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Original Article

Shift Work, Stress, and Smoking: Understanding Tobacco Use and Oral Health Awareness Among Business Process Outsourcing Employees in Chennai, India (2023)

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Abstract

Background: Tobacco use is one of the major public health issues worldwide and affects both oral and general health. The Business Process Outsourcing (BPO) industry in India employs a predominantly young workforce, which may be at a higher risk of tobacco initiation and dependence due to occupational stress and lifestyle-related factors. This study aimed to assess the prevalence of tobacco use and related oral health problems among BPO employees in Chennai, India.

Methods: A descriptive cross-sectional analysis was conducted among 229 BPO workers from Chennai, India, in 2023. The study was carried out using a pretested structured questionnaire to collect information on demographic factors, use of tobacco in any form, and self-reported oral health problems. Statistical analysis was performed using SPSS v26, employing chi-square tests, independent t-tests, and multivariable logistic regression ($P<0.05$). Prevalence rates were estimated, and associated oral health effects were identified based on the analyzed data.

Results: The prevalence of tobacco use was 85%, and gingival bleeding was significantly higher among night-shift workers ($P=0.013$), with the majority using smoking forms of tobacco.

Conclusion: The study highlights an alarmingly high level of tobacco use in this population and indicates that a significant burden of oral disease exists among tobacco users. The findings underscore the urgent need for targeted health promotion strategies within the BPO sector. Worksite interventions focusing on preventive oral health education, routine dental check-ups, and access to tobacco cessation services are imperative to curb tobacco use and mitigate associated health risks. Immediate implementation of such programs is critical to prevent further oral and systemic health complications in this vulnerable workforce.

Keywords: Shift Work, Smoking, Tobacco, Oral Health

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Introduction

Tobacco use remains one of the leading causes of preventable mortality and morbidity worldwide, contributing to numerous chronic diseases, including various cancers, as well as cardiovascular and respiratory conditions. Although public health campaigns have been implemented globally to reduce tobacco use, the burden of tobacco-induced diseases continues to rise, particularly in low- and middle-income countries (LMICs).[1] These countries are emerging as the epicentre of the tobacco epidemic and demonstrate greater susceptibility to both smoking and smokeless tobacco products. According to the World Health Organization (WHO), tobacco use is estimated to be responsible for more than 7 million deaths per year, with the future burden expected to increase further if current consumption patterns persist.[2]

With the rapid growth of this global industry, the Business Process Outsourcing (BPO) sector employs millions of individuals, particularly in India, the Philippines, and several Latin American countries. In India alone, more than 4 million workers are employed in this industry, a large proportion of whom are young adults aged 18 - 35 years.[3] One of the largest subpopulations affected by tobacco use within LMICs is the BPO workforce. This group is particularly vulnerable to tobacco use due to several factors inherent to BPO work, including extended working hours, high stress levels, lack of predictable schedules, and exposure to job-related stressors that may encourage maladaptive coping strategies such as smoking.[4] The demanding lifestyle under which BPO employees operate, characterized by high performance

expectations and prolonged working hours, predisposes them to unhealthy lifestyle behaviors, including tobacco use.[5]

Recent research has indicated that younger individuals working in the BPO sector may engage in tobacco use as a means of coping with stress and anxiety, or as a consequence of atypical working hours leading to irregular sleep patterns. Additionally, a substantial proportion of this population is influenced by social and occupational environments that promote tobacco use.[6] A study by Patel et al. reported that tobacco consumption among Indian BPO workers was higher compared to the general population, potentially due to occupation-specific stressors and the presence of a younger, more impressionable workforce.[7] Similarly, Gupta et al. demonstrated that smoking is a major risk factor for the development of oral mucosal lesions, gingivitis, and other periodontal diseases, conditions that are not only highly prevalent but may also lead to tooth loss and, in severe cases, cancers of the oral cavity.[8]

Moreover, although difficult to predict, the serious health ramifications associated with tobacco use, including oral cancer and severe periodontal disease, may place a significant burden on both individual healthcare services and the overall healthcare system[9] Considering the lifestyle characterized by sedentarism, long working hours, and a stressful work environment among BPO workers, there is a high likelihood that systemic and oral health risks are compounded by tobacco use. Tobacco-induced oral health problems can have a debilitating impact on workers' quality of life, productivity, and overall well-being. Although numerous studies have examined stress levels, sleep disturbances, tobacco use, and health outcomes in this population, a substantial evidence gap remains regarding awareness and knowledge related to tobacco use and the need to sensitize this group toward tobacco cessation.

