearance

Approval was obtained from the Health Research and Ethics Committee of the Lagos State University Teaching Hospital, Ikeja, Lagos, with the protocol number LREC/06/10/1960 on 14th October 2022.

#### Study design and population

This was a retrospective study carried out using the dental records of patients who attended the Paediatric dental clinic, Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria, from January 2018 to May 2022. The Paediatric Dental Unit is one of the two units in the Department of Child Dental Health, LASUTH. It caters for the oral health of all children between ages 0-16 years.

#### Inclusion criteria

Dental records of patients who visited the paediatric dental unit with a history of carious tooth or its sequelae within the study time frame.

#### Exclusion criteria

Dental records of patients with no history of carious tooth or its sequelae within the study time frame or case files with incomplete information with respect to age, gender and caries presentation.

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### Sampling Technique

A convenience sampling of all patients who visited the paediatric dental unit during the time frame was included in the study.

### Data collection

Information on demographics, caries presentation, diagnosis and treatment was collected from patients' records. Information on decayed, missing due to caries and filled teeth was recorded. Information about the carious teeth, the arch location, and the tooth type was also recorded.

The calibration of the principal investigator and a second examiner was done using randomly selected patients' records. The principal investigator obtained the relevant information like age, gender, the diagnosis of dental caries made by the dental surgeon, pattern and distribution of the carious teeth in the arches and the treatment details such as restorations and extractions of the patient's teeth. The chart review process was repeated by the other calibrated examiner, and the data were compared for reproducibility and consistency. Each examiner also reassessed the patient's record after a week interval, and the extracted data were compared for reproducibility. The inter-examiner reliability for both examiners was 0.92, and the intra-examiner reliability was 0.93 and 0.89 for the principal investigator and second examiner, respectively.

### Statistical analysis

Data were inputted and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 20 (IBM, Armonk, New York). Descriptive statistics was used to quantify variables such as age, gender, and carious teeth. Results were presented as

tables and charts. Mean and Standard deviation were calculated.

### RESULTS

The study population consisted of 410 children, 199 males and 211 females, aged 0-16 years, with a mean age of 7.3 years. The prevalence of caries in the study population was 52.4%. The gender distribution of the 215 subjects with dental caries was 92 (42.8%) males and 123 (57.2%) females, with the mean dmft of 2.78 (Table 1). Majority of the subjects (59.5%) who had caries were in the 5-9 year age group (Table 1).

Majority of the affected subjects 176 (81.9%), had the decayed component (Table 1). About 81.8% of the caries active children had between 1-4 carious teeth (Table 2). The most commonly affected arch was the mandible, with 341 (54.8%) of all affected teeth, and the right side was more affected with 184 teeth (54%) than the left side which had 157 teeth (46%) (Table 3). The most commonly affected primary tooth in the study population was the lower right first primary molar 73 (11.7%), followed by the lower right second primary molar 63 (10.1%) (Figure 1). The most commonly affected permanent tooth was the lower right first permanent molar 33 (5.3%), followed by the lower left first permanent molar 31 (5.0%) (Figure 1). The least affected primary teeth in the study population were the right and left lower incisors (0.3%) each, followed by the lower left canine (0.5%) (Figure 1). The least affected permanent teeth were the upper and lower incisors (Figure 1).

The commonest treatment was extraction, carried out in 117 subjects, followed by Glass Ionomer cement (78) and Pulp therapy in 58 subjects (Table 4).

**Table 1: Socio-demographic data of subjects with caries**

Variable	Frequency (n = 215)	Percentage (%)
Gender		
Male	92	42.8
Female	123	57.2
Age group (years)		
0-4	30	14.0
5-9	128	59.5
10-14	57	26.5
Caries experience (DMFT) of subjects with caries		
Decayed	176	81.9
Missing	50	23.3
Filled	55	25.6

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**Table 2: Distribution of number of affected carious teeth among subjects**

