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Perception and Impact of Pictorial Health Warnings on Tobacco Packages among Dental Patients in Ahmedabad, India: A Cross-Sectional Study

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Abstract

Background: Tobacco use remains a significant global public health challenge. WHO Framework Convention on Tobacco Control mandates that nations take steps to ensure that tobacco product packaging carries health warnings and messages. This study aims to explore the perception of pictorial health warnings (PHWs) on tobacco packages among the patients attending dental institute in Ahmedabad city. **Methods:** A cross-sectional study was conducted among 210 patients attending dental institute in Ahmedabad city. The data were collected through self-aministered questionnaire by using a self-designed, pre-tested questionnaire. The questionnaire consists of questions pertaining to demographic details, tobacco related habits and perception on PHWs. Data was analyzed using descriptive statistics. Multivariate logistic regression analysis was performed to identify independent predictors for perception of PHWs. **Result:** More than half of the subjects (n=129, 61.43%) were having current habit of tobacco consumption in any form. Total 197 (93.80%) were aware about health warning messages on tobacco packages. Among 197 respondents, 67 (34.00%) respondents noticed only PHWs. Total 136(69.04%) subjects had perception of imagine health harms after seeing PHWs and 132(67.00%) subjects were worried for their health. More than half (n=64, 55.17%) wants to quit habit after seeing PHWs. Among individuals with a habit of tobacco consumption, the likelihood of imagining health harms (OR = 3.61, 95% CI: 1.73–7.53) and feeling worried about their health after viewing PHWs (OR = 3.71, 95% CI: 1.81–7.59) was significantly higher ($p < 0.001$). **Conclusion:** There was a favourable perception and positive impact on tobacco users to quit the habit.

Keywords: Pictorial Health Warnings; Tobacco Use; Risk Perception; Tobacco Cessation; Dental Patients

Introduction

Tobacco use remains a persistent global public health challenge, accounting for approximately 8.7 million deaths worldwide (World Health Organization, 2023). In developing countries like India, its impact is particularly severe. The Global Adult Tobacco Survey (GATS) 2016-17 reported that 28.6% of Indian adults use tobacco in some form, with 21.4% consuming smokeless tobacco (SLT) and 10.7% smoking tobacco (ST). Prevalence is significantly higher among males (42.4%) compared to females (14.2%). In India alone, tobacco is responsible for an estimated 1.3 million deaths annually, underscoring the urgent need for effective public health interventions (Ministry of Health and Family Welfare, Government of India, 2017).

Tobacco is a major contributor to non-communicable diseases such as cancers, cardiovascular and respiratory diseases, and it weakens multiple body systems, increasing vulnerability to various health complications. (West., 2017). The oral manifestations, such as periodontal disease, dental stains, oral precancerous lesions, and oral cancer, are also widespread, posing both functional and aesthetic health issues (Sham et al., 2003). To address these harms, pictorial health warnings (PHWs) on tobacco packaging have emerged as an effective and cost-efficient strategy to communicate health risks. They are particularly useful in multilingual and low-literacy populations, as they overcome language barriers and clearly convey serious risks such as cancer,

cardiovascular, and respiratory diseases. (Talreja et al.,2016; Kumar & Puranik, 2017). PHWs have the potential to motivate cessation, prevent initiation, and strengthen overall tobacco control efforts.

The World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC), under Article 11, mandates member countries to implement clear and prominent health warnings on tobacco packaging (World Health Organization, 2003). As of 2018, over 100 countries have introduced PHWs on cigarette packs (Hammond et al., 2019). In India, this was operationalized through the Cigarettes and Other Tobacco Products Act (COTPA), 2003, particularly under Section 7 (Ministry of Law and Justice, Government of India, 2003). The Ministry of Law and Justice mandated pictorial warnings in 2006, which became legally enforceable on May 31, 2009 (World Health Organization, 2008). Significant amendments followed, with a 2015 rule requiring 85% coverage of tobacco packs with warnings, differentiated for smoking and smokeless forms (Arora et al., 2012; Mullapudi et al., 2019).

