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The prevalence and influencing factors of ECC in Baiyun District, Guangzhou City:a cross-sectional study

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Abstract. To investigate the prevalence and influencing factors of Early Childhood Caries (ECC) in Longgui Street in Baiyun District of Guangzhou and establish a prediction model to establish a basis for the overall diagnosis and prevention of ECC. Seven kindergartens were randomly selected from seven administrative villages on Longgui Street, and more than 300 kindergartens were needed. A total of 1,096 preschool children were included. The questionnaires were distributed to parents to investigate the oral health behavior and medical treatment behavior of the tested children and the oral health knowledge behavior of the tested parents, and the results were analyzed differently to establish a prediction model. The incidence of dental caries in 1096 preschool children was 18.6%, with age being a risk factor for dental caries ($p<0.05$, $OR>1$); only child status being a protective factor for dental caries ($p<0.05$, $OR<1$); family income level being a protective factor for dental caries ($p<0.05$, $OR<1$); chewing food-feeding children being a risk factor for dental caries ($p<0.05$, $OR>1$); starting brushing time being a protective factor for dental caries ($p<0.05$, $OR<1$); and toothache informing family members that it is a risk factor for dental caries ($p<0.05$, $OR>1$), but this factor is not suitable as a predictive factor because, in many cases, children who inform their parents that they already have dental caries disease. Parents' awareness of whether bacteria can cause gum inflammation and dental caries plays an important role in their oral health knowledge and attitudes. Conclusion: The prevalence of dental caries among preschool children in Longgui Street of Baiyun District is lower than the national level, indicating that remarkable achievements have been made in the prevention of dental caries among preschool children in Longgui Street. Dental caries in preschool children on Longgui Street are closely related to children's age, whether they are only children, parents' education level, parents' oral knowledge, beliefs and behaviors, and children's bad oral behaviors. Oral health behaviors should be cultivated as early as possible, and some aspects of traditional feeding habits should be abandoned.

Keywords: dental caries, preschoolers, oral health, ECC

1. Introduction

The WHO ranks dental caries as the third key disease in the world of noninfectious diseases, and early childhood dental caries (Early Childhood Caries) is defined in children 71 as the presence of one or more caries deletions (noncavitated or cavitating lesions) at months or younger or filled deciduous teeth [2]. China is a country with a high incidence of oral diseases. The results of the fourth national oral health epidemiological survey released in 2017 revealed that the caries rate in the permanent teeth of 12-year-old children is 38.5%, and the caries rate in the primary teeth of 5-year-old children is 71.9% [3]. Studies in the past 3 years have shown that the prevalence of ECC in China is between 54% and 74%, which indicates that deciduous dental caries is still a serious social health problem in China.

Dental caries can have adverse effects on children's physical and mental health and can cause pulpitis, jaw osteomyelitis, alveolar abscess and other diseases [4]. Dental caries and individuals' daily behavior, cognitive attitudes and eating habits, as well as progressive damage to hard dental tissue, are closely related to temporal factors [5]. Among preschool children, their self-management ability is immature, and they generally lack oral health knowledge. Therefore, children's health behaviors and concepts mainly depend on the guidance of guardians. However, many parents lack oral health knowledge and disregard oral health, which leads to insufficient guidance and assistance for children's health behavior in daily life. These factors may be the key reasons for the increasing prevalence of dental caries in preschool children. Therefore, exploring the influencing factors of dental caries in preschool children is highly important for the diagnosis and early prevention of diseases.

As one of the important national central cities in China, its Baiyun District is the largest urban area in Guangzhou. By the end of 2020, the permanent resident population of Longgui Street had reached approximately 115,900. Given the large population base and large floating population, studies on early childhood dental caries (ECC) are lacking. This study conducted a systematic survey of preschool children and their parents through questionnaires, aiming to explore the potential influencing factors of dental caries in preschool children from multiple aspects and to conduct an in-depth analysis of parents' knowledge, beliefs and behavior patterns in oral health. On the basis of the collected data, this study constructed a predictive model aiming to reveal the associations between relevant variables. The research results provide a scientific basis for local medical and health departments to formulate targeted prevention and control strategies and then lay a solid theoretical foundation for children's oral health care work.