Understanding the extent of tobacco use, the demographic factors associated with its use, and the adverse health effects of tobacco in this population is essential for the development of targeted public health interventions. The present study seeks to address this gap by estimating the prevalence and patterns of tobacco use among BPO workers and by increasing awareness of the oral health risks associated with tobacco consumption. By elucidating these factors, the study aims to provide valuable insights to support focused interventions designed to reduce the burden of tobacco-related diseases among BPO employees in Chennai, India.

Methods

Study Design

A cross-sectional descriptive study was conducted to assess patterns of tobacco use, awareness of health hazards, and sociodemographic factors associated with tobacco use among Business Process Outsourcing (BPO) employees in Chennai, South India, in 2023. The study protocol was approved by the Institutional Ethics Committee (reference: SRB/SDC/PHD/2023-1110) and was conducted in accordance with the tenets of the Declaration of Helsinki and its subsequent amendments.

Study Population

The study population consisted of full-time BPO employees working in Chennai. Participants aged 18 to 45 years with at least one year of continuous work experience in the BPO sector were included in the study. Individuals who refused to participate or had a history of serious systemic disease were excluded. All participants provided written informed consent in accordance with the Declaration of Helsinki.

Sampling Strategy

Participants were selected using convenience sampling from four different BPO offices in Chennai. Permission was obtained from the Human Resource Managers of these workplaces to access eligible staff members. All employees who met the selection criteria were invited to participate voluntarily. Participation was entirely anonymous to enhance the accuracy of self-reported personal behaviors and attitudes.

Sample Size Justification

The sample size was calculated assuming an expected prevalence of smoking among BPO workers of 30% (based on pilot surveys and local reports), an absolute precision of 5%, and a confidence level of 95%. The sample size was estimated using the standard cross-sectional study proportion formula, which yielded a required sample size of 323. However, due to non-response and lack of cooperation from some participants, a final sample of 299 individuals was obtained. This sample size still provided sufficient statistical power to detect significant associations between smoking and sociodemographic variables within the study population.

Data Collection

Data were collected using a pretested, structured questionnaire consisting of 20 items. The instrument covered six major domains: (1) Sociodemographic characteristics (age, sex, education, income, and work shift); (2) oral hygiene habits (frequency and timing of toothbrushing and dental visits); (3) tobacco use (type, age of initiation, frequency, duration, place of use, and quit attempts); (4) alcohol consumption; (5) self-reported oral symptoms during the past 6 months (gingival bleeding, ulcerations, discolorations, white or red patches, recurrent ulcers, burning sensation, or swelling); and (6) knowledge regarding the health hazards of tobacco and its association with cancer.

The questionnaire was pretested among 30 BPO employees to ensure clarity, cultural relevance, and feasibility. Reliability assessment demonstrated good internal consistency, with Cronbach's alpha values of 0.81 for knowledge-related items and 0.78 for behavioral items. Content validity was

established through evaluation by two public health dentistry experts, yielding a Content Validity Index (CVI) of 0.89. To minimize reporting bias, data collection was conducted through confidential interviews, and responses were reviewed and confirmed prior to data entry.

Statistical Analysis

All collected data were recorded and verified for accuracy prior to analysis. Demographic characteristics were summarized using descriptive statistics, including means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. Associations between categorical variables (such as work shift type and oral hygiene practices or tobacco and alcohol consumption) were examined using the chi-square test of independence. Means and standard deviations were calculated for continuous variables, including age and income. Differences in means (e.g., age of onset of tobacco use) between day- and night-shift workers were assessed using independent samples t-tests when assumptions of normality were met. A p-value of less than 0.05 was considered statistically significant.

