Burden of tobacco, kola nut and alcohol consumption and its association with periodontal disease, potentially malignant lesions and quality of life among bus drivers, Lagos State, Nigeria

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ABSTRACT

INTRODUCTION To improve their performance and alertness, bus drivers are known to abuse alcohol, cigarette, kola nut and other substances that have substantial independent and combined deleterious effects on oral tissues. The study aimed to characterize risk associations between aggregates of alcohol/tobacco use and oral-health outcomes among a group of road transport workers in the Ojota and Berger bus terminals in Lagos State.

METHODS Data were obtained from a probability sample of 150 commercial drivers from two bus terminals (Ojota and Berger) in Lagos State via face-to-face interviews and oral examination using a validated structured questionnaire. Multistage cluster sampling was conducted through the selection of two clusters from the major registered motor parks at the first stage by simple random sampling; while the selection of drivers was done by simple random sampling (balloting), using the list of registered drivers in the two garages as the sampling frame. Past and present tobacco and alcohol use were self-reported by respondents. Multivariable regression analysis measured the relationship between the outcomes [potentially malignant lesions (Leukoplakia, Erythroplakia, Smokers palate, Lichen planus), periodontal disease (CPITN Scores 3,4) and oral-health-related quality of life, OHRQoL (OHIP-14)] and exposures, controlling for the covariates age, marital status, education status, income level, oral hygiene, dental caries, functional tooth units, and previous treatment.

RESULTS All the respondents were male. The prevalence of alcohol ever use was 82%, and 35% were moderate or heavy drinkers (2–4 drinks). Prevalence of tobacco ever use was 71%; while 32% were heavy smokers (>11 cigarettes/day), 64% had a history of kola nut chewing habit, and 53% ate at least 2 kola nuts daily. Heavy smokers had more potentially malignant lesions (OR=1.89, 95% CI: 1.33–3.27); significantly worse periodontal destruction (OR=3.12, 95% CI: 2.28–5.17); and significantly worse OHRQoL (OR=2.35, 95% CI: 1.42–4.54). For individual OHRQoL domains, Pain 3.03 (95% CI: 1.77–4.21], Discomfort 2.89 [95% CI: 2.32–4.17], Speech 3.02 (95% CI: 2.32–4.13), Diet 2.77 (95% CI: 1.87–4.28), Embarrassment 1.97 (95% CI: 1.65–3.14) and Self-consciousness 2.34 (95% CI: 1.93–3.48), were significantly associated with heavy smoking, after controlling for covariates.

CONCLUSIONS This study highlights the role of tobacco and alcohol as modifiable risk factors for periodontal disease and potentially malignant lesions that can impact negatively on OHRQoL. Bus drivers, in Lagos State, Nigeria, are an important target group in controlling tobacco and alcohol use in Nigeria and should receive adequate attention for oral health promotion and other preventive initiatives.

INTRODUCTION

Occupation has a direct bearing on health, wellbeing, and quality of life, while several psychosocial and physical risk exposures make workers in agricultural, construction, healthcare and transportation occupations especially prone to health disparities[1]. Personnel in the transportation sector often experience inadequate rest and have sleep deprivation due to long working hours, in addition to being deprived of home and other support systems[2]. Additionally, they are predisposed to risky behaviors and lifestyles such as alcohol consumption and casual sex[3], placing them at high risk for sexually transmitted infections (STIs), HIV, and hepatitis virus transmission[4]. These drivers often abuse psychoactive substances such as marijuana, cocaine, amphetamines, and cigarettes, to reduce sleepiness during trips, endure stress and to improve socialization, among other reasons[5,6]. A recent study obtained a prevalence as high as 82.9% for cigarette smoking among bus, minibus and taxi drivers[7].

Many of the substances abused by bus drivers have grave consequences on general and oral health. Marijuana abuse causes acidic erosion from cannabinoid hyperemesis, dental caries, gingival inflammation, leukoplakia, oral papilloma and tongue carcinoma[8]. Several epidemiological studies have also confirmed a strong association between tobacco use and periodontal disease[9]. Smokers typically have more severe periodontal destruction, attachment loss, and pocket formation, with an established dose-response relationship between the numbers of cigarettes smoked daily and the odds of periodontal disease[10]. Alcohol similarly increases the risk of developing periodontal disease[11], due to decreased resistance to infection by Gram-negative organisms during acute alcohol intoxication[12]. Research has shown a positive correlation between gamma glutamyl transpeptidase, a liver enzyme and an indicator of alcohol consumption and periodontal attachment loss[13].