2. Methods

2.1. Study eligibility and quality assessment

This study was a cross-sectional study in which baiyun district dragons to streets were used as a sample collection area. In Guangzhou baiyun district, seven administrative villages were chosen according to the size of probability sampling. Each administrative village randomly grouped a kindergarten, a total of seven kindergartens, and each kindergarten met the age criteria for preschool children (3--7 years old). A total of 1216 Guangzhou baiyun districts dragged to street kindergarten children, trained investigators 3 days before the survey, and unified the evaluation criteria. After kindergarten health education, parents fill out the questionnaire on the spot by the investigators. After unified recycling, the parents did not present the research purpose by contacting the kindergarten in the parents' WeChat group and completing the relevant considerations and other content, such as questionnaire leakage, timely return and please parents, to ensure the quality and quantity of the questionnaire. After the exclusion of questionnaires with missing information, a total of 1096 preschool children were included in the analysis.

The diagnostic criteria for dental caries in children in this study were referred to the Fourth National Oral Health Epidemiological Survey Methods [7], and the diagnostic criteria for dental caries were investigated and recorded by occupational physicians in each kindergarten health hospital. The questionnaire was designed according to the relevant questionnaire [8] in the Third National Oral Health Epidemiological Survey and revised according to clinical experience and expert opinion. The final questionnaire included demographic statistics, oral health behavior problems of preschool children and their parents, medical treatment behavior, oral health knowledge of parents, parents' oral health attitudes, daily eating habits, self-assessments of the general body and oral health. Given that the development of dental caries is the result of a variety of factors, including bacterial infection and children's behavior and parents' behavior, as well as children's and parents' and parents' oral health knowledge and attitudes, this study questionnaire contains general data and mainly covers children's oral behavior, oral behavior, parents' oral health knowledge and parents' oral health attitudes in four dimensions.

2.2. Data analysis

In this study, parents' completed questionnaire data were entered using Excel software and data analysis was performed using SPSS26.0 statistical software. Measurement data were presented as the mean ± standard deviation (Mean ± SD) and the differences between groups were compared by independent sample t test; count data were expressed as frequency (percentage) and analyzed by chi-square test (x2 test). This study further used univariate Logistic regression analysis to identify factors affecting early childhood caries (ECC). Complex network analysis was conducted with the JASP software to explore the key issues between parents' oral health knowledge and attitudes. The prediction model was constructed in R language, using regression analysis through multivariate logistic regression model to screen out risk factors and draw Nomogram maps to visually show the relationship between the predictor variables in the model and the risk of dental caries. The specific variables are shown in Table 1 below. Furthermore, this study benchmarked the ROC curves to assess the predictive efficacy of the model.

Table 1. Multivariate regression analysis of dental caries in preschool children

variable	voluation
Age interval assignment	1=1-4 years, 2=4-5 years, 3=5-6 years, 4=6 years or older
How many children are there	1= more than 2,2=2, and 3=1
Whether the child is the only child	1= No, and 2= yes
Your average monthly income (RMB yuan/month)	1=3000 and below, 2=3000-6000,3=6000-10,000,4 = 10,000 and above
Whether the family member will chew the food to feed the child	1= unclear, 2= yes, and 3= No
Children start brushing their teeth at tie	1= <2 years, 2=2-3 years, and 3=> 3 years
Whether the child toothache will inform the family	1= Yes, and 2= No

