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Knowledge and perceptions of Lagos state healthcare workers regarding the causes and implications of gingival bleeding (GB)

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Abstract

Background: Healthcare workers other than oral healthcare workers are likely to be patients' first contact. This study examines the knowledge, perceptions, and practices of GB among these healthcare workers, as it significantly impacts the information passed on to patients.

Methods: This cross-sectional study included freely consented six-hundred-and-forty-eight 18-year-old or older healthcare professionals from secondary (274) and tertiary (374) healthcare facilities with no formal dental education. Sociodemographic information and responses to questions about GB awareness, knowledge, and practice were obtained using a self-administered questionnaire. Each correct and incorrect response was scored 1 and 0 respectively; obtainable score ranged from 0-12. The data was analyzed using SPSS version 25. Statistical significance was at p-value < 0.05.

Results: Mean knowledge score was 6.77 ± 2.92, with 15.4%, 79.8%, and 4.8% of participants having low, medium, and high GB knowledge status respectively. Among the 54.6% of participants who experienced GB, 42.1% did nothing and only 12.7% sought professional help, despite 77.9% knowing that GB was abnormal. Educational status (CI: 2.054-8.223; $p < 0.001$), profession (CI: 0.75-2.19, $p < 0.001$), and health facility (CI: 0.36-1.22; $p < 0.001$) were major predictors of GB knowledge level.

Conclusion: Significant knowledge gaps and misconceptions regarding GB exist among healthcare workers. While encouraging awareness levels were observed among tertiary-educated participants and medical doctors, substantial disparities existed across other professional and educational groups. Targeted education and health promotion interventions are essential for enhancing healthcare workers' role in promoting oral health, preventing periodontal disease, and dealing with its systemic consequences.

Keywords: Gingival Bleeding; Gingivitis; Healthcare Workers; Gingival Bleeding Knowledge

1. Introduction

Gingival bleeding (GB) is a reversible and mildest form of periodontal pathology that indicates the presence of inflammation and periodontal disease. Periodontal disease is highly preventable and completely reversible in the early stage when the inflammation is limited to the gingiva (gingivitis). Other healthcare workers apart from oral healthcare workers are likely to be the first contact due to poor awareness about oral health in general and periodontal health in

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particular. Also, access to oral healthcare facilities is low in our environment due to high costs and general poverty. The perception and practices of this group about GB will largely influence the information and advice they pass on to people who believe in them.

GB is a common oral health condition that is usually ignored by affected individuals. GB represents an early and objective sign that indicates the presence of periodontal disease. Periodontal disease is a chronic inflammatory, infective disease of the investing and tooth-supporting structures. It is considered a public health problem because of its high global prevalence (affecting more than 50% of the world's adult population) and significant social impact causing impairment of oral and general well-being of affected people [1]. The prevalence of periodontal disease has been reported to be between 70% to 100% in Nigeria.

GB is a reversible and mildest form of periodontal pathology referred to as gingivitis when it is limited to the gingiva. If this reversible state is left untreated it can proceed in some individuals to destruction of deeper periodontal tissues; the cementum, periodontal ligament, and alveolar bone. At this stage, it has become periodontitis which is irreversible and carries the potential to result in tooth loss causing disability-adjusted life due to defects in chewing and aesthetics. Severe periodontitis is adjudged to be the sixth most prevalent disease in the world [2,3]. Bleeding is one of the most reliable parameters in evaluating periodontal status, hence bleeding on probing (BoP) has been accepted as the gold standard for clinical assessment of gingival inflammation [4].

Periodontal health refers to a situation where the periodontium demonstrates an absence of attachment loss (AL) and presence of less than 10% of gingival sites with bleeding on probing (BoP) [5]. Bleeding on probing >10% is regarded as gingivitis and considered an unstable state in the periodontal risk assessment of patients undergoing periodontal supportive therapy [6]. Self-reported gingival bleeding (SRGB) which may be during brushing or spontaneous gives significant insight into periodontal conditions and treatment needs in a population.

The prevalence of gingival bleeding among adolescents varies across the world and has been found to range from 37.4% to 99.0% in different populations [7-10]. 75% of 15–19-year-olds in Europe and 76% of dental attenders aged 18–92 – year-olds in a UK study had bleeding on probing [11,12]. The average prevalence of GB in the Africa region was put at 43% by WHO. In Nigeria, the prevalence of this condition in adolescents on clinical examination was reported to be above 50% and a little below 50% on self-report [13,14]. Osuh et al [15] reported a prevalence of GB of 75% and 53% in people living in the slum and non-slum areas of Ibadan, Nigeria respectively. Many failed to give attention to or report GB because it is perceived to be a feature of tooth cleaning thereby making early diagnosis and treatment of periodontal disease elusive.