Furthermore, a strong association between oropharyngeal cancer and tobacco use is widely documented. Epidemiological evidence shows that the odds ratio can be as high as 17 times higher for extremely heavy smokers who smoke 80 or more cigarettes per day[14]. Alcohol, in addition, acts additively and even synergistically with tobacco in the pathogenesis of cancers[15]. Most oral squamous cell carcinomas arise from premalignant precursor lesions[16] and alcohol has been found to increase the risk of oral premalignant lesion (OPL) in the presence of tobacco. After adjustment for tobacco use, some analytical studies observed an odds ratio of 2 to 3 for leukoplakia, oral submucous fibrosis, erythroplakia, and oral epithelial dysplasia[17,18].

The oral diseases caused by tobacco and alcohol use, such as oral cancer, periodontal disease, tooth loss, oral malodor, dental caries and teeth staining, have significant impacts on physical, psychological and social well-being, and oral-health-related quality of life (OHRQoL)[19,20]. Maida et al.[21] observed worse OHRQoL among current smokers while Åstrøm et al.[22] observed a correlation between the duration of smoking and OHRQoL. Since commercial bus drivers are known to indulge in these deleterious oral habits, the present study aimed to determine the association between tobacco, alcohol and kola nut consumption and the prevalence of periodontal disease and potentially malignant lesions, as well as association with quality of life in this high risk group in Lagos State, Nigeria.

METHODS

Study setting and population

This was a motor park based descriptive study conducted among bus drivers at the Ojota and Berger bus terminals in Lagos State, Nigeria. Lagos State has a population of over 17 million people in 20 local government areas (LGAs), 37 local council development areas consisting of approximately 2000 communities[23]. The participants were bus drivers who operate the public intra-city and inter-city transport services in the metropolis. A multistage cluster sampling method was used to recruit drivers among those registered with the National Union of Road Transport Workers (NURTW) and Road Transport Employers Association of Nigeria (RTEAN). The first stage involved selection of two clusters by simple random sampling from the list of the major registered motor parks that serve as a connecting nucleus to major cities in Lagos State and other Southwestern states in Nigeria with a sizeable number of drivers. The second stage involved the random selection of drivers and bus conductors that were on the list of registered transporters that were in the two bus stations, by simple random sampling (balloting), using the list of registered drivers in the two garages as the sampling frame. Bus drivers employed for at least 3 years prior to the study, were above 18 years old, and who gave informed consent, were enlisted. Those excluded from the study included those with diabetes mellitus or hypertensive patients on calcium channel blockers, which can worsen periodontal inflammation.

The primary outcome was periodontal disease, while 80% power and a confidence interval of 95% and an absolute precision of 0.05 were adopted. Since we were not comparing two groups, and our study design is descriptive and not experimental, we calculated the sample size from:

$$n = z^2 p(1-p)/d^2$$

where, n = required sample size, z = confidence level at 95% (standard value of 1.96), p = expected prevalence or proportion of chronic gingivitis in the project area, and d = precision or margin of error at 5% (standard value of 0.05). Using a prevalence of 8% for severe periodontal attachment loss among tobacco smokers from a reference study[24], a sample size of 150 was determined.

Ethical approval to conduct this study was obtained from the Health Research and Ethics Committee of the Lagos State University Teaching Hospital (LREC/06/10/1177). Verbal permission was obtained from the Road Transport Employers Association of Nigeria (RTEAN) and NURTW

executive at each park, while individual written consent was obtained from each participating driver.

The study was conducted from 14 January to 21 June 2019. Respondents were recruited between January and March while data analysis was done in April and May. We used an adapted validated interviewer-administered questionnaire to obtain the data. It was pretested for face and content validity by three experts in oral pathology, community dentistry, and periodontology, who gave their expert opinion with regard to its relevance and straightforwardness and tested the content validity. The English language questionnaire was translated into Yoruba language by two bilingual experts in English and Yoruba by a forward and backward translation method. Furthermore, a pilot test was performed on a random sample of 25 drivers from Yaba garage to test the reliability of the questionnaire. Amendments were made to the questionnaire without altering the meaning of relevant terms. Questionnaire reliability coefficient, obtained by calculating Cronbach's alpha, was found to be adequate (0.83).