Associations between shift work, tobacco use, and oral health outcomes — specifically the presence of gingival bleeding and self-reported oral mucosal lesions — were analyzed using multivariable logistic regression, adjusting for age, gender, education, and income. All statistical analyses were performed using SPSS software (version 26; IBM Corp., Armonk, NY, USA). Results were presented in tabulated form, with exact p-values reported to facilitate interpretation of statistical significance.

Results

The present study analyzed the demographic characteristics and oral hygiene-related behaviors (Table 1) of two hundred and twenty-nine respondents, with a mean age of 28.52 years (SD = 3.24). Most participants were male (n = 207; 90.4%), while females accounted for 9.6% (n = 22). The majority of participants had completed an undergraduate degree (n = 180; 78.6%), whereas 21.4% had postgraduate education (n = 49). The mean monthly income was ₹46,128.82 (SD = ₹140,792.8), indicating a wide range of economic backgrounds among participants. Regarding work shifts, 47.2% (n = 108) were day-shift workers and 52.8% (n = 121) were night-shift workers.

Table 2 shows that nearly all participants reported having visited a dentist at least once; 98.1% of day-shift workers and 100% of night-shift workers stated that they had visited a dentist in the past (p = 0.221). Routine preventive visits were uncommon, as only two day-shift participants (1.9%) reported visiting a dentist for a routine check-up, while none of the night-shift workers reported such visits. Instead, reasons for dental visits were predominantly related to teeth cleaning, reported by 98.1% of day-shift workers and 100% of night-shift workers (p = 0.480).

Overall dental hygiene practices were suboptimal.

Table 1. Demographic Details of the Study Participants

Demographic	N (%)
Age in years	Mean ± SD 28.52 ± 3.236
Gender	
Male	207 (90.4)
Female	22 (9.6)
Education	
Undergraduate	180 (78.6)
Postgraduate	49 (21.4)
Income	Mean ± SD 46128.82 ± 140792.8
Type of Work Shift	
Day	108 (47.2)
Night	121 (52.8)

Values are presented as mean ± standard deviation (SD) or frequencies (%).

Almost all participants reported brushing their teeth once daily (97.2% of day-shift workers and 100% of night-shift workers; p = 0.103). Only two day-shift workers (1.9%) and one night-shift worker reported brushing twice daily, while one participant reported brushing after every meal. The majority of respondents reported cleaning their teeth before the start of their work shift (98.1% of day-shift workers and 100% of night-shift workers; p = 0.221), while only two day-shift workers reported brushing both before and after their shifts. Overall, neither group demonstrated consistent preventive oral health behaviors, and most participants reported infrequent dental visits and inadequate daily oral hygiene practices.

Chi-square test was used to compare categorical variables between day-shift and night-shift workers. Independent samples t-test was used for continuous variables (age of initiation of tobacco use). A p-value < 0.05 was considered statistically significant.

There were high rates of tobacco use, with 88.9% of day-shift workers and 86% of night-shift workers identifying as smokers (p = 0.321). The mean age of initiation of tobacco use was 20.31 years (SD = 6.89) among day-shift workers and 19.96 years (SD = 7.82) among night-shift workers (p = 0.723), and the duration of tobacco use was reported to be 1 - 5 years among all users. The frequency of cigarette consumption differed significantly across work shifts (p = 0.016), with most users smoking 1 - 5 cigarettes per day (88.5% of day-shift workers and 87.5% of night-shift workers). A higher proportion of night-shift workers reported smoking more than 10 cigarettes per day (8.7%) compared to day-shift workers (1.1%).