No of decayed teeth	Frequency of subjects	Percentage (%)
1	68	38.6
2	41	23.3
3	15	8.5
4	20	11.4
5	9	5.1
6	12	6.8
7	4	2.3
8	3	1.7
11	2	1.1
12	2	1.1
<b>Total</b>	<b>176</b>	<b>99.9</b>
No of missing teeth		
1	36	72.0
2	7	14.0
3	3	6.0
4	4	8.0
<b>Total</b>	<b>50</b>	<b>100.0</b>
No of filled teeth		
1	30	54.5
2	9	16.4
3	6	10.9
4	6	10.9
5	3	5.5
6	1	1.8
<b>Total</b>	<b>55</b>	<b>100.0</b>

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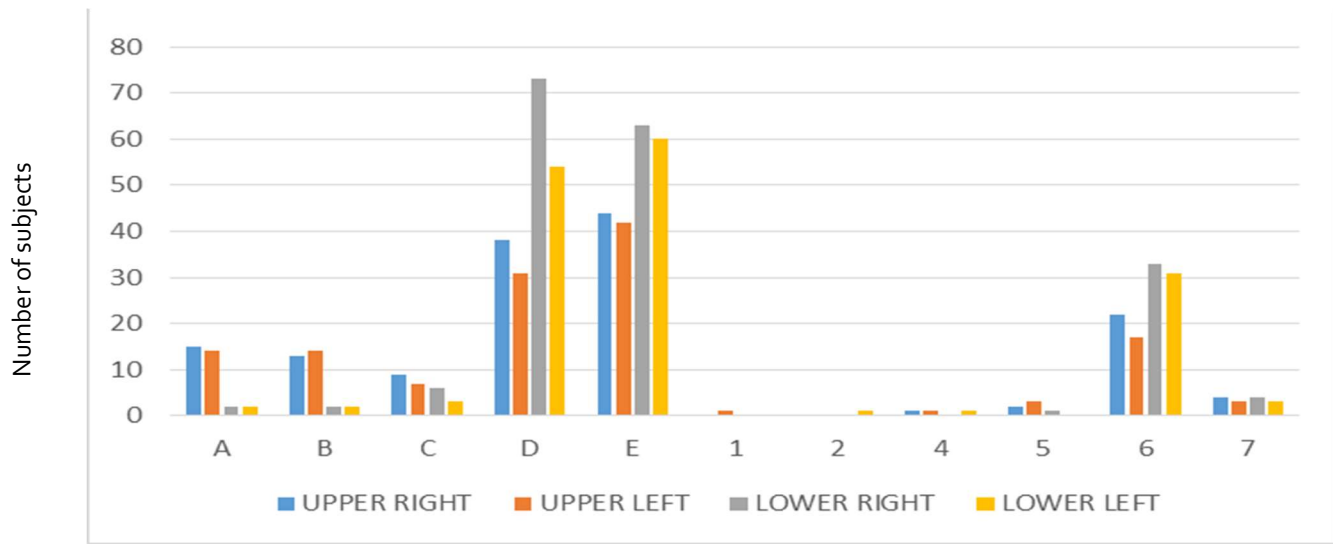
**Table 3: Pattern of caries according to the dental arch**

ARCH	UPPER (n = 281)				LOWER (n = 341)			
	RIGHT	LEFT	TOTAL	%	RIGHT	LEFT	TOTAL	%
TOOTH								
A	15	14	29	10.3	2	2	4	1.2
B	13	14	27	9.6	2	2	4	1.2
C	9	7	16	5.7	6	3	9	2.6
D	38	31	69	24.6	73	54	127	37.2
E	44	42	86	30.6	63	60	123	36.1
1	-	1	1	0.4	-	-	-	-
2	-	-	-	-	-	1	1	0.3
4	1	1	2	0.7	-	1	1	0.3
5	2	3	5	1.8	1	-	1	0.3
6	22	17	39	13.9	33	31	64	18.8
7	4	3	7	2.5	4	3	7	2.1
<b>TOTAL</b>	<b>148</b>	<b>133</b>	<b>281</b>	<b>100.1</b>	<b>184</b>	<b>157</b>	<b>341</b>	<b>100.1</b>

\* Tooth notation was done using the Zsigmondy-Palmer system of nomenclature

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Figure 1: Pattern of caries according to tooth type



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Table 4: Distribution of subjects based on the treatments received