The questionnaire included sections on sociodemographic characteristics, OHRQoL, health-related behavior such as cigarette smoking, alcohol consumption and kola nut chewing as well as a section on oral examination. Ever smokers were classified as those who had previously smoked cigarettes (smoked at least 100 cigarettes in their lifetime or at least 1 cigarette/day for one year), while never smokers were those who had never smoked a cigarette. Former smokers were classified as those who had smoked >100 cigarettes in their lifetime but had not smoked in the last one month. Cigarette smokers were categorized into light (1–5 cigarettes/day), moderate (6–10 cigarettes/day) or heavy smokers (≥11 cigarettes/day). OHRQoL was determined using the Oral Health Impact Profile (OHIP-14), a shortened version of OHIP-49 developed using a conceptual model of oral health by Locker[25]. The questionnaire has 14 items of impact (subdomains), which are conceptually grouped into seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. To calculate the OHIP-14 impact scores for individual subdomains, the mean of the subjects' scores was obtained to give a maximum score of 4. For individual subdomain scores, 0, 1 and 2 were classified as low impact while scores 3 and 4 were classified as high impact.

Moderate alcohol consumption was defined as taking up to 14 units of alcohol weekly while heavy drinking was defined as taking 2–4 drinks daily or more than 15 units weekly. A former alcohol drinker was classified as a previous drinker who has had no drinks in the past year. Occasional kola nut consumption was defined as taking 1–2 nuts weekly while daily kola nut consumption was defined as taking 1–2 nuts daily. A former kola nut consumer was classified a previous consumer who had not chewed a kola nut in the past year.

Oral examination was done using the criteria established by WHO[26]. Periodontal measurements were determined using the following continuous measures: clinical attachment loss (CAL), probing pocket depth (PPD), and gingival Index (GI). Leukoplakia was defined as a white patch or plaque that does not rub off and cannot be characterized clinically as any other disease, while Erythroplakia as a red patch that cannot be clinically diagnosed as any other condition. Erythroleukoplakia was characterized as an area of leukoplakia that has red patches, while lichen planus was identified as a dermatologic lesion with mucosal involvement with a reticular or erosive pattern. The principal investigator, who had been assessed by a consultant oral pathologist with an intra-examiner kappa score of 0.92 conducted all clinical examinations while a trained research assistant recorded the findings. Examinations were conducted using standard precautions with gloved hands, mouth mirrors and periodontal probes in a well-lit environment. Visual examination, digital palpation of the mucosa, and periodontal examination using Williams periodontal probes, were done and findings were appropriately recorded.

Data processing and analysis
The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0 (IBM, Armonk, NY). Categorical variables are given as frequencies and percentages, while continuous variables as mean ± standard deviation. For the OHIP-14, scores were converted from ordinal to scale values and divided into low, moderate and high impacts. The total impact score was also calculated by adding up the individual scores recorded for the 14 items. For the bivariate analyses, chi-squared tests were used to test for statistical significance. Additionally, Fisher's exact test was used to examine the association of the outcome variable with categorical independent variables when the sample size was relatively small. An ordinal logistic regression analysis was performed to determine odds ratios and confidence intervals. The main predictor variable was smoking status while the main outcome was periodontal disease. We controlled for other variables such as alcohol consumption, kola nut chewing and sociodemographic variables, and also measured other outcomes (potentially malignant lesions and OHRQoL). Two-tailed p-values <0.05 and 95% CI were considered to be statistically significant.

RESULTS
The sample of 150 male respondents comprised mainly those aged 30–49 years (73.7%) who had high school level education or less (70.9%). Prevalence for ever use of cigarettes, alcohol and kola nut was 71%, 82% and 64%, respectively. Bivariate analyses using chi-squared or Fisher's exact test revealed significant associations between income, educational attainment, smoking, alcohol consumption, kola nut consumption, and age group. Respondents aged 30–49 years were significantly more likely to be heavy smokers,

heavy alcohol drinkers, and daily kola nut consumers (p<0.005)(Table 1).