Table 1. Continued

Have you ever seen a doctor	1= No,2= seen

3. Discussion

3.1. Demographic data

In this study, the gender, age, family structure, residence, and parental education of 1,096 preschool children were analyzed. In terms of gender distribution, there were 557 male children and 539 female children, accounting for 50.8% and 49.2% of the total survey population, respectively. In terms of age distribution, 407 children were aged 3--4 years, 37.1%; 428 children were aged 4--5 years, 39.1%; and 261 children were aged 5--6 years, 23.8%. In terms of family structure, nonchild-only families accounted for 72.3%, and only child families accounted for 27.7%. The distribution of residences revealed that urban children accounted for 58.4%, and nonurban children accounted for 41.6%. In terms of parents, the greatest percentage of those with a college degree, 472, accounting for 43.07%, 291 with a bachelor's degree, accounting for 26.55%, 17 with a master's degree or above, accounting for 1.55%, and those with a bachelor's degree or above, accounting for 28.1%. In terms of the number of children, 304 families had only children, accounting for 27.7%; 636 families had two children, accounting for 58%; and 156 families had two or more children, accounting for 14.2%. The average monthly income of the family is concentrated in the range of 3,000—6,000 yuan, accounting for 37.1%, 3000 yuan and below 3000 yuan 21.3%, 6000--10000 yuan 23.5%, and 10000 yuan or above 18.1%, respectively. The detailed data are presented in Tables 2 and 3.

Table 2. Demographic characteristics of the preschool children

Item	group	frequency	percentage
census			
	town	640	58.4
	Nontown	456	41.6
sex			
	man	557	50.8
	woman	539	49.2
the only child			
	yes	304	27.7
	no	792	72.3
Age interval			
	3-4	407	37.1
	4-5	428	39.1
	5-6	261	23.8

Table 3. Demographic characteristics of the parents who participated in the questionnaire

Item	group	frequency	percentage
degree of education			
	Junior high school and below	316	28.8
	junior college	472	43.1
	undergraduate course	291	26.6
	Master's degree or above	17	1.6
Number of children			
	More than two children	156	14.2
	There are two children	636	58.0
	A child	304	27.7

Table 3. Continued

Monthly income			
	3000 and below	233	21.3
	3000~6000	407	37.1
	6000~10000	258	23.5
	10000 and above	198	18.1

3.2. Differential analysis of the survey results

3.2.1. Analysis of the differences between the general data and caries rates of preschool children and parents

In this survey of dental caries among preschool children in Longgui Street, Baiyun District, Guangzhou city, a total of 204 children were found to have dental caries, with a prevalence rate of 18.6%. By comparing and analyzing general data such as different age groups, numbers of children, monthly average family income and only child status, this study revealed significant differences in the prevalence of dental caries among preschool children in different categories. The incidence of dental caries increased with age, with the highest prevalence in children aged 5--6 years reaching 31.4%. In terms of the number of children, the greater the number of children is, the greater the prevalence of dental caries, with the prevalence in families with more than two children reaching 26.92%. In terms of family economic status, the highest prevalence of dental caries among families with an average monthly income of 3000--6000 yuan was 23.1%. Moreover, the prevalence in children was significantly greater than that in only children, and the prevalence in nononly children was 21.09%. In other general data categories, such as sex and parental education level, no significant associations were found with the prevalence of dental caries in children ($p > 0.05$; see Table 4).

Table 4. Differential analysis of caries rates for general data

Item	divide into groups	Wheather have dental caries		x2	p
		Not suffering from	Has suffered from		
Age interval					
	3-4	367(90.17)	40(9.83)	49.485	0.000
	4-5	346(80.84)	82(19.16)		
	5-6	179(68.6)	82(31.4)		
Children's household registration					
	Nontown	524(81.88)	116(18.13)	.242	0.623
	town	368(80.7)	88(19.3)		
Children's gender					
	man	458(82.23)	99(17.77)	.527	0.468
	woman	434(80.52)	105(19.48)		
Education of parents					
	Junior high school and below	252(79.75)	64(20.25)	2.717	0.437
	junior college	380(80.51)	92(19.49)		
	undergraduate course	246(84.54)	45(15.46)		
	Master's degree or above	14(82.35)	3(17.65)		
How many children					
	More than two children	114(73.08)	42(26.92)	15.894	0.000
	There are two children	511(80.35)	125(19.65)		
	A child	267(87.83)	37(12.17)		