TYPE OF TREATMENT	Only/Main treatment	Second treatment	Third treatment	Fourth treatment	Total
Non-operative (medication)	21	-	-	-	21
Preventive (Fissure sealant, fluoride therapy)	4	-	-	-	4
Glass Ionomer cement	41	37	-	-	78
Composite	2	1	1	-	4
Pulp therapy	37	14	4	1	58
Apicectomy	1	1	-	-	2
Extraction	107	8	2	-	117
Total no of subjects	215	61	7	1	284

### DISCUSSION

Dental caries is a public health problem experienced in all countries of the world.<sup>2, 9, 16</sup> Although it is a preventable disease, its prevalence has been on the increase in some countries.<sup>5</sup> The main factors influencing caries progression are cariogenic microflora, cariogenic diet, susceptible tooth and time/frequency.<sup>25</sup> The susceptibility of a tooth to dental caries could be influenced by the time of eruption, surface configuration, especially pits and fissures usually seen in molars, thin enamel in the primary teeth, irregularities in arch form, crowding and overlapping of teeth. The knowledge of the pattern of dental caries in a child population will aid in designing preventive, clinical and community-based programmes and policies.

The prevalence of caries in this study was 52.4%. This is higher than previous studies conducted in Lagos and other parts of Nigeria, with the highest

prevalence recorded as 42.5%.<sup>13</sup> This corroborates Olatosi et al.,<sup>5</sup> who stated that there had been an increase in caries prevalence reported in Nigerian studies since the year 2007 till date.<sup>3, 5, 8, 13, 19, 22</sup> This increase could be due to poor dental awareness, poor attitude of parents toward primary dentition and high cost of treatment, the out-of-pocket payment system of care employed in Nigeria. However, more community, rather than hospital-based data are needed to confirm this trend because most studies on dental caries from Nigeria are sporadic and may not be a true representation of the national picture for caries.

The gender distribution of subjects with dental caries showed a male/female ratio of 1: 1.34. This is similar to several studies that reported that girls are more affected by dental caries than boys<sup>6, 8, 13</sup> and vice versa.<sup>2, 7, 9-12</sup> Females have an earlier eruption date compared to males, possibly resulting in their teeth

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being exposed to cariogenic factors earlier. Moreover, as experienced among adults, there were more females (57.2%) among the study population, possibly indicating that females are more conscious and expressive about any condition that compromises their oral health than males.

Majority of the subjects (59.5%) who had caries were in the 5-9 year age group, with the highest values seen in the 9-year-olds. This is similar to findings in some studies with the highest caries prevalence in 5-9 years<sup>13, 26</sup> and 5-10 years, with the highest values seen in the 8-year-olds.<sup>22</sup> This may be due to children of this age group brushing their teeth by themselves, either supervised or without supervision.<sup>13</sup> Also, it is reported that manual dexterity is developed at about 7-8 years, so children below this age may not effectively remove plaque or food debris from their teeth.<sup>13</sup> Another reason could be that this is the early mixed dentition stage with the first and second primary molars and the first permanent molar already erupted, having been exposed to the oral environment for a longer period could have developed caries. At the late mixed dentition stage (10-12 years), the primary molars would have exfoliated and cannot be evaluated for caries. This age group could also represent the age of self-awareness, where the children choose to buy cariogenic foods with their lunch money. It would be expedient if preventive programmes for school children are focused on children between ages 3-6 when the primary and permanent molars have newly erupted in order to prevent the initiation of caries.

Most caries active children had the decayed component 176 (81.9%). This is similar to the high index of unrestored teeth reported in several Nigerian studies 100%,<sup>8</sup> 98.8%,<sup>7</sup> 96%<sup>5</sup> and 80%<sup>21</sup>, which shows the underutilization of dental services. This could be due to poor awareness and access to dental care,<sup>3, 15</sup> out-of-pocket payment system, the low pediatric dentist/population ratio in Nigeria,<sup>5</sup> caregivers delay in seeking dental treatment due to poor perception of oral health needs because of the low priority placed on oral health compared with other health care needs.<sup>2, 8</sup>

In this study, majority (81.8%) of the caries active children had between 1-4 carious teeth, out of which 68 subjects presented with one carious tooth, followed by 41 subjects with two carious teeth. This is similar to Eigbobo et al.,<sup>13</sup> who reported that 79.7% of caries active subjects had 1-4 carious teeth. Majority of the subjects (72%) who had missing teeth due to caries had only one tooth affected, in contrast

to Omotuyole et al.,<sup>21</sup> who reported no missing teeth due to caries. Out of the 55 subjects who had a filled tooth, 54.5% had one filling in place, and 1.8% had six fillings. This contrasts with Adeniyi et al.,<sup>8</sup> who reported no subject had any filled teeth. This shows the varying severity of caries in the different study populations. In this study, the highest numbers of decayed, filled and missing teeth were only reported in the minority of subjects. This finding supports the need to implement more preventive measures and improve access and affordability of dental services.