Table 2 gives a summary of the periodontal parameters of the respondents based on their pattern of tobacco smoking. The prevalence of gingivitis was insignificantly higher among light smokers while the prevalence of moderate/severe periodontitis was significantly higher among heavy smokers (p<0.05). Heavy smokers similarly had significantly higher percentage of sites with probing depth >4 mm [35.7 (3.8)] and mean CAL [5.3 (0.9)] (p<0.05). Nicotinic stomatitis and leukoplakia were similarly significantly prevalent among heavy smokers (p<0.001) while they also had more erythroplakia, lichen planus, non-healing ulcers and indeterminate lesions.

Bivariate analyses between proportions with severe impacts in OHRQoL subdomains and participant characteristics are presented in Table 3. Respondents aged 30–49 years, those with high school education or less, heavy smokers, heavy alcohol drinkers, and daily kola nut consumers, had more severe impacts in the subdomains of pain, discomfort, difficulty speaking, chewing, social embarrassment and self-consciousness.

Table 1. Association between age and other sociodemographic/clinical characteristics of participants (N=150)

Characteristics	Overall	Age (years)			
		18–29	30–49	≥50	
	%	%	%	%	p^{a}*
Population	100	9.8	73.7	16.5	
Monthly income (NGN)**					
<20000	5.3	3.7	1.6	0.0	0.035
20000–50000	15.3	1.6	9.5	4.2	
51000–100000	41.3	1.1	34.4	5.8	
>100000	19.6	1.1	14.8	3.7	
Chose not to answer	18.5	2.1	14.8	1.6	
Education					
High school education or less	70.9	4.6	53.2	42.2	0.039
Post high school diploma/certificate	21.9	2.6	16.1	3.2	
University degree	7.2	2.6	4.6	0.0	
Number of household members					
1–3	19.2	50.0	30.0	20.7	0.000
3–6	39.2	29.4	32.1	27.5	
>6	31.6	20.2	37.6	50.8	
Payment for healthcare					
Some form of insurance	7.5	3.7	2.7	1.1	0.000
Out of pocket	93.0	6.5	71.5	15.0	
Smoking status					
Never	29.0	7.0	10.0	12.0	0.007
Stopped	4.0	2.1	0.5	1.4	
Light	35.0	2.0	25.9	7.1	
Heavy	32.0	0.0	23.4	8.6	
Alcohol drinking					
Never	18.0	5.2	11.2	1.6	0.003
Stopped	0.0	0.0	0.0	0.0	
Light	47.0	2.6	32.9	11.5	
Heavy	35.0	1.6	24.5	8.9	
Kola nut consumption					
Never	36.0	22.0	12.0	0.0	0.003
Occasional	11.0	1.1	8.1	1.8	
Daily	53.0	3.5	37.7	11.8	

* All p-values significant. a p-value based on chi-squared test, Fisher's exact test for cells <5. ** NGN: 361 Nigerian Naira about 1 US$ in 2019.

Table 2. Periodontal parameters and potentially malignant lesions observed among participants according to smoking status

Parameters	Never (n=44)	Light (n=52)	Heavy (n=48)	
Periodontal	% (SE)	% (SE)	% (SE)*	p[a]
Gingivitis	34.2 (1.5)	41.6 (2.7)	37.4 (3.4)	0.214
Moderate periodontitis	10.5 (0.9)	16.3 (1.3)	22.8 (2.2)	0.006
Severe periodontitis	2.1 (0.8)	5.8 (1.7)	8.2 (2.6)	0.014
Bleeding on probing	4.4 (1.3)	5.6 (2.2)	4.8 (1.5)	0.125
Sites with probing depth >4 mm	18.9 (1.6)	28.3 (3.2)	35.7 (3.8)	0.015
Periodontal	Mean (SE)	Mean (SE)	Mean (SE)	p[b]
Maximum CAL (mm)	3.2 (0.5)	6.4 (0.7)	7.9 (0.6)	0.000
Mean CAL (mm)	2.9 (0.5)	4.1 (1.2)	5.3 (0.9)	0.001
Maximum PPD (mm)	3.8 (0.2)	7.0 (0.4)	8.2 (0.3)	0.003
Mean PPD (mm)	3.3 (0.1)	4.8 (0.3)	5.7 (0.4)	0.018
Mean number of teeth	28 (1.3)	26 (0.8)	23 (0.3)	0.087
Potentially malignant lesions	% (SE)	% (SE)	% (SE)	p[c]
Nicotinic stomatitis	0 (0.0)	3.8 (1.1)	12.5 (1.3)	0.000
Leukoplakia	2.3 (0.3)	1.9 (0.2)	6.3 (0.7)	0.001
Erythroplakia	0 (0.0)	0 (0.0)	2.1 (0.2)	0.143
Lichen planus	0 (0.0)	0 (0.0)	2.1 (0.2)	0.287
Non-healing ulcer	0 (0.0)	0 (0.0)	4.3 (0.8)	0.026
Indeterminate	0 (0.0)	3.8 (0.9)	6.3 (1.2)	0.012