Table 4. Continued

Your average monthly income (RMB yuan/month)					
	3000 and below	189(81.12)	44(18.88)	12.938	0.005
	3000~6000	313(76.9)	94(23.1)		
	6000~10000	227(87.98)	31(12.02)		
	10000 and above	163(82.32)	35(17.68)		
Whether it is an only child					
	yes	267(87.83)	37(12.17)	11.525	0.001
	no	625(78.91)	167(21.09)		

3.2.2. Analysis of differences between parental behavior and the caries rate

There was a significant difference between the caries rates of family members who chewed food ($p < 0.01$), with the highest rate of 35.29%. There was no significant difference in caries rates among the remaining parents ($p > 0.05$, see Table 5).

Table 5. Analysis of caries rate differences in parental behavior

Item	group	Wheater have ECC		x2	p
		Not suffering from	Has suffered from		
Do you brush your teeth every day					
	No, occasionally forget	33(76.74)	10(23.26)	0.723	0.868
	Yes, three times or more times a day	7(77.78)	2(22.22)		
	Yes, each morning and evening	652(81.6)	147(18.4)		
	Yes, once a day	200(81.63)	45(18.37)		
Do you monitor and check your child's tooth brushing deny					
	no	28(77.78)	8(22.22)	5.290	0.071
	Yes, occasionally supervise and inspect	335(78.27)	93(21.73)		
	Yes, daily supervision and inspection	529(83.7)	103(16.3)		
Will you help your children to brush their teeth					
	no	220(78.01)	62(21.99)	3.577	0.167
	Yes, occasionally help your child brush his teeth (3 times a week)	409(81.64)	92(18.36)		
	Yes, help your child brush your teeth every day	263(84.03)	50(15.97)		

Table 5. Continued

Do you have good eating habits					
	dont know	30(78.95)	8(21.05)	.726	0.867
	no	38(80.85)	9(19.15)		
	Yes, occasionally the meal time is regular, and the nutrition collocation is even	263(80.18)	65(19.82)		
	Yes, the meal time is regular, and the nutrition collocation is even	561(82.14)	122(17.86)		
Whether the family member will chew the food to feed the child					
	Dont know	15(93.75)	1(6.25)	11.256	0.004
	NO	844(82.02)	185(17.98)		
	YES	33(64.71)	18(35.29)		
Do you brush your teeth for more than 3 minutes					
	NO	267(79.23)	70(20.77)	1.497	0.221
	YES	625(82.35)	134(17.65)		
The type of toothpaste you brush your teeth					
	Do not contain fluorine	94(81.74)	21(18.26)	.426	0.808
	Dont know	285(80.28)	70(19.72)		
	contain fluorine	513(81.95)	113(18.05)		
Whether you use dental floss or toothpick yourself					
	No, do not use	178(81.65)	40(18.35)	.968	0.616
	Yes, occasionally used	443(82.34)	95(17.66)		
	Yes, daily use	271(79.71)	69(20.29)		

3.2.3. Analysis of differences between child behavior and the caries rate

There was a significant difference in the rate of caries at the onset of brushing ($p < 0.01$). The rate of dental caries increased gradually. The highest rate of dental caries in children who started brushing at > 3 years of age reached 22.91%. There was a significant difference in the rate of caries when children often sleep with a nipple or a sweet pacifier at night ($p < 0.05$). The rate of caries frequently asleep with a nipple or sweet pacifier reached 28.42%. Whether there was a significant difference ($p < 0.01$) was that the rate of dental caries reached 24.56%. There were significant differences in the rate of caries by the age of visit ($p < 0.05$), and the rate of dental caries without seeing a doctor reached 19.93%. There was no significant difference in caries rates among the different categories of child behavior ($p > 0.05$, Table 6).