It commonly developed as a result of the insult posed by the accumulation of dental plaque on the teeth and other hard objects in close proximity to the gingiva. If this inflammation is allowed to continue untreated it can extend beyond the gingiva progressing to periodontitis; a more severe condition that is irreversible. With the destruction of the underlying periodontal tissues, the affected teeth become loose and eventually lost. One of the leading causes of tooth loss in adults is periodontal disease. The pathogenic bacteria in plaque and their metabolic products after entering the bloodstream have been found to extend beyond the oral cavity where they may promote immune response [16,17]. This is supported by the presence of keystone pathogens of periodontal disease (Porphyromonas gingivalis, Tannerella forsythia, Treponema denticola, and Aggregatibacter actinomycetemcomitans) in the blood, coronary atheromatous plaque, placenta, and brains of Alzheimer's disease patients [18-21]. Hence, the association of many systemic diseases like cardiovascular disease, diabetes, adverse pregnancy outcomes, Alzheimer's disease, oral and colorectal cancers, respiratory tract infection, bacterial pneumonia, and rheumatoid arthritis with severe periodontal disease [18,22-24].

In a country like ours where there is poor awareness about oral health in general and periodontal health in particular other healthcare workers apart from oral healthcare workers are likely to be the first contact of the people. Also, access to oral healthcare facilities is low in our environment due to high costs and general poverty. To improve awareness of the importance of gingival health, it is necessary to know what information they are being given by other healthcare workers and what they believe. More so, the perception and practices of this group about GB will largely influence the information and advice they pass on to people who believe in them.

The cost of periodontal diseases to individuals and society is grave and the knowledge of their aetiology and the right attitude to GB by healthcare workers is crucial to passing the right information that will enable patients to make improvements to their oral hygiene and make changes that will result in long-term periodontal health. This will promote prevention, early detection, and treatment of periodontal disease. Also, the evaluation of awareness, knowledge, attitude, and practices of general healthcare workers to GB is scarce.

Hence, this study aimed to describe the perceptions, attitudes, and practices among healthcare workers of GB with the intention of identifying the gap which will enable healthcare bodies to plan educative programs to improve the knowledge and perception of healthcare workers about GB thereby impacting the information that is passed to patients. This will in turn enhance prevention and promote early diagnosis and treatment of periodontal disease.

2. Methodology

2.1. Setting

The study took place in two Lagos state-owned Hospitals; Ikorodu General Hospital (secondary healthcare facility) which was randomly selected, and Lagos State University Teaching Hospital (LASUTH); the only tertiary healthcare facility owned by the state government. Ikorodu General Hospital is one of the several secondary healthcare facilities. It is located in Ikorodu town within Ikorodu local Government area of the state. It serves people in the adjoining towns and has a staff strength of about 700. LASUTH is the only state-owned teaching hospital which evolved from an existing general hospital in July 2001 and is situated in Ikeja Local Government, one of the most populous local governments in the state. It has a staff strength of about 3,000 and serves as a referral centre for primary and secondary healthcare facilities in the state and its environs.

2.2. Participants

Participants were consented individuals who had been members of staff of Ikorodu General Hospital and LASUTH for at least 6 months.

2.3. Sampling and study design

The study was a cross-sectional questionnaire-based study. Staff members who consented were recruited into the study.

2.3.1. Sample Size

The required sample size "*n*" was calculated based on the formula:

$$N = \frac{Z^2P(1-P)}{D^2}$$

Where *n* = sample size, Z = Z statistic for a level of confidence, *P* = expected prevalence or

proportion and *d* = level of precision.

The actual sample size "n_a" was then calculated using the formula:

$$na = \frac{n}{1 + [\frac{(n-1)}{N}]}$$

Where n_a = the actual sample size, *n* = the required sample size and *N* = population size

For this study, prevalence (*P*) was assumed to be 31.6%; the prevalence of awareness of gingival bleeding being a sign of periodontal disease [25]. The total number of staff which represents the population size (*N*) are 700 and 3,000 for the secondary (N_1) and tertiary (N_2) healthcare facilities respectively.

Step 1

$$Z = 1.96, \quad P = 31.6\%, \qquad d = 0.05$$

$$n = \frac{1.962 \times 0.316(1-0.316)}{0.052} = \frac{3.84 \times 0.316(0.684)}{0.0025} = 331.99 \text{ appox. } 332$$

Step 2

$$n = 332,\ \ N_1 = 700,\ N_2 = 3{,}000$$

$$na^1 = \frac{332}{1 + [\frac{332 - 1}{700}]} = \frac{332}{1 + [\frac{331}{700}]} = \frac{332}{1.47} = 225.9 \text{ approx. } 226$$

$$na^2 = \frac{332}{1 + [\frac{332 - 1}{3000}]} = \frac{332}{1 + [\frac{331}{3000}]} = \frac{332}{1.11} = 299.1 \text{ approx. } 299$$

Thus, putting the nonresponse rate at 10%, the minimum sample size for this study was two-hundred and forty-nine (249) and three-hundred and twenty-nine (329) for secondary and tertiary healthcare facilities respectively. The figures were rounded up to 274 and 374 for secondary and tertiary facilities respectively.