Patterns of tobacco use also differed significantly with respect to the place of consumption (p < 0.001). The workplace was the most common site of tobacco use among day-shift workers (49%), whereas a designated location was most frequently reported by night-shift workers (41.3%). Additionally, 26.9% of night-shift workers reported smoking at home, compared to only 3.2% of day-shift workers. Tobacco use in public places was reported by 32.7% of night-shift workers and 23.9% of day-shift workers. A significant difference was also

Table 2. Association of Shift Work and Oral Hygiene Among the Study Participants

Question Items	Options	N (%)		*P* value
		Day Shift	Night Shift	
Have you ever visited a dentist?	Yes	106 (98.1)	121 (100)	0.221
	No	2 (1.9)	0	
Reason for the visit	Regular Check up	2 (1.9)	0	0.480
	Cleaning teeth	104 (98.1)	121 (100)	
How often do you brush your teeth in a day?	Once	105 (97.2)	121 (100)	0.103
	Twice	2 (1.9)	0	
	After each meal	1 (0.9)	0	
When do you clean Your teeth?	Before shift	106 (98.1)	121 (100)	0.221
	Both (Before and after)	2 (1.9)	0	
Do you use tobacco?	Yes	96 (88.9)	104 (86)	0.321
	No	12 (11.1)	17 (14)	
Age of initiation of tobacco use		Mean ± SD		
		20.31 ± 6.886	19.96 ± 7.823	0.723
Duration of tobacco use	1-5 years	N (%)		
		96 (100)	104 (100)	0.407
Tobacco Frequency	1-5 cigarettes/ day	85 (88.5)	91 (87.5)	0.016
	6-10 cigarettes/ day	10 (10.4)	4 (3.85)	
	>10 cigarettes/ day	1 (1.1)	9 (8.65)	
Have you ever tried to quit tobacco?	No	96 (100)	104 (100)	NA
Where do you take tobacco more often?	At work	47 (49)	0	0.000
	Residence	3 (3.2)	28 (26.9)	
	Specific place	23 (23.9)	42 (41.3)	
	Public Place	23 (23.9)	34 (32.7)	
Do you know the harmful effect of using tobacco?	Yes	11 (10.2)	66 (54.5)	0.000
	No	97 (89.8)	55 (45.5)	
Do you know that the risk of developing cancer is more in tobacco users?	Yes	60 (55.6)	53 (43.8)	0.086
	No	48 (44.4)	68 (56.2)	
Do you consume alcohol?	Yes	0	121 (100)	0.000
	No	108 (100)	0	

observed in awareness of the general health hazards of tobacco use, with 10.2% of day-shift workers and 54.5% of night-shift workers reporting awareness ($P<0.001$). Regarding specific knowledge of cancer risk associated with tobacco use, 55.6% of day-shift workers and 43.8% of night-shift workers reported awareness; however, this difference was not statistically significant ($P=0.086$). After adjustment, no significant difference was observed in overall tobacco use prevalence between day- and night-shift workers (adjusted OR = 1.12, 95% CI: 0.75 - 1.67). However, night-shift workers demonstrated significantly higher odds of heavy tobacco use, defined as consumption of more than 10 cigarettes per day (adjusted OR = 2.45, 95% CI: 1.30 - 4.62), as well as a markedly higher prevalence of alcohol consumption (100% vs. 0%, $P<0.001$).

Table 3 shows that night-shift workers had significantly higher odds of reporting gingival bleeding compared to day-shift workers (OR = 2.02, $P=0.013$). Although tobacco use was associated with increased odds of gingival bleeding, this association was not statistically significant after adjustment (OR = 1.33, $P=0.471$). Age, gender, education, and income were also not significant predictors in this multivariable model.

Table 4 demonstrates that, after adjusting for potential confounders, shift work was significantly associated with higher values of the outcome variable ($P<0.001$, 95% CI: 1.78 to 3.87), while tobacco use was significantly associated with lower values of the outcome variable ($P<0.001$, 95% CI: -5.88 to -2.07). The odds ratios for both shift work and tobacco use were greater than 1, indicating a positive direction of association and suggesting a meaningful relationship with the presence of self-reported oral mucosal lesions in this sample. In contrast, age, sex, education, and income did not show statistically significant associations with the outcome variable.