Despite these regulatory efforts, evidence regarding perception and behavioral impact of PHWs among tobacco users remains inconsistent. In Gujarat, where tobacco use prevalence is 25.1% (GATS 2016-17) (Ministry of Health and Family Welfare, Government of India, 2017), limited studies have explored user perceptions of PHWs, (Shah et al., 2013; Sharma et al., 2024) and data from clinical setting are scarce. Furthermore, there is inadequate evidence assessing whether PHWs influence risk perception and behavior state of quitting intentions among users. This leads to a research question on how the tobacco users perceive a risk of using tobacco products as well as intend to quit the habit after noticing a PHW. So, the attempt was made to explore perception of PHWs on tobacco packages among patients attending dental institute in Ahmedabad city. The study objectives include to assess the awareness regarding PHWs and also to evaluate the behavioral impact of PHWs among tobacco users.

Methods

This cross-sectional study was conducted from February to April 2025 among adult patients attending the Outpatient Department (OPD) of the Government Dental College and Hospital, Ahmedabad (GDCHA). Participants included both male and female patients aged 18 years and above. Patients who were illiterate and unwilling to provide informed consent were excluded from the study.

Sample size estimation

To estimate the sample size, proportion of awareness regarding PHWs (84%) from previous study by Naik B N et al (2023) was considered. The estimated sample size was 206 considering this proportions, at a 95% confidence interval and 5% of allowable error. This was rounded up to 210.

Table 1. Demographic characteristics of study participants

Variables	Frequency (n = 210)	Percentage (%)
Age (in years)		
18-33	58	27.62
34-49	81	38.57
50-65	57	27.14
66-80	14	6.67
Mean age	43.06 ± 14.50	
Gender		
Male	179	85.24
Female	31	14.76
Socio-economic status		
Upper	2	0.95
Upper middle	19	9.05
Lower middle	71	33.81
Upper lower	118	56.19
Marital Status		
Married	175	83.33
Unmarried	34	16.19
Divorce	1	0.48

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Study tool and procedure

Data were collected using a self-designed, pre-tested questionnaire comprising three sections. Section 1 captured sociodemographic details, including age, gender and socioeconomic status (SES) was assessed using the Kuppuswamy scale (Radhakrishnan & Nagaraja, 2023). Section 2 included questions related to tobacco use (type, duration, and frequency), and Section 3 consisted of 20 close-ended items assessing knowledge of tobacco hazards, awareness, perception, and the impact of PHWs on tobacco products. The questionnaire was initially developed in English and translated into Gujarati and Hindi by two bilingual experts from the Department of Public Health Dentistry. A strong inter-rater agreement was observed (Kappa = 0.83). A pilot study with 25 participants was conducted to validate the tool, and necessary modifications were made based on feedback. The final questionnaire included 3 items on tobacco hazards, 4 items on awareness, 10 items on perception, and 3 items on the impact of PHWs.

Table 2. Tobacco habit among study participants

Variables	Frequency (n)	Percentage (%)
Status of Consumption		
Past	28	13.33
Current tobacco user	129	61.43
No habit	53	25.24
Total	210	100
Type		
Smoker	39	24.84
Smokeless tobacco chewer	93	59.24
Both	25	15.92
Total	157	100
Duration of tobacco chewing		
1-25 years	99	83.90
26-50 years	19	16.10
Total	118	100
Duration of smoking		
1-25 years	50	78.13
26-50 years	14	21.87
Total	64	100

Patients attending the OPD during the study period constituted the sampling frame. Each patient was assigned a sequential registration number at entry. A computer-generated randomization sequence was applied, and participants corresponding to odd-numbered allocations were enrolled. This approach ensured objective participant selection and reduced the possibility of selection bias. Written informed consent was obtained from all participants. Data were collected by using self-administered questionnaire. The questionnaire was given to each participant by the principal investigator (ZM). Data collection was conducted three times a week over two-hour sessions, the average time of filling the questionnaire was 9.56 ± 1.79 minutes. After collection of data those participants who willing to quit tobacco were referred to the Tobacco Cessation Centre, while others were sensitized about the health benefits of quitting.

Statistical analysis

The collected data were coded and entered into Microsoft Excel 2021 and analyzed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the sociodemographic characteristics of the participants and to calculate the proportions related to knowledge of tobacco-related health hazards, awareness, perception, and the impact of PHWs on tobacco products. Multivariate logistic regression analysis was adjusted for independent predictors (categorical variables) such as age (<40 years vs >40 years), gender (male vs female), SES (upper class vs lower class), and tobacco consumption status (no habit vs tobacco habit) on dependent variables: (1) imagining health harms after viewing PHWs (Yes vs No), and (2) feeling worried about health after seeing PHWs (Yes vs No). The goodness-of-fit of the logistic regression model was assessed using the Hosmer–Lemeshow test. Odds ratios (OR) with 95% confidence intervals (CI) were calculated, and a P-value of <0.05 was considered statistically significant.