- Inclusion criteria: Consented staff of the healthcare facility who have worked in the facility for a minimum of 6months and are 18 years old and above.
- Exclusion criteria: Those staff members who have had formal dental education.
- Measures
  - Sociodemographic data was recorded on a structured self-administered questionnaire.
  - Questions on awareness, knowledge, and practice concerning gingival bleeding were also recorded.
- Procedures:
  - The aim and objectives of the study were explained to every individual after which written consent to participate in the study was obtained. Those who refused to give their consent were not coerced to take part in the study.
  - All consented individuals completed a structured self-administered questionnaire which contained questions on sociodemographic information, awareness and knowledge about gingival bleeding, as well as attitude towards its occurrence. Oral hygiene practices were also recorded. Each correct response to the questions assessing the awareness and knowledge about gingival bleeding was given a score of 1 for correct response and a score of 0 for incorrect response. The minimum score attainable was 0 while the maximum was 12. The participants were grouped into low, medium, and high GB knowledge categories based on the formula given by Hamilton and Coulby; and used by previous researchers [26]. Low: Scores below Mean−1SD (< 4); Medium: Scores between Mean−1SD and Mean+1SD (4 – 10); High: Scores above Mean+1SD (>10).

2.4. Statistical analysis

Data was analyzed using SPSS software version 25. Mean and standard deviation were calculated for quantitative variables. The Chi-square and Fisher's exact tests were used for hypothesis testing and bivariate association of age, sex, level of education, and knowledge about gingival bleeding. Multivariate binary logistic analysis was carried out to control for confounders. A p-value of < 0.05 was considered statistically significant.

3. Results

Table 1 describes the demographic and professional distribution of the 648 participants in the study. The participants' ages ranged from 18 to 74 years, with a mean of 38.37 ± 12.37 years. Most participants were aged 30–39 years (28.1%), followed by 40–49 years (27.2%), whereas participants aged ≥60 years accounted for the smallest proportion (2.9%). Females were more represented (63.6%) compared with males (36.4%). The ethnic distribution showed that the majority of participants were Yoruba (79.9%), followed by Igbo (12.8%), with Hausa comprising only 3.4%. Regarding educational status, 84.7% of the participants had tertiary education, 13.0% had secondary education, and only 0.6% reported no formal education. Professionally, nurses formed the largest group (22.1%), followed by medical doctors (21.8%), whereas laboratory scientists and physiotherapists accounted for 2.6% and 3.5%, respectively. The participants were almost evenly distributed, though the teaching hospital had more respondents (57.7%) than the general hospital (42.3%).

Table 1 Demographic and Professional Characteristics of Study Participants

Variable		**Frequency (%)**
Age range	18yrs – 74yrs	
Mean	38.37 ± 38.37	
Age Group	18yrs-29yrs	166 (25.6)
	30yrs-39yrs	182 (28.1)
	40yrs-49yrs	176 (27.2)
	50yrs-59yrs	105 (16.2)
	≥ 60yrs	19 (2.9)
Gender	Male	236 (36.4)
	Female	412 (63.6)
Ethnicity	Igbo	83 (12.8)
	Hausa	22 (3.4)
	Yoruba	518 (79.9)
	Others	25 (3.9)
Educational Status	No formal education	4 (0.6)
	Primary	11 (1.7)
	Secondary	84 (13.0)
	Tertiary/Post secondary	549 (84.7)
Profession	Medical doctor	141 (21.8)
	Pharmacist	43 (6.6)
	Nursing	143 (22.1)
	Lab Scientist	17 (2.6)
	Physiotherapist	23 (3.5)
	Administration & Account	75 (11.6)
	Others (Dieticians, Pharmacy Technicians, Radiographers, Medical record, ICT, Engineering, Community extension workers, Health assistants, Laundry, Domestic & social workers, Catering, Store officers, etc)	206 (31.8)
Health Facility	Teaching Hospital	374 (57.7)
	General Hospital	274 (42.3)

The frequency and context of gingival bleeding among 648 participants is shown in table 2. Most patients (54.6%) reported gum bleeding, predominantly during brushing (87.3%). Other triggers included eating (7.1%), trauma (4.0%), and waking (1.1%). In response to gum bleeding, 42.1% of the participants did nothing, 19.8% changed their toothbrush, and 15.0% used mouthwash. A smaller percentage consulted a dentist (12.7%), consumed vitamins (9.0%), or brushed their teeth more vigorously (7.3%).