Table 6. Analysis of the different groups of children and dental caries

Item	group	Do you have dental caries		x2	p
		Not suffering from	Has suffered from		
Feeding mode of the child within four months of birth					
	Breastfeeding	273(80.53)	66(19.47)	0.762	0.859
	Artificial feeding is the main	156(80.41)	38(19.59)		
	Full breast milk	384(82.58)	81(17.42)		
	Fully artificially fed	79(80.61)	19(19.39)		
At what age is the child is breastfed					
	<1Years old	681(82.55)	144(17.45)	4.291	0.117
	1-2Years old	170(76.58)	52(23.42)		
	>2Years old	41(83.67)	8(16.33)		
Whether the children brush their teeth for more than 3 minutes					
	no	542(79.59)	139(20.41)	3.838	0.050
	yes	350(84.34)	65(15.66)		
Whether the children should brush their teeth every day					
	No, occasionally forget	126(77.78)	36(22.22)	2.425	0.489
	Yes, each morning and evening	471(82.34)	101(17.66)		
	Yes, once a day	292(81.34)	67(18.66)		
	Yes, three times a day or more	3(100)	0(0)		
Children start brushing their teeth at time					
	<2Years old	369(88.28)	49(11.72)	21.179	0.000
	2-3Years old	348(77.16)	103(22.84)		
	>3Years old	175(77.09)	52(22.91)		
At night, whether the child often sleeps with a nipple or a sweet pacifier					
	no	824(82.32)	177(17.68)	6.605	0.010
	yes	68(71.58)	27(28.42)		
Do your children know the right way to brush their teeth					
	NK	115(78.77)	31(21.23)	1.118	0.572
	no	129(80.12)	32(19.88)		
	yes	648(82.13)	141(17.87)		
Whether the child toothache will inform the family	NK	233(97.9)	5(2.1)	67.826	0.000
	no	60(93.75)	4(6.25)		
	yes	599(75.44)	195(24.56)		
Ever seen the doctor					

Table 6. Continued

	never	687(80.07)	171(19.93)	4.523	0.033
	yes	205(86.13)	33(13.87)		
Whether he (she) keeps brushing his teeth after the child's baby teeth sprout					
	No, there is no need to brush your teeth, and the deciduous teeth will fall off to take a look at	29(80.56)	7(19.44)	3.153	0.207
	Did not see				
	Yes, occasionally (3 to 5 days a week)	297(78.57)	81(21.43)		
	Yes, insist on every day	566(82.99)	116(17.01)		

3.3. Differences in oral knowledge scores and attitudes scores between parents with and without caries

An independent sample t test of preschool children with dental caries and without dental caries as categorical variables revealed that the total score of OHC was -1.251, p=0.211, greater than 0.05; t=0.879, p=0.379, greater than 0.05, indicating that the total score of parents with dental caries and without dental caries (Table 7).

Table 7. Analysis of the difference between dental caries and parents' oral knowledge and attitudescore

	Do you have dental caries		t	p
	NO	YES		
Total score of parents oral health knowledge	6.50±1.83	6.68±1.80	-1.251	0.211
Total score of parents' oral health attitude	40.77±4.61	40.45±4.95	0.879	0.379