Dental caries has been reported to have a predilection for the pits, fissures, proximal and occlusal surfaces of teeth in both dentitions.<sup>13</sup> In this study, the most commonly affected arch was the mandible (54.8%). This could be due to the force of gravity, which favours food packing/retention and plaque accumulation in the mandible than in the maxilla. It could also be because the mandibular teeth erupt earlier than the maxilla. In the mandible, the right side was more affected (54.0%) than the left side. It could also be due to the effective cleaning of the teeth on the left side by most right-handed people. This finding is different when compared to Olatosi et al.<sup>9</sup> and Omotuyole et al.,<sup>21</sup> who reported a higher prevalence on the left mandible followed by the right mandible and attributed it to a predominance of chewing on the right side, thereby enhancing oral toileting and hygiene of teeth on the right side.

The molars were the most commonly affected teeth in the mandible (94.1%) and maxilla (71.6%). This pattern of mandibular vs. maxillary molar presentation is similar to several studies<sup>13, 21, 22, 27, 28</sup> but different from Folayan et al.<sup>18</sup>, who reported the maxillary incisors as the commonest. This variation<sup>18</sup> could be due to the use of the International Caries Detection and Assessment System (ICDAS)<sup>29</sup> in detecting caries which considers incipient caries, which are usually seen on maxillary incisors. A study carried out by Omotuyole et al.<sup>21</sup> also used the ICDAS system to detect caries but reported the mandibular molars as the most commonly affected teeth. This finding of higher susceptibility in the molars could be because of the presence of pits and fissures, which easily retain food especially sticky ones, unlike the smooth surfaces of the incisors and canines, which do not retain food. Also, the posterior position of the molars makes them less accessible to regular oral hygiene practices.

The most commonly affected primary tooth in the study population was the lower right first primary

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molar (11.7%), followed by the lower right second primary molar (10.1%), showing a predominance to the right side. Several studies stated that the mandibular first molar was more susceptible to caries than the mandibular second molar.<sup>7, 13, 28, 30, 31</sup> Several other studies stated that the mandibular second molars had higher caries incidence than the first molars to dental caries.<sup>9, 11, 14, 21, 22</sup> This variation in susceptibility of first and second molars has been linked to the time of eruption and fissure topography of molars. The higher prevalence of first primary molar, as reported in this study may be because it erupts about a year earlier than the second primary molars and so it has a longer exposure to acid attack.<sup>13</sup> The higher prevalence of second primary molar reported in other studies has been related to the pits and fissure in second primary molars which are deeper and less completely coalesced than the first primary molars which are shallow.<sup>25</sup> The predominance to the right side (mandibular right primary molars), as reported in this study, varies with some studies<sup>7, 22</sup> that reported the mandibular left primary molars had the highest occurrence of caries. In the anterior segment of the primary dentition, the maxillary arch (n=72) showed more caries-affected teeth than in the mandibular arch (n=17). The least affected primary tooth in the study population were the lower incisors (0.3% each), followed by the lower left canine (0.5%). Similarly, Rahman et al.,<sup>10</sup> Saravanan et al.<sup>11</sup> and Eigbobo and Etim<sup>13</sup> reported that the mandibular primary incisors were almost unaffected by caries. This could be due to protection by the tongue, the opening of the sublingual salivary ducts acting as a means of oral cleansing and the smooth surface of the teeth, which does not encourage adhesion of food debris. Omotuyole et al.<sup>21</sup> reported that the mandibular canines were the most common non-cavitated caries-affected teeth. This is contrary to other studies<sup>3, 8, 19</sup> that reported that the mandibular canines were not affected by caries. This finding may be due to the caries diagnostic criteria ICDAS<sup>29</sup> and WHO<sup>32</sup> used in determining caries for these studies, respectively. The most commonly affected permanent tooth was the lower right first permanent molar (5.3%), followed by the lower left first permanent molar (5.0%). This is similar to the reports of Eigbobo and Etim<sup>13</sup> and Adeniyi et al.<sup>22</sup> but different from that of Loto et al.<sup>27</sup>, who reported that caries were more prevalent in the second permanent molars. The higher prevalence of first permanent molars, as reported in this study, may be because they erupt