Table 2 Gingival Bleeding Experience Among Study Participants

Variable		**Frequency (%)**
Experienced gum bleeding before?	No	294 (45.4)
	Yes	354 (54.6)
When do you experience gum bleeding?	Unprovoked	15 (4.2)
	While brushing	309 (87.3)
	While eating	25 (7.1)
	On waking	4 (1.1)
	Others (trauma etc.)	14 (4.0)
What did you do when you experienced gum bleeding?	Nothing	149 (42.1)
	Changed toothbrush	70 (19.8)
	Used mouthwash	53 (15.0)
	Saw a dentist	45 (12.7)
	Took more vitamins	32 (9.0)
	Brushed the teeth more	26 (7.3)
	Others	9 (2.5)

Table 3 summarizes participants' understanding of gingival bleeding. When asked about the best course of action for gum bleeding, 81.8% believed in seeing a dentist immediately, 4.0% suggested using a mouthwash, and 6.6% did not know what to do. Only 2.2% recommended brushing more, indicating general awareness of appropriate dental interventions. Regarding the perception of bleeding gums, 77.9% correctly believed that it was abnormal, 10.3% thought it was normal, and 11.7% were unsure. The commonly identified causes of gingival bleeding included poor oral hygiene (76.9%), hard toothbrush use (84.9%), gum infection (80.6%), and tooth decay (68.4%). Notably, misconceptions, such as worms (37.2%) and systemic diseases (42.9%), were also reported. The mean GB knowledge score was 6.77 ± 2.92, with 15.4% of participants categorized as having low knowledge, 79.8% as medium knowledge, and 4.8% as high knowledge.

Table 3 Participants' Knowledge and Opinions on Gingival Bleeding

	Participants' responses		
			Freq (%)
What is the best that should be done when you experience gum bleeding?	Nothing		6 (0.9)
	Brush your teeth more		14 (2.2)
	Use mouthwash		26 (4.0)
	See a dentist immediately		530 (81.8)
	Take more vitamins		21 (3.2)
	Others		8 (1.2)
	I don't know		43 (6.6)
	Correct Freq (%)	**Incorrect Freq (%)**	**I don't know Freq (%)**
Do you think bleeding gum is normal?	505 (77.9)	67 (10.3)	76 (11.7)

Causes of gingival Bleeding			
Aging	222 (34.3)	205 (31.6)	221 (34.1)
Gum infection	522 (80.6)	29 (4.5)	97 (15.0)
Gum swelling	443 (68.4)	52 (8.0)	153 (23.6)
Tooth decay	89 (13.7)	405 (62.5)	154 (23.8)
Poor oral hygiene	498 (76.9)	40 (6.2)	110 (17.0)
Hard toothbrush	550 (84.9)	25 (3.9)	73 (11.3)
Wrong brushing technique	445 (68.7)	68 (10.5)	135 (20.8)
Lack of vitamins	443 (68.4)	58 (9.0)	147 (22.7)
Use of toothpicks	475 (73.3)	58 (9.0)	115 (17.7)
Worms	241 (37.2)	163 (25.2)	244 (37.7)
Diseases in other parts of the body	278 (42.9)	170 (26.2)	200 (30.9)
Smoking	182 (28.1)	235 (36.3)	231 (35.6)
Mean GB knowledge score	6.77 ± 2.924		
GB knowledge status	Low: GB knowledge score < 4		100 (15.4)
	Medium: GB knowledge score 4 - 10		517 (79.8)
	High: GB knowledge score > 10		31 (4.8)

The relationship between participants' belief in the normalcy of gum bleeding and variables such as age, sex, and ethnicity are presented on table 4. Among participants aged ≥60 years, 89.4% correctly believed that gum bleeding was abnormal compared to 75.3% in the 18–29 age group. This difference was statistically significant ($P = 0.010$). Regarding sex, 78.9% of females and 76.3% of males correctly identified gum bleeding as abnormal (p = 0.491). Ethnicity was significantly associated (p = 0.008) with Yoruba participants showing the highest percentage of correct responses (80.0%) compared to Hausa participants (59.1%). Educational status and profession also demonstrated trends, although not all of them were statistically significant.

Table 4 Association Between Belief About Normalcy of Gingival Bleeding and Demographic Variables

Variable		**Participants' Response**			**Total**	**p-value**
		Yes (Incorrect) Freq (%)	**No (Correct) Freq (%)**	**I don't know Freq (%)**		
Age group	18yrs-29yrs	20 (12.0)	125 (75.3)	21(12.7)	166	0.010*
	30yrs-39yrs	21 (11.5)	129 (70.9)	32 (17.6)	182	
	40yrs-49yrs	19 (10.8)	143 (81.3)	14 (7.9)	176	
	50yrs-59yrs	6 (5.7)	91 (86.7)	8 (7.6)	105	
	≥ 60yrs	1 (5.3)	17 (89.4)	1 (5.3)	19	
Gender	Male	27 (11.4)	180 (76.3)	29 (12.3)	236	0.491
	Female	40 (9.7)	325 (78.9)	47 (11.4)	412	
Ethnicity	Igbo	7 (8.4)	64 (77.1)	12 (14.5)	83	0.008*
	Hausa	1 (4.5)	13 (59.1)	8 (36.4)	22	
	Yoruba	58 (11.2)	409 (80.0)	51(9.8)	518	

