# Determinants of Dental Caries among Pensioners in Port Harcourt, Rivers State, Nigeria

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## Abstract

**Background and Aim:** Data on oral health of the elderly are uncommon in the South-South region of Nigeria. The purpose of this research was to find the relationship between dental caries and oral health knowledge, attitude, behavior, and oral hygiene status of the pensioners in Port Harcourt, Rivers State. **Materials and Methods:** The research was a correlational study. A total of 543 pensioners were selected by systematic random sampling. Data were collected with a self-developed Oral Health Assessment Questionnaire designed in five sections (A-E) and analyzed using SPSS version 20 (IBM SPSS Armonk, New York, USA). Relationship between variables was established using simple and multiple regressions. Significance was determined at 0.05 alpha level. **Results:** The mean knowledge, attitude, and behavior scores were 12.23, 27.61, and 8.76, respectively. Whereas oral health knowledge accounted for 11.56% ( $R^2 = 0.1156$ ) of the variance in the pensioners' dental caries status, oral health attitude and behavior, respectively, accounted for 33.64% ( $R^2 = 0.3969$ ) and 27.04% ( $R^2 = 0.2704$ ) of the variance in the pensioners' dental caries status. Oral hygiene accounted for 33.64% ( $R^2 = 0.3364$ ) of the variances in the dental caries status of the pensioners. **Conclusion:** This study found a low and negative nonsignificant correlation between dental caries and oral health knowledge, a moderate and negative nonsignificant correlation between oral health behavior and dental caries. Similarly, oral hygiene level of the pensioners was moderately and significantly correlated to dental caries.

Keywords: Correlation, dental caries, oral hygiene, pensioners

## INTRODUCTION

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Dental caries is a disease of the mineralized tissues of the teeth, caused by the action of microorganisms on fermentable carbohydrate.<sup>[1]</sup> The etiology of dental caries has been a subject of great interest and postulations.<sup>[1]</sup> Various theories have been suggested regarding the etiology of dental caries. However, the current concept is that the etiology of dental caries is multifactorial involving interplay between four principal factors, namely, bacterial plaque, dietary substrate in the form of refined carbohydrates, susceptible host or tooth, and time.<sup>[2]</sup> Other factors which predispose to dental caries include poor oral hygiene, reduced salivary flow and viscous saliva, lack of fluoride in drinking water, and crowding of the teeth. The modern understanding of caries also includes consideration of how behavioral, social, and psychological factors are also involved in the expression of the disease in different individuals.<sup>[2,3]</sup>

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In addition to these factors enumerated above, the occurrence of dental caries is reported to be influenced by individuals' oral health knowledge, attitude, and behavior. Dental caries has decreased over time due to improvements in individual's oral health behavior.<sup>[4]</sup> Sheiham and Watt reported that healthy oral health behaviors are imperative among all individuals to decrease their risk of the development of dental diseases.<sup>[5]</sup> Positive attitude toward oral health is highly correlated to low risk of oral health problems;<sup>[6]</sup> hence, individuals who have good attitude and behavior by brushing the teeth daily have better oral hygiene, less dental caries, and periodontal disease experience than those who brush less frequently.<sup>[7]</sup> Individuals with good

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knowledge of oral health practices are also reported to have lower prevalence of periodontal disease and dental caries.<sup>[8,9]</sup>

Data on oral health of the elderly in Nigeria are uncommon, particularly in the South-South region of the country. The few available data are from the South-West region of the country, and it may not be appropriate to extrapolate the results from these studies to South-South elderly, due to social and cross-cultural differences. Furthermore, to the best of the researcher's knowledge, none of these studies have looked at the influence of oral health knowledge, attitude and behavior, as well as oral hygiene status on the occurrence of dental caries among the elderly. According to the United Nation Population Division (2003),<sup>[10]</sup> the Nigerian National Population Commission defines the elderly in Nigeria as person's age 60 years and over, pensioners are a distinct group of the elderly 60 years and older but with varied cultural, educational, socioeconomic, and psychological experiences, which are factors that affect oral health. The objectives of this research therefore were to find the relationship between dental caries and oral health knowledge, attitude, and behavior as well as the relationship between dental caries and oral hygiene status of the pensioners in Port Harcourt, Rivers State. The study would provide baseline data on oral health of the elderly for reference purposes and future use.