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Ethical clearance and permission

The study received ethical approval from the Institutional Ethics Committee of Government Dental College and Hospital, Ahmedabad (IEC GDCH/PHD.4/2025), and permission for data collection was obtained from the Department of Oral Medicine and Radiology. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from the willing participants after explaining the purpose and method of study in a language best known to them (Gujarati/Hindi).

Results

A total of 210 participants were enrolled in the present study. The age of participants ranged from 18 to 79 years, with a mean age of 43.06 ± 14.50 years. Most participants (38.57%) belonged to the 34-49 years age group. Most of the respondents were male (85.24%). More than half (56.19%) belonged to the upper lower class. Detail of demographic characteristics of study participants is presented in Table 1.

Table 2 shows a total of 61.43% participants were current tobacco users. Among 157 tobacco users, 59.24% used smokeless tobacco. Most users had a habit duration under 25 years 83.90% for smokeless tobacco and 78.13% for smoking. Most participants (64.29%) perceived physical health hazards as the most common consequence of tobacco use, most participants (91.90%) reported that tobacco causes serious illness, among those who believed tobacco causes serious illness, the majority identified cancer (90.16%) as the most common health-related problem associated with tobacco use.

Table 3. Responses of the participants regarding awareness of Health warning and on tobacco products

Questions	Frequency (n)	Percentage (%)
1.What is the first thing you notice on tobacco packages?		
Brand name	68	32.38
Design	10	4.76
Health warning	115	54.76
Price	5	2.38
None	12	5.71
2. Have you ever noticed health warning on tobacco packages?		
Yes	197	93.80
No	13	6.20
3. If yes, which type of health warning/s you noticed on tobacco packages?		
Pictorial health warning	67	34.00
Text messages	-	
Both	130	66.00
4. Are you aware of any rules and regulation on pictorial health warning laid by the government?		
Yes	26	13.20
No	171	86.80

Table 3 shows the response of the participants regarding awareness of Health warning and on tobacco products, where more than half (54.76%) reported the health warning as the first noticed feature on tobacco packaging. Overall, 93.80% were aware of health warnings, with 34.00% noticing only pictorial warnings and 13.20% aware of government regulations on PHWs. Furthermore, among 197 participants who noticed PHWs, 92.90% identified oral cancer as the most depicted harm. While 69.04% imagined the health harms and 67.00% worried for their health, only 8.63% took time to understand the warnings. Though responses were mixed on whether PHWs hamper tobacco use. Detail of the participants responses regarding perception of PHWs on tobacco products is presented in Table 4.

Table 5 shows participants responses regarding impact of PHWs on tobacco products, where out of the 197 participants, 116 were tobacco users. Among them, 55.17% expressed a willingness to quit the habit after viewing the warnings. Of those, 42.19% had attempted to quit more than twice in the past year. Additionally, 65.99% reported encouraging their peers to quit tobacco use by showing them the PHWs.

Multivariate logistic regression analysis showed that current tobacco users had significantly higher odds of imagining health harms (OR = 3.61; 95% CI: 1.73–7.53; $p < 0.001$). The model demonstrated acceptable fit (Hosmer–Lemeshow $\chi^2 = 2.07$, df = 7, $p = 0.95$) with a Nagelkerke R^2 of 0.15 indicating moderate explanatory power and stable estimates. Similarly, current tobacco users had significantly higher odds of worried about

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their health (OR = 3.71; 95% CI: 1.81–7.59; $p < 0.001$) after viewing PHWs. The model demonstrated acceptable fit (Hosmer–Lemeshow $\chi^2 = 2.30$, df = 7, $p = 0.94$) with a Nagelkerke R^2 of 0.14 indicating moderate explanatory power and stable estimates. Detail of multivariate logistic regression analysis for perception of PHWs is presented in table 6.