	Others	1 (4.0)	19 (76.0)	5 (20.0)	25	
Educational Status	No formal education	1 (25.0)	2 (50.0)	1 (25.0)	4	0.393
	Primary	0	9 (81.8)	2 (18.2)	11	
	Secondary	8 (9.5)	62 (73.8)	14 (16.7)	84	
	Tertiary/ Postsecondary	58 (10.6)	432 (78.7)	59 (10.7)	549	
Profession	Medical doctor	3 (2.1)	131 (92.9)	7 (5.0)	141	0.001*
	Pharmacist	6 (14.0)	32 (74.4)	5 (11.6)	43	
	Nursing	15 (10.5)	112 (78.3)	16 (11.2)	143	
	Lab Scientist	1 (5.9)	14 (82.4)	2 (11.7)	17	
	Physiotherapist	2 (8.7)	17 (73.9)	4 (17.4)	23	
	Admin & Account	6 (8.0)	57 (76.0)	12 (16.0)	75	
	Others	34 (16.5)	142 (68.9)	30 (14.6)	206	
Health Facility	Teaching Hospital	34 (9.1)	279 (74.6)	61 (16.3)	374	0.000*
	General Hospital	33 (12.0)	226 (82.5)	15 (5.5)	274	

*Significant p-value < 0.05

Table 5 explores the relationship between the participants' knowledge of causes of gingival bleeding and demographic or professional variables. Significant associations were observed between perceptions of the role of aging as a cause, and the educational level of the respondents, which was significant (p = 0.005), with tertiary-educated participants (65.6%) demonstrating better knowledge than those with lower educational levels. Knowledge of the role of gum swelling was significantly associated with educational status (p = 0.037) and ethnicity (p = 0.029), with tertiary-educated (70.3%) and Yoruba (69.1 %) participants showing higher awareness. Knowledge of the role of tooth decay showed significant differences across educational levels (p = 0.002) and professions (p = 0.031). Medical doctors (75.2%) and tertiary-educated participants (65.6%) were most knowledgeable. Similarly, for the role of poor oral hygiene, significant associations were observed for educational status (p = 0.006) and ethnicity (p = 0.018), with tertiary-educated (78.9%) and Yoruba (78.6 %) participants showing the highest awareness. Awareness of the role of hard-toothbrush use was significantly associated with profession (p = 0.000) and educational status (p = 0.028). Medical doctors (97.2%) and nurses (83.2%) had the highest level of knowledge. The brushing technique also showed significant differences according to educational status (p = 0.001) and profession (p = 0.000), with tertiary-educated participants (71.6%) and medical doctors (92.9%) leading the awareness. Regarding the role of lack of vitamins, knowledge differed significantly by educational status (p = 0.023) and profession (p = 0.000), with medical doctors (90.8%) and tertiary-educated participants (70.1%) being the most knowledgeable. Worse awareness was associated with age group (p = 0.022) and educational status (p = 0.005), with participants aged ≥60 years (52.6%) and tertiary-educated individuals (36.8%) performing better. Knowledge of the role of systemic diseases and smoking was significantly associated with sex (p = 0.001), educational status (p = 0.000), and profession (p = 0.000). Female participants (38.1%) were less knowledgeable about systemic diseases than male participants (51.3%), whereas medical doctors and teaching hospital participants consistently demonstrated higher awareness across all significant causes.

Table 5 Association Between Knowledge of Gingival Bleeding Causes and Participant Characteristics

Causes of GB	**Variables**	**X^2**	**p-value**
Aging	Age group	15.087	0.057
	Gender	3.363	0.187
	Ethnicity	5.577	0.477
	Educational status	17.298	0.005*
	Profession	62.185	0.000*