* SE: standard error of mean. CAL: clinical attachment loss. PPD: probing pocket depth. a p-value based on chi-squared test. b p-value based on ANOVA test. c p-value based on Fisher's exact test.

Table 3. Association between sociodemographic variables and oral-health-related quality of life (% with high impacts) (N=150)

Characteristics	Pain	Discomfort	Speech	Diet	Embarrassment	Self-consciousness*
Total	11.5	22.8	18.5	16.7	15.3	24.6
Age (years)						
18–29	2.0	3.5	4.5	3.8	2.0	4.3
30–49	6.1	11.3	6.8	6.2	8.2	11.1
≥50	3.3	8.0	7.2	6.7	5.1	9.2
Income (NGN)**						
<20000	2.9	6.1	3.1	4.5	4.2	5.3
20000–50000	3.2	5.8	6.0	5.1	4.7	7.5
51000–100000	2.3	3.5	2.6	2.3	2.6	3.2
>100000	0.6	1.2	2.5	1.3	0.8	3.0
Chose not to answer	2.5	6.2	4.3	3.5	3.0	6.6
Education						
High school education or less	3.5	9.4	6.8	5.8	5.0	9.4
Post high school diploma/ certificate	4.6	8.9	7.6	6.1	6.0	9.8
University degree	3.4	4.5	4.1	4.8	4.3	5.4

Table 3. Continued

Characteristics	Pain	Discomfort	Speech	Diet	Embarrassment	Self-consciousness*
Number of household members						
1–3	2.0	4.6	2.4	4.1	3.6	4.6
3–6	3.7	7.2	6.3	5.5	5.0	7.5
>6	5.8	11.0	9.8	7.1	6.7	12.5
Payment for healthcare						
Some form of insurance	3.8	7.5	7.4	7.5	6.0	8.6
Out of pocket	7.7	15.3	11.1	9.2	9.3	16.0
Smoking status						
Never	1.1	2.6	1.0	1.3	1.1	2.9
Stopped	2.2	4.4	2.1	2.5	2.4	3.7
Light	3.7	7.0	7.0	5.2	4.5	7.9
Heavy	4.5	9.8	8.4	6.7	7.3	10.1
Alcohol drinking						
Never	2.4	3.0	1.6	1.9	1.4	2.5
Stopped	2.6	5.1	2.5	3.2	2.5	5.0
Light	2.9	6.4	6.8	5.4	4.9	7.2
Heavy	3.6	8.3	7.6	6.2	6.5	9.9
Kola nut consumption						
Never	2.7	5.0	4.3	3.5	3.3	4.0
Occasional	3.3	8.2	6.1	6.0	5.1	9.7
Daily	5.5	9.6	8.1	7.2	6.9	10.9

*Only 6 subdomains that were significant are included in the Table. ** NGN: 361 Nigerian Naira about 1 US$ in 2019.

In the multivariable logistic regression model, after controlling for alcohol consumption, kola nut chewing and other sociodemographic covariates, heavy cigarette smoking was a significant predictor of potentially malignant lesions (OR=1.89; 95% CI: 1.33–3.27), severe periodontitis (OR=3.12; 95% CI : 2.28–5.17) and severe OHRQoL impacts (OR=2.35; 95% CI: 1.42–4.54). For individual OHRQoL subdomains, Pain 3.03 (95% CI: 1.77–4.21), Discomfort 2.89 (95% CI: 2.32–4.17), Speech 3.02 (95% CI: 2.32–4.13), Diet 2.77 [95% CI: 1.87–4.28], Embarrassment 1.97 (95% CI: 1.65–3.14) and Self-consciousness 2.34 (95% CI: 1.93–3.48) were significantly associated with heavy smoking (Table 4).