Table 4. Responses of the participants regarding perception of PHWs on tobacco products

Questions	Frequency (n = 197)	Percentage (%)
1.If you see pictorial health warning, which of the following is the most common health harms had you notice?		
Oral cancer	183	92.90
Throat cancer	7	3.55
Lung cancer	7	3.55
2. Do you imagine the health harms after seeing pictorial health warning?		
Yes	136	69.04
No	61	30.96
3. Do you worry about your health after seeing pictorial health warning?		
Yes	132	67.00
No	65	33.00
4. Have you noticed pictorial health warning with text messages?		
Yes	130	65.99
No	67	34.01
5. If yes, how you can read the text warnings? (n=130)		
Can not read	-	-
Read little bit	1	0.77
Read clearly	129	99.23
6. Do you spend time in understanding pictorial health warning?		
Yes	17	8.63
No	180	91.37
7. Do you think pictorial health warning hampers you for using tobacco?		
Yes	98	49.75
No	99	50.25
8. Do you think tobacco packets requires pictorial health warning to be displayed?		
Yes	175	88.83
No	22	11.17
9. If yes, how much portion of packet should have health warning? (n=175)		
Full	165	94.29
Half	10	5.71
10. Do you wish to know more about pictorial health warning?		
Yes	24	12.18
No	173	87.82

Discussion

Pictorial health warnings are more effective than text alone in communicating the health risks of tobacco use, especially in a country like India with diverse linguistic and literacy profiles (Talreja et al., 2016; Naik et al., 2023). As per WHO-FCTC guidelines, PHWs covering at least 50% of tobacco packs can influence quitting behavior (Ministry of Law and Justice, Government of India, 2003). In India, the 2014 amendment to the COTPA Rules mandates 85% coverage (60% pictorial and 25% text) on both sides of tobacco packs, effective from April 2015 (Ministry of Health and Family Welfare, Government of India, 2014).

Physical hazards were the most identified health risks (64.29%), likely due to the clear pictorial warnings depicting conditions like cancer and lung disease. Total 91.90% of participants believed tobacco causes serious illness, among them 90.16% specifically identifying cancer as the most common health risk. This likely reflects the strong and widely recognized association between tobacco use and cancer compared to other health issues (Kulothungan et al., 2024).

In the present study, 93.80% of participants reported being aware of and having noticed PHWs on tobacco products, which is notably higher than the 39.50% awareness reported in a rural Puducherry study (Majumdar et al., 2017). Awareness rates across India show wide variation, ranging from 39.50% to 97.50%, likely due to differences in demographic factors and study settings (Talreja et al., 2016; Majumdar et al., 2017; Karinagannanavar et al., 2011; Kumar et al., 2018; Vanishree et al., 2017; Gupta et al., 2022). Interestingly, 6.20% of users had not noticed the warnings, possibly as a psychological coping mechanism to avoid guilt or due to habituation over time (Hassan et al., 2020).

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Total 66% of participants noticed both PHWs and text warnings, while 34.00% noticed only PHWs findings comparable to Gupta VK et al., (2022) where 56.5% noticed both and 32.5% only PHWs. However, 86.80% were unaware of the regulations governing PHWs, highlighting a significant gap in public awareness (Verma et al., 2023). This lack of knowledge suggests weaknesses in current communication strategies, emphasizing the need for stronger public education and policy efforts to improve awareness and the effectiveness of tobacco control measures (Tan et al., 2022).

Table 5. Responses of the participants regarding impact of PHWs on tobacco products

Questions	Frequency (n)	Percentage (%)
1. Do you want to quit your habit after seeing pictorial health warning? (n=116)		
Yes	64	55.17
No	52	44.83
2. In last one year, after seeing pictorial health warning how many attempt/s you made to quit your habit? (n=64)		
Never	3	4.69
One time	9	14.06
Two times	25	39.06
More than 2 times	27	42.19
3. After seeing pictorial warning did you advise your peer to quit the habit by showing the pictorial health warning? (n=197)		
Yes	130	65.99
No	67	34.01

In this study, 69.04% of participants imagined health harms and 67.00% worried about their health after viewing PHWs, indicating their effectiveness in raising awareness. However, only 8.63% took time to understand the warnings, which is significantly lower than the 66.30% reported by Talreja K et al (2016). This may be due to denial, cultural beliefs, or reduced risk perception (Hammond et al., 2004). Additionally, only 49.35% believed PHWs hamper tobacco use, possibly due to desensitization, cognitive dissonance, or addiction (Noar et al., 2016). Strengthening educational campaigns and community engagement is essential to improve PHW effectiveness. Only 24 (12.18%) of the 197 participants showed interest in learning more about PHWs. This is significantly lower than the 87.6% reported in a study by Talreja K. et al (2016). Variations may be due to differences in demographics and literacy levels.