3.4. Multivariate logistic regression analysis of dental caries in preschool children

To explore the prevalence of dental caries in preschool children under the influence of multiple factors, the variables showing significant differences in the univariate analysis in Tables 3, 4, 5, and 6 were selected as independent variables, and binary logistic regression analysis was conducted to determine whether dental caries was the dependent variable. Variables were screened via the forward LR method to exclude nonsignificant and redundant variables ($p > 0.05$). The analysis revealed that the risk of dental caries increased significantly with age ($p < 0.05$), indicating that age is a risk factor for dental caries. For the categorical variable of the number of children, the regression coefficient was less than 0, indicating that only children may have a lower risk of dental caries ($p < 0.05$). When monthly parental income was used as a categorical variable, the regression coefficient was also less than 0, suggesting that higher parental income levels may be associated with a lower risk of dental caries in children ($p < 0.05$). In terms of feeding method, the regression coefficient for children who did not chew food was less than 0, indicating that the feeding method may be a protective factor against dental caries in children ($p < 0.05$). The regression coefficient of the time to tooth brushing was greater than 0, and the OR was greater than 1, indicating that late brushing initiation was a risk factor for dental caries ($p < 0.05$), and the later the brushing time was, the greater the possibility of dental caries. In addition, the OR of the parents when the degree of toothache was greater than 1 indicated that informing the parents when toothache was present was also a risk factor for dental caries ($p < 0.05$), probably because the children had dental caries at the time of notification rather than informing them that it could effectively prevent the occurrence of dental caries. The equation of the logistic regression prediction model is shown in formula (1). On the basis of the results of the logistic regression, this study drew a visual prediction model diagram (nomogram diagram, Figure 1), and the ROC curve was drawn according to the predicted value (Figure 2). The ROC curve is located on the upper left of the reference line, and the area under the curve is 0.768, indicating a better predictive efficacy of this prediction model.

Table 8. Multivariate logistic regression analysis of factors affecting dental caries in preschool children

variable	β	standard error	Wald	significance	Exp(B)	EXP(B)95%CI	
						lower limit	superior limit
Age interval	0.567	0.096	34.642	0.000	1.763	1.459	2.129
Number of children			7.518	0.023			
Number of children (2 children)	-0.344	0.221	2.413	0.120	0.709	0.460	1.094
Number of children (more than 2)	-0.734	0.269	7.465	0.006	0.480	0.283	0.813
Your average monthly income (RMB yuan/month)	-0.230	0.084	7.440	0.006	0.795	0.674	0.937
Whether the family member will chew the food to feed the child			8.142	0.017			
Whether family members can chew food to feed children (unclear)	-1.999	1.115	3.215	0.073	0.136	0.015	1.204
Whether the family members can chew the food to feed the child (no)	-0.878	0.333	6.940	0.008	0.415	0.216	0.799
Children start brushing their teeth at time	0.294	0.112	6.852	0.009	1.342	1.077	1.672
Children toothache will inform the family (will)	1.731	0.286	36.602	0.000	5.645	3.222	9.890
constant (quantity)	-4.566	0.748	37.231	0.000	0.010		

-

$$log\frac{P}{1-P} = -4.566 + 0.567x_1 - 0.344x_2 - 0.734x_3 - 2.3x_4 - 1.999x_5 - 0.878x_6 + 0.294x_7 + 1.731x_8 \quad (1)$$

Note: X_1 is the age range; X2 is the number of children equal to 2; X_3 is the number of children more than 2; X_4 is the average monthly income of parents; X_5 is whether the parents are not aware of how to chew food to feed children; X_6 is the number of parents to chew food; X_7 is the number of children who start brushing; X_8 is whether the child's toothache will inform the family.