	Health Facility	2.881	0.094
Gum infection	Age group	5.538	0.236
	Gender	5.393	0.065
	Ethnicity	12.615	0.050
	Educational status	21.404	0.013*
	Profession	78.200	0.000*
	Health Facility	2.190	0.332
Gum swelling	Age group	6.423	0.602
	Gender	2.349	0.311
	Ethnicity	14.208	0.029*
	Educational status	8.325	0.037*
	Profession	36.819	0.000*
	Health Facility	14.659	0.001*
Tooth decay	Age group	6.232	0.180
	Gender	3.856	0.147
	Ethnicity	5.554	0.130
	Educational status	21.988	0.002*
	Profession	13.941	0.031*
	Health Facility	4.952	0.028*
Poor OH	Age group	3.768	0.442
	Gender	3.586	0.169
	Ethnicity	9.967	0.018*
	Educational status	13.164	0.006*
	Profession	38.708	0.000*
	Health Facility	6.549	0.011*
Hard toothbrush	Age group	6.333	0.173
	Gender	0.225	0.903
	Ethnicity	4.965	0.532
	Educational status	16.981	0.028*
	Profession	39.718	0.000*
	Health Facility	6.585	0.011*
Wrong brushing technique	Age group	7.590	0.107
	Gender	3.056	0.094
	Ethnicity	9.395	0.149
	Educational status	15.358	0.001*
	Profession	75.545	0.000*
	Health Facility	16.343	0.000*
Lack of Vitamins	Age group	5.466	0.243

	Gender	2.876	0.096
	Ethnicity	2.222	0.902
	Educational status	15.265	0.023*
	Profession	91.782	0.000*
	Health Facility	10.911	0.001*
Use of Toothpick	Age group	5.421	0.247
	Gender	0.904	0.625
	Ethnicity	4.488	0.614
	Educational status	5.947	0.104
	Profession	31.475	0.000*
	Health Facility	1.516	0.243
Worm	Age group	17.843	0.022*
	Gender	2.101	0.346
	Ethnicity	4.236	0.236
	Educational status	17.900	0.005*
	Profession	29.155	0.004*
	Health Facility	7.320	0.025*
Disease in other parts of the body/Systemic disease	Age group	7.533	0.110
	Gender	10.615	0.001*
	Ethnicity	6.398	0.383
	Educational status	7.277	0.294
	Profession	109.691	0.000*
	Health Facility	17.505	0.000*
Smoking	Age group	3.688	0.452
	Gender	5.179	0.076
	Ethnicity	0.846	0.991
	Educational status	31.397	0.000*
	Profession	31.734	0.000*
	Health Facility	2.713	0.257

*Significant p-value < 0.05

Table 6 examines the distribution of low, medium, and high knowledge scores for gingival bleeding across the participant subgroups. Participants aged ≥60 years had the lowest proportion of low scores (5.3%) and the highest proportion of high scores (10.4%), whereas those aged 50–59 years had the highest medium scores (84.8%) ($p = 0.041$). Gender did not significantly affect knowledge levels ($p = 0.141$), although females had slightly higher scores (79.9%) than males (79.7%). Educational status showed a strong association ($p = 0.000$) with tertiary-educated participants having the lowest proportion of low scores (14.4%). Among the professions, medical doctors demonstrated the highest knowledge levels, with only 0.7% scoring low and 94.3% scoring medium.

Table 6 Association Between Knowledge Levels of Gingival Bleeding and Demographic Variables

Variable	GB knowledge status			Total	p-value
	Low Freq (%)	Medium Freq (%)	High Freq (%)		
Age group					
18yrs-29yrs	21 (12.7)	130 (78.3)	15 (9.0)	166	0.041*
30yrs-39yrs	32 (17.6)	142 (78.0)	8 (4.4)	182	
40yrs-49yrs	32 (18.2)	140 (79.5)	4 (2.3)	176	
50yrs-59yrs	14 (13.3)	89 (84.8)	2 (1.9)	105	
≥ 60yrs	1 (5.3)	16 (84.2)	2 (10.4)	19	
Gender					
Male	32 (13.6)	188 (79.7)	16 (6.7)	236	0.141
Female	68 (16.5)	329 (79.9)	15 (3.6)	412	
Ethnicity					
Igbo	14 (16.9)	61 (73.5)	8 (9.6)	83	0.185
Hausa	5 (22.7)	15 (68.2)	2 (9.1)	22	
Yoruba	77 (14.9)	420 (81.1)	21(4.0)	518	
Others	4 (16.0)	21 (84.0)	0	25	
Educational Status					
No formal education	0	4 (100)	0	4	0.000*
Primary	1 (9.1)	6 (54.5)	4 (36.4)	11	
Secondary	20 (23.8)	52 (61.9)	12 (14.3)	84	
Tertiary/Post secondary	79 (14.4)	455 (82.9)	15 (2.7)	549	
Profession					
Medical doctor	1 (0.7)	133 (94.3)	7 (5.0)	141	0.000*
Pharmacist	8 (18.6)	34 (79.1)	1 (2.3)	43	
Nursing	20 (14.0)	121(84.6)	2 (1.4)	143	
Lab Scientist	2 (11.8)	13 (76.4)	2 (11.8)	17	
Physiotherapist	2 (8.7)	21(91.3)	0	23	
Administration & Account	22 (29.3)	51(68.0)	2 (2.7)	75	
Others	45(21.8)	144 (69.9)	17 (8.3)	206	
Health Facility					
Teaching Hospital	43 (11.5)	303 (81.0)	28 (7.5)	374	0.000*
General Hospital	57 (20.8)	214 (78.1)	3 (1.1)	274	