about six years earlier than the second permanent molars, and so have been exposed to the oral cavity much longer. The higher prevalence of caries in the second permanent molar, as seen in other studies<sup>27</sup>, maybe due to its more posterior position in the oral cavity; as such, it is more inaccessible to hygiene measures. Loto et al.<sup>27</sup> suggested that the period the second permanent molars erupts corresponds to the period of increased cariogenic diet consumption hence the higher prevalence of dental caries. The least affected permanent teeth were the incisors. Eigbobo and Etim<sup>13</sup> reported that the incisors and canines were spared, while Adeniyi et al.<sup>22</sup> reported that the lateral incisors and canines were spared.

The commonest treatment done was extraction, carried out in 117 subjects, followed by Glass Ionomer cement 78 and Pulp therapy in 58 subjects. This finding could be due to poor dental health-seeking behaviour<sup>2</sup> resulting in the late presentation of most patients to the dental clinic. They present when they are in severe pain, and most times, the tooth is unrestorable and needs to be extracted. All the subjects received one main type of treatment, out of which 61 subjects received two different types, seven subjects received three different types, and only one subject received four different types of treatment. This can be attributed to the severity of caries presented, where majority 68 subjects presented with only one carious tooth, followed by 41 subjects with two carious teeth.

These reported variations suggest that the individual tooth in the primary dentition follows a specific susceptibility pattern to caries, notably, the mandibular molars, maxillary molars, maxillary anterior teeth, and then the mandibular anterior teeth in decreasing order of susceptibility. The caries status in the primary dentition has been reported to be a risk indicator for predicting caries in the permanent dentition.<sup>2, 33</sup> The study by Li and Wang<sup>33</sup> stated that children having caries in their primary teeth were three times more likely to develop caries in their permanent teeth (relative ratio = 2.6, 95% CI = 1.4-4.7;  $p < 0.001$ ).

In addition to efforts being carried out to increase oral health awareness through various information platforms and programmes which are mainly targeted at mothers, caregivers, teachers, and paediatricians,<sup>5, 6, 8</sup> a targeted preventive approach may be used in decreasing the prevalence of caries by the use of fissure sealants on the most susceptible primary teeth (molars) as suggested by Rahman et al.,<sup>10</sup> Eigbobo et al.,<sup>13</sup> Folayan et al.,<sup>18</sup> Adeniyi et al.<sup>22</sup>

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and Akpata.<sup>24</sup> The placement of fissure sealants provides a physical barrier that keeps bacteria and food debris from accumulating on the occlusal surfaces of molar teeth. This could be facilitated by policy formulation, carrying out school outreaches to identify children between the ages of 3-6 years with deep pits and fissures and placement of fissure sealants on the susceptible teeth in children with a high caries risk.

### LIMITATION

This study had a number of limitations. Firstly, an indirect limitation due to the use of the WHO <sup>31</sup> criteria of caries detection, which does not record non-cavitated lesions and could result in the underestimation of incipient caries, which are usually more prevalent on the smooth surfaces of primary teeth. Another limitation is the absence of information on the tooth surface affected by caries; this was because the study was a retrospective study and relied on the information recorded in the case files. The findings, however, provide valuable baseline data for further longitudinal studies, which may provide further evidence for policy formulations that could potentially save the healthcare system a lot of money.

### CONCLUSION

The pattern of presentation of caries was similar to other studies, with the molars in both arches being the most affected and the least affected being the mandibular anterior teeth. The first primary mandibular molar was the most susceptible tooth followed by the second primary mandibular molar. This is a good indication for targeted preventive measures, such as placing fissure sealants as soon as they erupt.

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Nil

### Conflict of interest

None declared

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