Discussion

Tobacco use remains a major public health problem worldwide and is particularly pronounced in certain populations and occupational settings. In the present study, a high prevalence of tobacco use (85%) was observed among BPO workers, which exceeds the prevalence reported by the Global Adult Tobacco Survey (GATS) India (28%).[10] This finding highlights the need to explore the specific determinants of tobacco use within this professional group, including work-related stressors and socio-cultural influences. The current study provides insight into the high prevalence of tobacco consumption among BPO employees by emphasizing the role of stress, gender, and socio-cultural factors that contribute to smoking behaviors, drawing upon evidence from both medical and dental literature.

The findings of this study are particularly relevant, as they allow for an assessment of oral health behaviors, tobacco use, and alcohol consumption among young adult shift workers. The study population was predominantly male and under 30 years of age, which aligns with the demographic profile of many industrial and occupational shift-based workforces in similar settings.[11] Although nearly all respondents reported having visited a dentist at least once, which may initially appear encouraging, the vast majority indicated that their visits were primarily for teeth cleaning, with very few reporting routine preventive check-ups. This suggests that a treatment-oriented rather than a preventive approach to oral health predominates among this population. These findings are consistent with previous literature indicating that preventive dental behaviors are often poorly adopted among young working adults, potentially due to limited motivation and inadequate knowledge regarding oral health maintenance.[12]

The high prevalence of tobacco use observed among

Table 3. Multivariable Logistic Regression for Gingival Bleeding

Variable	Odds Ratio	95% CI	*P* value
Shift work	2.02	1.16 – 3.53	0.013
Tobacco use	1.33	0.62 – 2.86	0.471
Age	0.92	0.84 – 1.01	0.091
Gender	1.24	0.55 – 2.80	0.610
Education	1.00	0.81 – 1.23	0.979
Income	1.00	1.00 – 1.00	0.126

Multivariable logistic regression was performed to identify predictors of self-reported gingival bleeding, adjusting for age, gender, education, income, shift work, and tobacco use. Significance was set at $P<0.05$.

Table 4. Multivariable Logistic Regression for Self-reported Oral Mucosal Lesions

Variable	Odds Ratio	95% CI	*P* value
Shift work	1.21	1.78 – 3.87	<0.001
Tobacco use	1.08	-5.88 to -2.07	<0.001
Age	1.07	0.97 – 1.17	0.168
Gender	0.71	0.32 – 1.59	0.410
Education	0.95	0.77 – 1.18	0.637
Income	1.00	1.00 – 1.00	0.609

Multivariable logistic regression was performed to assess predictors of self-reported oral mucosal lesions, adjusting for age, gender, education, income, shift work, and tobacco use. A *P* value<0.05 was considered statistically significant.

BPO workers in this study can largely be attributed to the stress and demanding working conditions characteristic of the BPO industry. BPO workplaces commonly involve shift-based schedules and extended working hours, which may create high-pressure environments, irregular eating patterns, and prolonged work durations, thereby fostering unhealthy coping mechanisms such as smoking and the use of smokeless tobacco.[13] Psychosocial risks in the workplace have been strongly associated with substance use, as individuals may resort to tobacco consumption as a form of self-medication for stress and anxiety[14] Furthermore, irregular work schedules and long working hours can disrupt sleep-wake cycles, and shift work-related circadian rhythm disturbances have been linked to an increased risk of smoking through heightened stress and nicotine dependence[15] In the context of BPO employment, where call centers operate continuously over 24-hour cycles and are often characterized by high job demands, these factors may collectively create an environment in which smoking is perceived as a readily accessible, albeit unhealthy, coping strategy.

The presence and proximity of tobacco products in and around BPO offices may further encourage tobacco use. The availability of tobacco products in workplace settings has been shown to increase the risk of use among employees [16] Furthermore, BPO employees, particularly in urban areas, often belong to high-smoking social groups, which may further reinforce the acceptability or perceived desirability of tobacco use, thereby normalizing smoking as an acceptable, and even desirable, behavior[17] Accordingly, the workplace environment, combined with occupational stress and social pressures associated with BPO work, is likely to contribute to the disproportionately high patterns of tobacco use observed in this population. In addition, the global pattern of tobacco initiation during adolescence and early adulthood, as reflected in the present study, underlies the high prevalence of tobacco use among young male BPO workers aged 18 - 35 years. Adolescents and young adults are particularly susceptible to tobacco initiation due to peer influence, curiosity, and limited awareness of the long-term health consequences of smoking. In this study, the higher levels of tobacco use among young adults are consistent with findings from studies conducted in other countries, which report that most adult smokers initiate smoking during their teenage years or early adulthood.[18]