## **MATERIALS AND METHODS**

#### **Research design**

The present research was correlational in design. Correlational research is the type of study that seeks to establish what relationship exists between two or more variables.<sup>[11]</sup> Usually, such studies indicate the direction and magnitude of the relationship between the variables. Oral health knowledge, attitude, behavior, and oral hygiene status (independent variables) were used to predict the occurrence of dental caries (dependent variable).

### Sample and sampling technique

The population of the study consisted of pensioners in Port Harcourt, Rivers State. The sample size (n) was determined according to the formula for sample size determination<sup>[12]</sup> given as  $n = \frac{z^2 pq}{d^2}$  for population less than 10,000 at 95% confidence interval, standard normal deviate (*z*) of 1.96, and degree of accuracy (*d*) 0.05. The proportion (*p*) of elderly with dental caries was 0.305 (30.5%),<sup>[13]</sup> and the proportion (*q*) without dental caries was 0.695 (69.5%). Therefore, the minimum sample size obtained for this study was 325.

The individuals were selected by systematic random sampling at the Secretariat of the Nigerian Union of Pensioners (NUP) located at the State Civil Service Secretariat in Port Harcourt. The register of the pensioners constituted the sampling frame for this study (source: NUP Secretariat) and every second individual was selected from the register. Individuals selected who were not present in a particular visit were contacted through their phone numbers for subsequent visit.

#### Instrument for data collection

Data were collected by the use of questionnaire. The questionnaire was a structured self-developed Oral Health Assessment Questionnaire designed in five sections (A-E). Section A contained the demographic information (gender, age, retirement grade level, and educational status), Section B and C contained questions on oral health knowledge and behavior; both were assessed on a scale of yes (1 point for correct response) or no (0 point for wrong response) for positively constructed questions and yes (0 point for wrong response) or no (1 point correct response) for negatively constructed questions.

The oral health knowledge was assessed using twenty questions. These included questions on the accumulation of plaque on the teeth, meaning of plaque and its effect on dentition and the gum, the cause of tooth decay, purpose of tooth brushing, meaning of gum bleeding and its reasons, methods to prevent gum bleeding, effect of sugar particularly soft/fizzy drinks on teeth, methods of prevention of tooth decay, methods of prevention of gum disease, and effect of fluorides on teeth. Oral health behavior was assessed using 16 questions. These included questions on frequency and time of tooth brushing, duration of tooth brushing, material used for brushing teeth, reasons for change of toothbrush, materials used for cleaning the teeth other than toothbrush, reasons for visiting a dentist, frequency of consumption of sweets, and bad habits such as cigarette smoking.

Thirteen questions on oral health attitude were contained in section D. These included questions on attitudes toward regular dental visits, cigarette smoking habit, cleaning of teeth without using paste, care of the teeth, bothering about color of teeth, services/care provided by a dentist, as well as attitude toward dental care and body care in general and involvement in the dental treatment. The questions were assessed on a 4-point modified Likert scale of strongly agree (4 points), agree (3 points), disagree (2 points), and strongly disagree (1 point) for positive questions and strongly agree (1 point), agree (2 points), disagree (3 points), and strongly disagree (4 points) for negative questions.

The dental caries and oral hygiene status were recorded in Section E of the questionnaire. Dental caries was recorded by counting the number of decayed (D), missing (M), and filled (F) teeth (DMFT) index according to WHO 2013, and the oral hygiene was recorded using the simplified oral hygiene index according to Green and Vermillion, 1964. Six teeth were examined, each for soft deposits (debris) and hard deposits (calculus). The debris and calculus scores for an individual ranged from 0 to 3; hence, the total oral hygiene score for an individual is the sum of debris and calculus score which ranged from 0 to 6.