Table 6. Multivariate logistic regression analysis for perception of PHWs

Variables		OR	95% CI	p-value
For imagination of health harms after seeing PHWs				
Age	<40 yrs	1		
	>40 yrs	0.86	0.44-1.67	0.65
Gender	Female	1		
	Male	0.38	0.10-1.45	0.16
Socio-economic status	Upper class	1		
	Lower class	1.20	0.60-2.38	0.60
Status of tobacco consumption	No habit	1		
	Tobacco habit	3.61	1.73-7.53	<0.001**
Constant		3.36		0.12
For worried about health after seeing PHWs				
Age	<40 yrs	1		
	>40 yrs	1.04	0.54- 2.00	0.90
Gender	Female	1		
	Male	0.49	0.15- 1.66	0.25
Socio-economic status	Upper class	1		
	Lower class	1.17	0.60- 2.32	0.64
Status of tobacco consumption	No habit	1		
	Tobacco habit	3.71	1.81- 7.59	<0.001**
Constant		2.17		0.28

Among 116 current tobacco users, 64 (55.17%) wanted to quit after seeing PHWs. This rate is lower than those reported by Talreja K et al. (2016) 77.3%, Kumar A et al., (2017) 70.70% and Shah VR et al., (2013) 66.00%, but higher than Karinagannanavar A et al., (2011) 14.5%. The desire to quit observed in more than half of the participants suggests that PHWs function effectively as motivational triggers. This finding can be better understood through the Transtheoretical Model (TTM) of behavior change proposed by Prochaska and DiClemente. According to this model, individuals progress through stages precontemplation, contemplation, preparation, action, and maintenance while attempting to modify addictive behaviors. PHWs primarily act as

external cues that increase risk perception and emotional arousal, thereby shifting individuals from the precontemplation stage (no intention to quit) to the contemplation stage (considering quitting). However, merely moving to contemplation does not guarantee successful cessation. Despite the desire to quit, many failed due to nicotine dependence, psychological factors, and lack of support (Benowitz, 2010). This highlights the common intention behavior gap in tobacco cessation. Progression from contemplation to preparation and action stages requires structured, stage-matched interventions. Evidence suggests that combining behavioral counseling, motivational interviewing, and pharmacological therapies such as nicotine replacement therapy significantly improves quit success rates (McLaughlin et al., 2015).

Tobacco users perceive greater health risks from PHWs due to their personal relevance. This relevance creates cognitive dissonance and increases emotional impact (Brewer et al., 2016). As a result, users are 3.71 times more likely to report health concerns after viewing PHWs. The graphic content makes the warnings feel more real and alarming. It intensifies fear and vulnerability, especially among current users. Considering these findings, professional-level interventions, including accessible, affordable, and widely available tobacco cessation services, should be prioritized alongside strengthened government initiatives such as public awareness campaigns, stricter regulatory measures (including higher taxation and advertising restrictions), and sustained investment in cessation programs. Policymakers and key stakeholders should also enhance communication strategies to improve public understanding of the importance and regulations of pictorial health warnings (PHWs). An integrated and coordinated effort between healthcare professionals and government agencies is essential to effectively reduce tobacco use, support cessation efforts, and promote overall public health.

This study employed a robust methodology with an adequate sample size, enhancing the reliability of its findings. However, the cross-sectional design limits causal inference, and the single-center setting may affect generalizability. Future longitudinal studies across diverse settings are recommended for more representative results. Further limitation of this study is the exclusion of illiterate participants. Although PHWs are intended to overcome literacy barriers, data collection in the present study relied on self-administered written questionnaires to reduce interviewer-induced bias. Future studies should consider incorporating structured interviewer-administered surveys, audio-assisted questionnaires, or visual-aided response scales to ensure the inclusion of low-literacy populations, thereby improving the comprehensiveness and external validity of the findings.

Conclusion

In conclusion, there was a favorable perception and positive impact towards quitting the tobacco habit. Although perception is favorable there is lack of awareness about rules and regulation of PHWs, hence, there is a need to sensitize the public through the awareness campaigns.

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