Table 4. Odds ratios from the logistic regression model between significant predictor variables in the bivariate analysis and outcome variables

Variables	AOR[a]	95% CI	p
Potentially malignant lesions			
Never smoker	1		
Light smoker	1.28	0.58–1.79	0.032
Heavy smoker	1.89	1.33–3.27	0.000
Severe periodontitis			
Never smoker	1		
Light smoker	2.05	0.99–3.14	0.013
Heavy smoker	3.12	2.28–5.17	0.000
OHRQoL (severe impact)			
Never smoker	1		
Light smoker	1.44	0.64–2.47	0.029
Heavy smoker	2.35	1.42–4.54	0.001

Table 4. Continued

Variables	Pain	Discomfort	Speech	Diet	Embarrassment	Self-consciousness*
Never smoker	1	1	1	1	1	1
Light smoker	1.64	1.38	1.33	1.20	1.37	1.68
	(0.98–2.24)	(1.02–1.96)	(0.86–2.05)	(0.77–1.55)	(1.14–1.92)	(1.27–1.84)
Heavy smoker	3.03	2.89	3.02	2.77	1.97	2.34
	(1.77–4.21)	(2.32–4.17)	(2.32–4.13)	(1.87–4.28)	(1.65–3.14)	(1.93–3.48)

a AOR: adjusted odds ratio, adjusted for alcohol consumption, kola nut use, and sociodemographic covariates. CI: confidence interval. OHRQoL: oral-health-related quality of life. * Only 6 subdomains that were significant are included in the Table.

DISCUSSION

This study investigated the association between the deleterious social habits of a cohort of bus drivers and their oral health status as well as their oral-health-related quality of life. Previous researchers have reported high levels of health-related events among bus drivers including cardiovascular disease, musculoskeletal complaints, psychosomatic disorders, chronic fatigue, and extreme stress[27]. They also have increased susceptibility to sickness absenteeism and disability than other occupational groups[28].

Our sample of 150 male respondents comprised mainly those aged 30–49 years who had high school level education or less. Unavoidably, high-risk groups mostly belong to lower socioeconomic groups, who least attend clinics or utilize other health services, thus limiting an opportunity for visual examination by a clinician[29]. There was a high prevalence for ever use of cigarettes, alcohol and kola nut among study participants. The high prevalence of smoking among these drivers indicates that this cohort is particularly vulnerable to initiating and continuing a smoking habit. Influences such as peer pressure, relative availability, ease of access to and affordability of cigarettes, as well as the high level of stress associated with their occupation and the perceived need for use of stimulants, may contribute to the high prevalence of smoking among these drivers[30]. Commercial bus drivers are thus an important high-risk group for tobacco control initiatives in Nigeria.

A high proportion also drink alcohol and consume kola nuts. There has been a rapid increase in alcohol consumption across all age groups in Nigeria[31]. It is common to see alcohol sold by hawkers or in kiosks in small sachets and bottles, within and around motor parks, without any opposition due to weak regulatory overseeing. The carcinogenic effect of tannins from kola nut has also been documented when it is taken in large quantities, frequently, and for a long time[32]. A review of literature shows that numerous biological, psychological, social and familial factors predispose bus drivers to substance abuse[33]. We observed significant associations between income, educational attainment, smoking, alcohol consumption, kola nut consumption, and age group. Respondents aged 30–49 years, who represent the most productive age group, were significantly more likely to be heavy smokers, heavy alcohol drinkers, and daily kola nut consumers. Choi et al.[34] hypothesized that workload and work resources based on specific working conditions such as prolonged driving, irregular shifts, conflicts with passengers, extended sedentary work, ergonomic hazards within the context of low wages, age, male gender, low educational attainment and poor health behaviors are fundamental in understanding drivers' work-stress-related health outcomes.