The prevalence of tobacco use in this study was unacceptably high, exceeding 85% across all work shifts. Although overall prevalence did not differ significantly between shifts, notable differences were observed in the frequency and contextual patterns of tobacco use. Night-shift workers were more likely to smoke more than 10 cigarettes per day and to use tobacco in specific designated locations, whereas day-shift workers more commonly reported tobacco use at the workplace. This pattern may indicate that night-shift workers experience greater environmental access that facilitates increased consumption, or that shift work disrupts normal social and circadian rhythms, leading to a greater reliance on coping behaviors such as smoking[19] Another noteworthy finding was the exceptionally high prevalence of alcohol consumption among night-shift workers (100%), contrasted with the absence of alcohol use among day-shift workers. This pattern may reflect attempts to compensate for circadian rhythm disruption, social isolation, or stress associated with nocturnal work schedules. Although unexpected, this finding is consistent with previous studies demonstrating an association between shift work and increased alcohol consumption in certain occupational sectors.[20]

The significantly higher prevalence of gingival bleeding observed among night-shift workers compared to their day-shift counterparts, independent of age, gender, education, and income, is consistent with emerging evidence linking circadian rhythm disruption and altered immune responses in night-shift workers to compromised periodontal health. Recent studies have demonstrated that disturbances in the circadian system among shift workers can influence inflammatory cytokine regulation and increase susceptibility to periodontal diseases[21] The lack of significant associations between gingival bleeding and age, gender, education, or income suggests that occupational factors, particularly shift work, may exert a more direct influence on periodontal health in this population than traditional sociodemographic determinants. This interpretation is supported by prior research indicating that the unique stressors and behavioral changes associated with night-shift work — such as disrupted sleep patterns, reduced salivary flow, and irregular oral hygiene practices — can adversely affect

oral health independent of demographic factors.[22]

Self-reported oral mucosal lesions were significantly associated with both shift work and tobacco use after controlling for potential confounders, with shift work showing a positive association and tobacco use also demonstrating a significant relationship. These findings corroborate earlier studies that have identified occupational disruption and tobacco use as key risk factors for oral mucosal changes. Notably, the lack of statistically significant associations for age, gender, education, and income in predicting mucosal lesions further underscores the importance of occupational and behavioral exposures over demographic characteristics in this context.[23,24]

The high prevalence of tobacco use among BPO employees can be explained by the interrelated influence of multiple factors. BPO workers commonly operate in stressful work environments characterized by extended working hours, night shifts, and high-performance pressures. Stress is a well-established risk factor for tobacco use, as nicotine produces temporary symptom relief by stimulating dopamine secretion in the brain, thereby inducing sensations of relaxation and pleasure.[25] Under increasing job demands and occupational stress, BPO workers may therefore be more likely to use tobacco as a coping mechanism. Work-related stress has previously been identified as a strong motivator for engaging in unhealthy behaviors such as smoking, particularly among young adults employed in high-stress industries.[26,27]

Tobacco use in the workplace may also be socially accepted among BPO employees. In many urban settings, BPO workers are likely to operate in environments where tobacco use is either normalized or socially acceptable among peers. Workplace smoking has been described as a social phenomenon in which employees gather to share tobacco use as part of bonding and camaraderie.[28] The visible presence of smoking and the ready availability of tobacco products within BPO office environments may contribute to the normalization of tobacco use and further reinforce the behavior, making it appear routine or even integral to the work culture.

The widespread availability of tobacco products further contributes to the high prevalence of use among BPO workers. In India, tobacco products are easily accessible through small retail outlets located in and around workplaces, allowing workers to purchase them with minimal effort[29] Such ease of access reduces barriers to tobacco use, particularly among younger employees who may be more inclined to experiment with tobacco during brief breaks or work transitions.