*Significant p-value < 0.05

Regression analysis highlighted key predictors of GB knowledge status (low versus medium/high) among participants. Educational status emerged as a significant predictor, with tertiary education showing a strong positive association with higher GB knowledge levels (CI: 2.054-8.223; $p < 0.001$). Similarly, profession was significantly associated with GB knowledge levels, with medical doctors demonstrating the highest odds of medium or high knowledge (CI: 0.75-2.19, p

< 0.001). Participants from teaching hospital also had significantly better knowledge than those from general hospital (CI: 0.36-1.22; p < 0.001). However, age, gender, and ethnicity were not significant predictors, as evidenced by their respective p-values. Thus, higher educational attainment, being a medical doctor, and working in a teaching hospital were the most significant predictors of higher gingival bleeding knowledge (Table 7).

Table 7 Key Predictors of Gingival Bleeding Knowledge Status

Variables		**Estimate**	**Std. Error**	**Wald**	**df**	**Significance**	**95% Confidence Interval**	
							Lower Bound	**Upper Bound**
Age	18yrs-29yrs	0.483	0.692	0.488	1	0.485	-0.873	1.840
	30yrs-39yrs	0.014	0.687	0.000	1	0.983	-1.333	1.361
	40yrs-49yrs	-0.185	0.682	0.073	1	0.787	-1.522	1.152
	50yrs-59yrs	-0.054	0.696	0.006	1	0.939	-1.417	1.310
	≥ 60yrs	0.936	1.378	0.538	1	0.933	-1.235	2.638
Sex	Male	0.080	0.223	0.129	1	0.719	-0.357	0.517
	Female	0.073	0.214	0.102	1	0.811	-0.231	0.442
Ethnicity	Igbo	0.421	0.579	0.529	1	0.467	-0.714	1.556
	Hausa	-0.019	0.733	0.001	1	0.979	-1.455	1.417
	Yoruba	0.447	0.515	0.755	1	0.385	-0.562	1.456
	Others	0.329	0.465	0.645	1	0.415	.-0.125	1.398
Education	No formal education	1.242	1.496	0.690	1	0.406	-1.690	4.174
	Primary	2.955	0.736	16.119	1	0.061	1.512	4.397
	Secondary	0.542	0.350	2.396	1	0.122	-0.144	1.228
	Tertiary/Post secondary	4.672	1.986	22.145	1	0.000*	2.054	8.223
Profession	Medical doctor	1.466	0.368	15.897	1	0.000*	0.745	2.187
	Pharmacist	-0.081	0.441	0.033	1	0.855	-0.945	0.784
	Nursing	0.263	0.318	0.686	1	0.408	-0.360	0.886
	Lab Scientist	1.147	0.708	2.623	1	0.105	-0.241	2.536
	Physiotherapist	0.429	0.616	0.485	1	0.486	-0.778	1.637
	Administration & Account	-0.478	0.333	2.063	1	0.151	-1.130	0.174
	Others	0.214	0.314	0.013	1	0.734	-0.823	0.652
Health Facility	Teaching Hospital	0.791	0.220	12.889	1	0.000*	0.359	1.222
	General Hospital	0.621	0.119	4.586	1	0.086	0.121	0.856

*Significant p-value < 0.05

4. Discussion

The findings of this study provide important insights into healthcare workers' knowledge, perceptions, and practices regarding gingival bleeding (GB) and its broader implications for periodontal and systemic health. Gingival bleeding, the mildest and most reversible form of periodontal pathology, is a key indicator of early-stage periodontal disease.

However, the study's results revealed significant knowledge gaps among healthcare workers, highlighting the need for targeted education and systemic interventions. These findings are consistent with the existing literature, which has underscored the prevalence and underappreciation of periodontal diseases globally, particularly in low-resource settings, such as Nigeria [1,2].

The demographic distribution of the 648 participants revealed that most were female (63.6%) and tertiary-educated (84.7%). Professionally, nurses and doctors formed the largest groups, accounting for 22.1% and 21.8%, respectively. These characteristics are comparable to the findings of a study by Bhoopathi et al. [26], who observed a predominance of tertiary-educated healthcare workers among respondents in India. However, disparities in knowledge were noted among professional groups in this study, with other health workers demonstrating comparatively lower awareness than medical doctors, reflecting similar findings by Popoola et al. [13], who noted significant variations in oral health knowledge among different healthcare workers. The higher representation of teaching hospital participants (57.7%) suggests that a higher proportion of health workers work in tertiary institutions or a higher propensity among them to respond to research inquiries, owing to greater access to educational opportunities and resources in specialized healthcare settings.