The prevalence of gingivitis was insignificantly higher among light smokers while the prevalence of moderate/severe periodontitis was significantly higher among heavy smokers. Studies have confirmed that gingival inflammatory response is altered by smoking, which has anti-hemorrhagic and anti-inflammatory effects, essentially inhibiting the cardinal signs of redness, bleeding, and edema[35]. Heavy smokers, however, had significantly higher percentage of periodontal sites with probing depth and clinical attachment loss >4 mm. Descriptive and analytical studies show a strong epidemiologic association between smoking and an increased risk of periodontitis in smokers. In a large study of 1361 subjects in the US, smokers had a greater risk of experiencing severe bone loss than non-smokers, with odds ratios ranging from 3.25 to 7.28 for light and heavy smokers, respectively[36].

Nicotinic stomatitis and leukoplakia were similarly significantly prevalent among heavy smokers while they also had more erythroplakia, lichen planus, non-healing ulcers, and indeterminate lesions. Regardless of the form of usage, all tobacco products contain hazardous chemicals with over 4000 known constituents. These include carbon monoxide, hydrogen cyanide, reactive oxidizing radicals, a high number of carcinogens, and of course nicotine, the main psychoactive and addictive molecule[37]. Alcohol has been found to increase the risk of premalignant lesions in the presence of tobacco16. Data from literature show that the malignant potential of leukoplakia, oral lichen planus and oral submucous fibrosis is 3.5%, with a reported[38] range of 0.13–34%.

The development of oropharyngeal cancer is often subtle and asymptomatic. Invasive oral squamous cell carcinoma is frequently heralded by clinically identifiable premalignant changes of the oral mucosa. Careful monitoring of these

lesions by an experienced specialist is highly recommended to identify any malignant changes in the early stages to reduce the cancer burden. Consequently, it is imperative for the clinician to maintain a high index of suspicion, especially in high risk groups like bus drivers who abuse tobacco and alcohol. Usually, when the premalignant lesions are not identified and late-stage symptoms such as bleeding, tooth mobility, ill-fitting dentures, dysphagia and odynophagia develop, the morbidity and mortality are usually more severe[14]. Secondary prevention through screening and prompt referral is thus advocated in this high-risk cohort.

We correspondingly observed more adverse oral impacts among heavy smokers, heavy alcohol drinkers and daily kola nut consumers, especially in the domains of pain in the mouth, discomfort with social interaction, difficulty with speaking, chewing difficulties, social embarrassment, and self-consciousness. There was a successive gradient risk for oral impact, with heavy smokers and heavy alcohol drinkers having the highest likelihood of oral impacts, followed by the moderate smokers and drinkers, compared to those who had never smoked or drank. These associations persisted in our multivariate regression model. Maida et al.[20] observed worse OHRQoL among current smokers while Åstrøm et al.[21] observed a correlation between the duration of smoking and OHRQoL. Smoking and alcohol consumption are associated with depression[39], esteem issues, tooth loss, stained teeth, oral malodor, and social exclusion, which are correlated with quality of life[18,19]. Due to weak implementations of the recommendations of MPOWER, resulting in cheap cigarettes that are widely available and freely smoked in car parks, bus drivers who are largely of low socioeconomic status with poor health seeking behavior, represent a high-risk group that should receive adequate attention for cessation services.

Limitations
Some limitations should be considered when interpreting our results. First, the descriptive study design limits our ability to make causal inferences from the associations that we observed. Second, the smoking status and other deleterious habits of the respondents were determined by self-report and not verified by exhaled carbon monoxide or urinary cotinine levels, giving the possibility of bias in reported prevalence values. Thirdly, even though we stringently utilized the WHO criteria for determining premalignant lesions, as obtained in clinical practice, we were unable to obtain biopsy samples for confirmatory histopathology due to the limited consent we were given by the participating union of drivers (NURTW). Within the context of these limitations, our study provides the first of such baseline community data in Nigeria.

CONCLUSIONS
This study shows that smoking and alcohol consumption have significant independent associations with periodontal disease, premalignant lesions, and oral-health-related quality of life, with the worst impacts recorded in heavy smokers and drinkers. It highlights the role of tobacco and alcohol as modifiable risk factors for periodontal disease and potentially malignant lesions that can impact negatively on oral-health-related quality of life. Bus drivers in Lagos State, Nigeria, are an important target group in controlling tobacco and alcohol use in Nigeria and should receive adequate attention for oral health promotion, regular screening, and other preventive initiatives.

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