A total of 543 copies of the questionnaire were administered to the respondents, and all were retrieved. The recording of dental caries was done by the first author. Data were collected over a period of two years from April 2015 to March 2017. The study was approved by the Research Ethics Committee, University of Port Harcourt, and informed consent was obtained from the participants. Pensioners who retired from public service of Rivers State government voluntarily or retired as a result of years of service who were below the age of 60 years were excluded from the study since they do not meet the age to be classified as elderly.

#### Validity and reliability of the instrument

Validity as defined by Kumar refer to the accuracy, quality, and appropriateness of the modalities adopted for finding answers to the research questions.<sup>[14]</sup> The researcher believes that this research study is accurate and valid due to the fact that procedures adopted for this study are from scientific and peer-reviewed sources. The reliability of the instrument was done using pensioners different from those recruited for the study. Twenty of them were selected; the selected pensioners completed the questionnaire and were examined by the researcher. The filling of the questionnaire and examination was repeated after an interval of 1 week. The reliability of the instrument was determined using the Cronbach's alpha, and alpha coefficient of 0.82 was obtained. The intraexaminer reliability for caries detection was determined using the Cohen's Kappa statistics and a Cohen score of 0.9. The intraexaminer reliability for recording of oral hygiene was determined by intraclass correlation, and reliability coefficient of 0.79 was obtained.

#### Procedure for data analysis

The completed copies of the questionnaires were collated, coded, and entered into the Statistical Package for Social Sciences (SPSS) spreadsheet. The data were subsequently analyzed using SPSS version 20 (IBM SPSS Armonk, New York, USA). Descriptive statistics of percentage, mean, and standard deviation was used to answer the research questions. Individual knowledge score varied from 0 to 20, behavior score from 0 to 16, and attitude score from 13 to 52. The mean score for the population was calculated, and respondents with score equal to or greater than the population mean score were rated as having good knowledge, good behavior, or positive attitude, and those with score less than the mean were rated as having poor knowledge, poor behavior, or negative attitude.

The population mean was calculated as the sum of individual DMF divided by number of study participants (mean DMFT). The proportion of individual with caries is the number of individuals with at least one decayed (D component) tooth. According to Green and Vermillion, 1964, the oral hygiene score of an individual ranged from 0.0 to 6.0. The oral hygiene was graded as good, when participant scored 0.0–1.2 of 6; fair, when participant scored 1.3–3.0 of 6; and poor, when participant scored 3.1–6.0 of 6. The population mean oral hygiene was calculated by adding up individual oral hygiene score divided by the number of study participants.

Inferential statistics of simple and multiple regressions was used to test the correlation between the independent

variables (knowledge, attitude, behavior, oral hygiene) and the dependent variable (dental caries). The relationship was considered significant if the *P* value was less than the alpha level of 0.05 or the F-calculated value was equal to or greater than the F-critical value and nonsignificant if the *P* value was equal to or greater than the alpha level of 0.05 or the F-calculated value was less than the F-critical value. The nature of relationship between independent and dependent variables was determined by the regression coefficient and the interpretation done according to Nwana.<sup>[15]</sup> According to Nwana, 00–0.19 implies "no relationship or very low relationship," 0.20–0.39 "low relationship," 0.40–0.69 "moderate relationship," 0.70–0.89 "high relationship," and 0.90–1.00 "very high relationship."

## RESULTS

There were more male pensioners than female pensioners; 295 (54.3%) were males and 248 (45.7%) were females. There were also more respondents in the 60–64 years age group, i.e., 234 (43.1%), the age group 65–69 years constituted 206 (37.9%) of the respondents, and 103 (19.0%) of the respondents were  $\geq$ 70 years. Regarding educational status, 119 (21.9%), 198 (36.5%), and 226 (41.6%) had primary, secondary, and tertiary education, respectively. A total of 277 (51%) of the pensioners retired on level 1–6, while 266 (49%) of the pensioners retired on level 7–17 [Table 1].