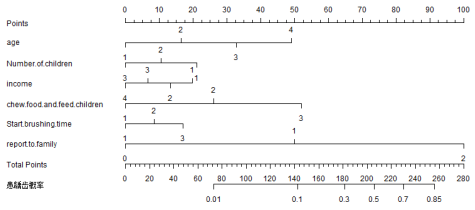

Figure 1. Nomogram diagram

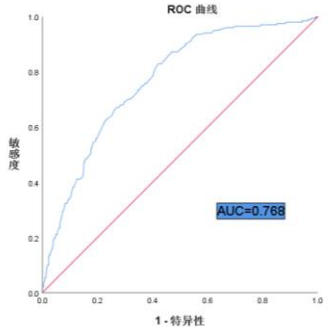

Figure 2. ROC curve

3.5. Complex network analysis

In this study, parents' oral health knowledge scores and attitudes toward oral health did not significantly differ between the caries group and the no caries group. However, these scores are considered key factors affecting parental behavior and the oral health behaviors of their children. Therefore, this study conducted a complex network analysis of the various items of parents' oral health knowledge scores and oral health attitudes scores to identify mental indicators. Through the analysis of mediation, proximity and intensity, the top three items were selected as references for subsequent prevention work. The results are presented through a network diagram (Figure 3) and a centrality diagram (Figure 4). The analysis results revealed that the entry "Q34-on whether bacteria can cause gingival inflammation and caries" was outstanding in terms of mediation, proximity and intensity, indicating that the problem has the strongest correlation with other problems and plays a core intermediary role in the network. In addition, several other key issues, including the understanding of the purpose of brushing, the common causes of gingival bleeding, the effectiveness of gum bleeding prevention, and the necessity of preschool children's regular oral examination and deciduous tooth damage directly after extraction and not treatment, are also important influences on preschool children and should be the focus of parents.

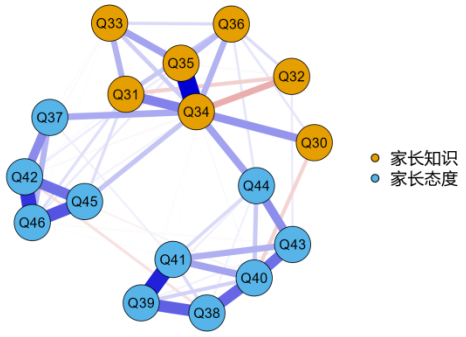

Figure 3. Result presented through network diagram

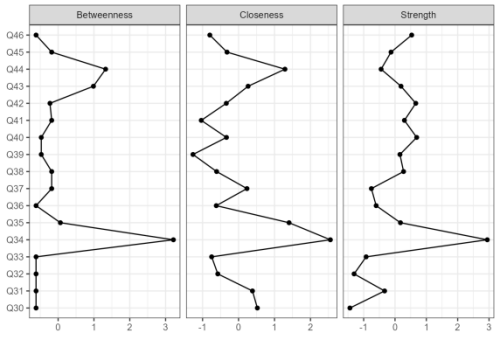

Figure 4. Result presented through centrality diagram

Table 9. Centrality indicators of complex network analysis

Question item	Intermediary degree	Question item	nearness	Question item	intensity	sequence
Q34	3.219	Q34	2.553	Q34	2.944	1
Q44	1.325	Q35	1.404	Q30	-1.439	2
Q43	0.985	Q44	1.29	Q32	-1.306	3

4. Conclusion

As a common chronic disease in children, dental caries not only has a negative impact on the masticatory function of children but also may be a potential cause of oral diseases such as pulpitis, periodontitis and other factors [9]. The prevalence of dental caries in preschool children in Longgui Street, Baiyun District, Guangzhou, was 18.6%, which is lower than the rate reported in the fourth national oral health epidemiological survey released in 2017. These results may be related to the active intervention of the preschool education department of the Baiyun District Education Bureau, as well as the emphasis of parents and schools on oral health education. The prevention and treatment of dental caries in preschool children at Longgui Street has achieved remarkable results.