Tobacco use among BPO workers may also become habitual due to the combined influence of psychosocial factors, including peer pressure, social norms, and limited awareness of the health hazards associated with tobacco use. Adults aged 18 - 35 years working in the BPO sector may possess lower levels of knowledge regarding the risks of tobacco consumption, as this age group is frequently targeted by tobacco advertising and promotional activities. Moreover, strong peer influence and workplace norms may discourage cessation or even consideration of quitting, particularly when smoking is perceived as a stress-relief strategy or a means of social bonding.[30,31,32]

The findings align with previous research indicating that occupational stress and irregular working hours contribute to increased tobacco and alcohol use among transport and security workers.[33] Recent studies have similarly reported high prevalence rates of tobacco use, including both smoking and smokeless forms, among police personnel, bus conductors, drivers, and night security guards, with a notable association between occupational stress, nicotine dependence, and adverse oral health outcomes.[34, 35] In the present study, increased tobacco and alcohol use among night-shift workers was associated with higher rates of oral health problems, including periodontal disease and oral mucosal lesions. These results are consistent with existing literature demonstrating that elevated stress levels and nicotine dependence are linked to poor oral health status, particularly in populations exposed to demanding work schedules and limited health awareness.[36,37,38]

Overall, this study highlights the substantial burden of tobacco and alcohol use among young, predominantly male workers engaged in shift-based occupations. Night-shift work, in particular, was associated with higher frequency of tobacco and alcohol use, lower awareness of health risks, and increased oral health problems.[39,40,41] These findings underscore the urgent need for targeted interventions focusing on health education, stress management, and cessation support, especially for night-shift workers who are at heightened risk for substance use and its associated adverse health consequences.[42]

Conclusion

The elevated rate of tobacco consumption among BPO workers observed in the present study reflects the complex interaction of occupational stress, social exposure, gender norms, and individual behavioral responses. The BPO work environment, characterized by high stress levels and atypical working hours, creates conditions conducive to the initiation and continuation of tobacco use, particularly among younger employees. Gender differences further complicate this issue, as women more frequently prefer smokeless tobacco products, while men predominantly engage in smoking. These findings contribute to the growing body of evidence supporting the need for tailored, model-based interventions that address specific patterns of tobacco use and gender-related behaviors to reduce the risk of tobacco-related diseases in this vulnerable population. Comprehensive tobacco control strategies — including targeted smoking cessation programs, workplace-based interventions, and broad awareness campaigns — are essential to promote overall health and well-being among BPO workers.

Limitations

The study sample was skewed toward young male participants; therefore, the findings may not be generalizable to female workers or older age groups.

Self-reported information regarding personal habits such as smoking and alcohol consumption is subject to recall bias and social desirability bias, which may result in underestimation or overestimation of actual usage levels. Additionally, the cross-sectional study design precludes the establishment of causal relationships between shift work and associated risk behaviors.

Recommendations

Future research should include more representative samples incorporating women and diverse occupational groups. The use of biochemical validation methods for assessing smoking and alcohol consumption would enhance the accuracy and reliability of findings. Prospective study designs are recommended to better elucidate causal pathways linking shift work with oral health outcomes. Furthermore, intervention trials evaluating comprehensive, workplace-based oral health promotion programs — integrated with routine dental preventive check-ups, tobacco cessation initiatives, and stress management strategies — may provide robust evidence to inform policy development and workplace health practices.

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Authors' Contributions

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Competing Interests

Delfin Lovelina Francis declares that there are no actual or potential conflicts of interest related to the submitted manuscript.
Saravanan Sampoornam Pape Reddy declares that there are no actual or potential conflicts of interest related to the submitted manuscript.
Arthi Balasubramaniam declares that there are no actual or potential conflicts of interest related to the submitted manuscript.

Data Availability Statement:

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval

Ethical approval was obtained from Saveetha Dental College and Hospital (Reference: SRB/SDC/PHD/2023-1110) prior to the commencement of the study. The study was conducted in accordance with the tenets of the Declaration of Helsinki and its subsequent amendments.

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