Table 2 shows the mean oral health knowledge, attitude, and behavior scores of the pensioners. The knowledge score of the participants was 12.23 (standard deviation [SD] =1.57), the behavior score was 8.76 (SD = 1.10), and the attitude score was 27.61 (SD = 1.31).

Table 3 shows that oral health knowledge accounted for 11.56% ( $R^2 = 0.1156$ ) of the variance in the pensioners'

 Table 1: Distribution of the respondents based on gender, age, educational status, and retirement grade level

Variables	Frequency (%)
Gender	
Female	248 (45.7)
Male	295 (54.3)
Total	543 (100)
Age (years)	
60-64	234 (43.1)
65-69	206 (37.9)
≥70	103 (19.0)
Total	543 (100)
Educational status	
Primary	119 (21.9)
Secondary	198 (36.5)
Tertiary	226 (41.6)
Total	543 (100)
Retirement grade level	
1-6	277 (51.0)
7-17	266 (49.0)
Total	543 (100)

dental caries status, oral health attitude accounted for 39.69% ( $R^2 = 0.3969$ ) of the variance in the pensioners' dental caries status, and oral health behavior accounted for 27.04% ( $R^2 = 0.2704$ ). According to Nwana's guideline,<sup>[15]</sup> the relationship between knowledge and dental caries was low and negative (R = -0.34). There was a moderate negative relationship between oral health attitude and dental caries status (R = -0.63), as well as a moderate negative relationship between behavior and dental caries status (R = -0.52). The P value of the relationship between knowledge and dental caries status (0.233) and between attitude and dental caries status (0.261) was greater than the 0.05 alpha level leading to the acceptance of the null hypothesis. Therefore, there was a low nonsignificant negative correlation between oral health knowledge and dental caries status and a moderate nonsignificant negative correlation between oral health attitude and dental caries status [Table 2]. The P value of the relationship between behavior and dental caries status (0.000) was less than the 0.05 alpha level leading to the rejection of the null hypothesis. Hence, there was a moderate significant negative correlation between dental caries status and oral health behavior of the pensioners [Table 2].

Table 2: The mean oral health knowledge, attitude, andbehavior scores of the respondents						
Variables	п	Mean	SD			
Oral health knowledge	543	12.23	1.57			
Oral health attitude	543	27.61	1.31			
Oral health behavior	543	8.76	1.10			
SD: Standard deviation						

The mean oral hygiene and DMFT scores for the sample was 2.55 (SD = 0.80) and 5.85 (SD = 1.03), respectively. Oral hygiene accounted for 33.64% ( $R^2 = 0.3364$ ) of the variances in the dental caries status of the pensioners. The regression coefficient (R) was 0.57 suggesting a moderate and positive relationship between oral hygiene and dental caries [Table 4]. Table 4 further shows that the calculated *F*-value (5.49) was greater than the critical *F*-value (3.84) at the degrees of freedom (1 and 541) and at 0.05 alpha level. The null hypothesis was therefore rejected indicating that there was a significant relationship between dental caries and oral hygiene status of the pensioners. Further analysis of the relationship in a regression model showed that the *P* value (0.000) was less than 0.05 alpha level; this further confirmed the significant relationship between oral hygiene and dental caries status.

## DISCUSSION

The present study showed that a significant relationship existed between dental caries and oral health behavior. The regression coefficient was -0.52 indicating a moderate and negative relationship between dental caries and oral health behavior. The relationship between dental caries and oral health knowledge was low, negative (R = -0.34) and nonsignificant, while the relationship between dental caries and oral health attitude was moderate, negative (R = -0.63) and nonsignificant. These findings suggested an inverse relationship between these variables, indicating that as the oral health knowledge, attitude, and behavior of the pensioners increased, the occurrence of dental caries reduced and same is true conversely. Furthermore, this study also observed that oral health knowledge, attitude,

Table 3: Multiple regression of the contribution of oral health knowledge, attitude, and behavior to the occurrence of dental caries