4.1. Analysis of the factors affecting caries in preschool children

In this study, the influencing factors of caries in preschool children were child age, whether the child was the only child, family monthly income, whether the family members chewed food to feed the child and the time when the child started brushing. For these reasons, in preschool children, age, as a risk factor for the onset of dental caries, increased the incidence of dental caries with increasing age. This phenomenon is consistent with the characteristics of dental caries as a disease characterized by progressive hard tissue damage; that is, the damage detection rate of dental caries has gradually increased over time, which is consistent with the research results of Huang Fang, Sun Lei, Yang Yanhui and other scholars on the incidence trend of dental caries in preschool children [10, 11]. Furthermore, only child status can be considered a protective factor against the onset of dental caries. The study revealed that when the number of children in the family is small, the family pays more attention and health to each child and has more behavioral and educational interventions for the children, thus effectively reducing the risk of dental caries. Therefore, only children tend to have better oral hygiene and eating habits than nononly children do, which is consistent with the findings of a survey by Qin. [12]. Family monthly income is also an important protective factor affecting the onset of dental caries. A higher family monthly income usually indicates better living conditions and more adequate material security, thus helping to reduce the risk of dental caries in preschool children and increasing the risk of caries among friends in Tianjin ninghe district preschool child caries status survey results that are consistent with those of [13]. In contrast, feeding their children after they chew food significantly increases the risk of dental caries, which provides a way and possibility for bacterial transmission. In addition, the age when children start to brush their teeth is also an important protective factor. Early brushing can help with dental care in advance and effectively prevent and remove bacteria from the mouth to protect dental health, which is consistent with the research results of Wang Liping and other scholars on the risk factors for dental caries in preschool children [14]. However, what children report to their family at the time of toothache may be a risk factor for the onset of caries, which may have already had caries at the time of reporting, rather than informing parents at an early stage.

4.2. Analysis of parental oral health knowledge and attitudes

In this study, oral health knowledge and attitudes were scored for parents of preschool children whose dental caries were diseased and not ill, and there was no significant difference in the total score between the two groups ($p > 0.05$). For these reasons, the parents of preschool children on Longgui Street were not significantly different in terms of their mastery of oral health knowledge or their attitudes toward oral health. Further analysis revealed that the direct factors affecting dental caries in preschool children include children's own behavior and parental behavior. In most cases, although parents have certain cognitions and positive attitudes toward oral health, insufficient actual implementation may lead to differences in the risk of dental caries in children [15]. Parents should pay attention to children's oral hygiene, help children brush their teeth on time every day, and regularly take children to hospitals or oral clinics for oral examination to cultivate good oral hygiene habits. In addition, through complex network analysis of parents' oral health knowledge and attitudes, we found that parents' understanding of whether bacteria can cause gingival inflammation and dental caries occupies a central position in the overall network. In a healthy state, various microorganisms, including bacteria, fungi, and viruses, in the oral cavity are in a dynamic balance and maintain the stability of the oral environment through interactions [16]. Therefore, better understanding of the problems faced by parents and other oral health-related issues can reveal that parents need to pay attention to the composition of children's oral microbial community beginning in early childhood [16], including maintaining the balance and diversity of children's oral microbial community and inhibiting the excessive growth of pathogenic microorganisms.

Although remarkable results have been achieved in Longgui Street, the popularization of oral health education still needs to be further strengthened. It is very important to improve parents' and children's awareness of and attention to oral health and to transform correct cognition and beliefs into actual oral health behaviors. In addition, it is urgent to explore how to more efficiently use existing medical resources to improve the accessibility and quality of oral health services. This may involve strengthening the construction of the grassroots oral health service network, improving the professional skills and service level of oral doctors, and promoting measures for the use of advanced oral treatment technology and equipment.

Comprehensive analysis revealed that Longgui Street has made remarkable achievements in the prevention and treatment of dental caries in preschool children, but unremitting efforts are still needed to reach the international advanced level. There is an obvious correlation between oral health behavior and the occurrence of dental caries in preschool children. In the clinic, the oral health examination of preschool children should be strengthened, and corresponding interventions should be implemented to guide them in the development of good oral health behavior to prevent and control dental caries effectively. However, this study has several limitations, including not selecting a larger sample size, not classifying dental caries, not analyzing more influencing factors, etc. A larger scale study is needed to analyze the correlation between dental caries and health behavior more comprehensively and provide a basis for the development of dental caries control measures. We should analyze the shortcomings of existing policies and practices in depth and take practical improvement measures to provide more comprehensive and better oral health protection for preschool children.

Declarations

Ethics approval and consent to participate: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). All information from the program is available and free for public, so the agreement of the medical ethics committee board was not necessary.

Consent for publication: Not applicable

Availability of data and materials: The data that support the findings of this study are available from [third party name] but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Baiyun District Education Bureau.

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