Reassuringly, 81.8% of the participants in this study recommended consulting a dentist as the best action for managing GB, while 77.9% correctly recognized GB as an abnormal condition. However, a substantial proportion of participants held misconceptions, with 37.2% associating GB with worms, and 42.9% linking it to systemic diseases. This gap in understanding reflects the previous findings by Sorunke et al. [25], who observed widespread misconceptions regarding periodontal disease among the Nigerian population.

Educational status emerged as a significant determinant of knowledge, with tertiary-educated participants consistently outperforming those with lower educational levels across all the knowledge categories. For instance, 78.9% of tertiary-educated participants identified poor oral hygiene as a cause of GB compared to only 56.0% of secondary-educated participants. This association was also significant in the regression analysis. Similar trends were reported by Jurgensen and Petersen [7], who emphasized the role of education in improving awareness of oral health practices. This study also highlights the pivotal role of profession and institutional affiliation in shaping knowledge of GB. Medical doctors consistently demonstrated higher levels of awareness than other professional groups, with 97.2% identifying hard toothbrush use as a cause of GB and 75.2% recognizing the role of tooth decay. These findings are consistent with those of Bhoopathi et al. [26], who found that medical professionals exhibited greater awareness of oral health conditions than non-medical professionals. Institutional affiliation also significantly influenced knowledge levels, with participants from the teaching hospital exhibiting higher awareness than those from the general hospital. This also aligns with the findings of Chrysanthakopoulos [9], who reported better periodontal health knowledge among healthcare workers with access to specialized resources and training.

Despite the reported prevalence of GB (54.6%) among the participants, 42.1% of those affected did not respond to it appropriately, and only 12.7% sought professional care. This apathy may stem from misconceptions about the seriousness of periodontal diseases and systemic barriers such as limited access to affordable dental care. Similar patterns were reported by Osuh et al. [15], who identified cost and limited access as major barriers to oral healthcare in Nigeria's urban slum and non-slum populations.

The association between periodontal diseases and systemic conditions, such as cardiovascular disease, diabetes, and adverse pregnancy outcomes, has been extensively documented in the literature [18,19]. However, the limited awareness of these associations among the participants in this study underscores the need for comprehensive education to improve their capacity to identify and address GB as an early marker of both oral and systemic health issues.

The knowledge gaps identified in this study are consistent with the global trends. For example, Midwood et al. [12] found that only 50% of dental patients in the UK correctly identified bleeding gums as a sign of periodontal disease, reflecting the global underappreciation of the clinical significance of GB. Similarly, Tomazoni et al. [8] reported high levels of gingivitis (bleeding on probing) among schoolchildren in Brazil despite public health initiatives to improve oral health awareness. These findings highlight the need for context-specific strategies to address the knowledge gaps in different populations.

Regression analysis identified educational attainment, profession, and institutional affiliation as the key predictors of GB knowledge. Participants with tertiary education were significantly more likely to achieve higher knowledge scores ($p < 0.001$), which is consistent with the findings of Petersen and Ogawa [11], who emphasized the importance of education in oral health promotion. Similarly, medical doctors demonstrated the highest odds of achieving medium or high knowledge scores ($p < 0.001$), reflecting their exposure to broader health education. Participants from the teaching

hospital also exhibited better knowledge levels than those from the general hospital, underscoring the role of specialized training in fostering awareness. Overall, respondents with better training had significantly higher knowledge. These findings align with that of Popoola et al [13], who reported that access to institutional resources significantly enhanced oral health knowledge.

The findings of this study highlight the need for targeted interventions to address knowledge gaps among healthcare workers, particularly nurses and those with lower educational attainment. Integrating oral health education into the curricula of all healthcare professionals could enhance their capacity to promote the early detection and prevention of periodontal diseases. Regular workshops and seminars focusing on the systemic implications of periodontal disease, as highlighted by Lund Håheim et al. [24], could further reinforce the importance of oral health among healthcare workers. Additionally, public health campaigns tailored to address local misconceptions, such as the association of GB with worms, are essential for improving community awareness. Expanding access to affordable dental care through subsidized services and community-based initiatives could mitigate the systemic barriers that hinder timely treatment.

5. Conclusion

This study highlights significant knowledge gaps and misconceptions regarding gingival bleeding among healthcare workers in Nigeria. While encouraging levels of awareness were observed among tertiary-educated participants and medical doctors, substantial disparities existed across professional groups and educational levels. Addressing these gaps through targeted education and health promotion interventions is critical for enhancing the role of healthcare workers in promoting oral health, preventing periodontal disease, and addressing its systemic implications. Comparisons with global data and previous studies emphasize the universal challenge of improving oral health knowledge and the need for context-specific solutions tailored to local populations.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

This study was approved by the Health Research and Ethics Committee of Lagos State University Teaching Hospital (LASUTH. Permission was also obtained from the management of Ikorodu General Hospital.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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