Independent variables	Unstandardized coefficient		Standardized coefficient	R <sup>2</sup>	t-value	<i>P</i> -value	
	Beta (B)	SE	Beta (β)=R				
Constant	0.261	0.051			5.11	0.001	
Oral health knowledge	2.683	0.462	-0.34	0.1156	5.83	0.233	
Oral heath attitude	2.012	0.409	-0.63	0.3969	4.91	0.261	
Oral health behavior	1.741	0.345	-0.52	0.2704	5.05	0.000	
SE: Standard error							

Table 4: Simple regression analysis of the relationship between oral hygiene and dental caries occurrence among the pensioners

Sources	R	<b>R</b> <sup>2</sup>	Adjusted R <sup>2</sup>	Sum of square	df	Mean square	F-calculated	<b>F-critical</b>
Oral hygiene (regression)	0.58	0.3364	0.3357	0.2196	1	0.2196	5.49	3.84
Residual				21.64	541	0.04		
Total				21.86	542			
Model		Unst	andardized coeffic	ients	Standardized coefficients		<i>t</i> -value	<i>P</i> -value
		Beta <i>(B)</i>		SE		Beta (β)		
Constant		0.196		0.044			4.435	0.000
Oral hygiene		1.138		0.252		0.57	4.520	0.000
010 01 1 1								

SE: Standard error

and behavior could predict dental caries among the pensioners approximately by 12%, 40%, and 27%, respectively.

This research confirms the report of other studies. Ogundele and Ogunsile observed negative nonsignificant correlation of oral health knowledge, attitude, and behavior with the occurrence of dental caries and concluded in the study that good health knowledge when allowed to influence our attitude and practice was capable of reducing disease occurrence.<sup>[9]</sup> Broadbent et al. observed that individuals with good knowledge of oral health practices have lower prevalence of dental caries.<sup>[8]</sup> Petersen et al. observed similar findings among secondary school students in Southern Thailand.<sup>[6]</sup> The study reported that positive attitude toward oral health was highly correlated to low risk of oral health problems. Sheiham and Watt reported that healthy oral health behaviors are imperative among all individuals to decrease their risk of the development of dental diseases.<sup>[5]</sup> Petersen et al. reported that dental caries has decreased over time due to improvements in individual's oral health behavior.<sup>[16]</sup>

The oral hygiene level of the pensioners was significantly related to their dental caries status. Oral hygiene accounted for 33.6% of the variance in the dental caries status of the pensioners, indicating that oral hygiene could predict the occurrence of dental caries in the pensioners by approximately 34%. Regression coefficient (*R*) of 0.58 was found between oral hygiene level and mean DMFT score, indicating moderate and positive relationship between the variables. The implication of this is that as the mean oral hygiene score increases (poor oral hygiene), the probability of developing dental caries also increases. Conversely, as the mean oral hygiene score decreases (good oral hygiene), the probability of developing dental caries decreases.

These results are in conformity with other studies. Number of researches has documented that dental caries could be completely eliminated through improved oral hygiene and that poor oral hygiene leads to increased incidence of dental caries.<sup>[1,17]</sup> Gaĩao *et al.* also report low DMFT in old people with good oral hygiene.<sup>[18]</sup> However, ur Rehman *et al.* reported different findings. In their study, no relationship was reported between oral hygiene and dental caries.<sup>[19]</sup>

## CONCLUSION

This study found a low and negative nonsignificant correlation between dental caries and oral health knowledge, a moderate and negative nonsignificant correlation between dental caries and oral health attitude, and a moderate and negative significant correlation between oral health behavior and dental caries. Similarly, oral hygiene level of the pensioners was moderately and significantly correlated to dental caries. This study recommends the need to educate the pensioners on appropriate oral self-care including regular brushing of the teeth at least twice a day, brushing the teeth with fluoride-containing toothpaste, and regular visits to the dentist.

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## **Conflicts of interest**

There are no conflicts of interest.

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