

Warning Signs and Communication Effects: The Influence of Pictorial Health Warnings on Smoking-Related Knowledge, Attitudes, and Practices among Student Athletes

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ABSTRACT

INTRODUCTION: Pictorial health warnings (PHWs) on cigarette packaging are a widely recognised tobacco control strategy that aims to increase awareness of smoking-related health risks and discourage tobacco use. Although PHWs have demonstrated effectiveness in the general population, evidence regarding their impact on athletic populations remains limited. This study examined the relationship between responses to pictorial health warnings on cigarette boxes (PHWCB) and smoking-related knowledge, attitudes, and practices (KAP) among university student athletes. **MATERIALS AND METHODS:** A cross-sectional study was conducted among 68 university student athletes selected through convenience sampling. Data were collected using a self-administered online questionnaire assessing participants' cognitive and emotional responses to PHWCB and their smoking-related KAP. Descriptive statistics and Spearman's rank correlation were used to analyse the associations between PHWCB responses and KAP. **RESULTS:** Significant positive correlations were found between PHWCB responses and smoking-related knowledge ($p < 0.05$) and attitudes ($p < 0.05$), indicating that stronger responses to PHWCB were associated with greater awareness of smoking hazards and more negative attitudes toward smoking. However, no significant association was observed between PHWCB responses and smoking practices ($p > 0.05$). PHWCB effectively enhanced knowledge and influenced attitudes toward smoking but did not significantly affect smoking practices among student athletes. This intention-behaviour gap may be explained by factors beyond awareness, including social influences, nicotine dependence, and athlete-specific motivations. **CONCLUSION:** PHWCB improves smoking-related knowledge and attitudes but has limited influence on smoking behaviour among university student athletes. Athlete-specific tobacco control interventions emphasising the immediate effects of smoking on physical performance are recommended.

Keywords

anti-smoking campaign, athletes, cigarette box, KAP, pictorial health warning

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INTRODUCTION

Tobacco smoking remains a major global public health concern, affecting individuals across diverse populations, including athletes. The World Health Organisation (WHO) reports that tobacco use is the

leading preventable cause of death worldwide, killing well over 8 million people each year.^{1,2} There were about 1.25 billion people aged 15 and up who used tobacco in 2022.³ In Malaysia, the Ministry of Health revealed that

the Malaysian National Health and Morbidity Survey⁴ found a smoking prevalence of 19% among adults over 15 years old, which includes 35.7% of males and 0.9% of females, while the prevalence of vaping was 5%.⁴

Athletes, despite their active lifestyles and knowledge of health's importance, are susceptible to the temptations of smoking, especially to relieve competitive anxiety and stress from expectations of their team and fans. Studies have shown that smoking prevalence among athletes varies across different sports and countries, with some athletes using tobacco products to manage weight, stress, or as a social habit.⁵ Although the epidemiology of smoking among athletes in Malaysia lacks extensive documentation, it remains a significant issue. Smoking among athletes presents unique challenges and behaviours that differ from those in the general population.⁵ These challenges and behaviours are influenced by various factors, including the nature of their sports, social environments, and the specific demands of their profession, especially performance and health awareness, peer influences, stress, coping mechanisms, weight management, cultural role models, policies, and regulations. The study among adolescent athletes found that smoking prevalence was significantly higher among football and basketball players compared with swimmers, who showed the lowest smoking rates.⁶

Differences in smoking prevalence between individual and team sports may be explained by variations in perceived responsibility and performance contribution, with athletes in team sports potentially experiencing less direct accountability for individual performance outcomes compared to those in individual sports.⁶ Malaysia has not extensively studied the effect of PHWs on cigarette boxes among athletes. Athletes, with their heightened awareness of health and body maintenance, might be more responsive to the graphic nature of PHWs.⁷ The warnings could serve as a constant reminder of the potential health risks that could impair their performance and overall well-being. Athletes are supposed to be more worried about smoking because damaged their lungs and affects their peak physical performance. Because of this, pictorial health warnings

(PHWs) may have an even greater effect on athletes' perception that smoking affects their performance and endurance.

Indeed, the social and professional environment of athletes, where health and fitness are paramount, might amplify the impact of PHWs. Peer influence and the need to maintain a certain image could make athletes more susceptible to the messages conveyed by the warnings.⁸ However, further research is needed to understand the specific impact of PHWs on athletes' KAPs in relation to smoking and to tailor interventions that effectively leverage the unique context of athletic communities.⁹

Implementation of pictorial health warnings (PHWs) on cigarette packaging is a strategy adopted by many countries, including Malaysia, to deter smoking. Malaysia has been proactive in implementing policies and interventions to achieve the Tobacco Endgame, particularly through the use of Pictorial Health Warnings (PHWs) on cigarette packaging. Malaysia introduced PHWs in 2009, and these warnings have since been revised to include more graphic images and messages in line with the Framework Convention on Tobacco Control (FCTC) guidelines.¹⁰ These warnings feature graphic images and strong messages to convey the health risks associated with smoking.^{11,12} Designed to be highly visible, the PHWs occupy at least 40% of the principal display areas of cigarette packs.

Pictorial health warnings have been established as a cost-effective tool for educating the public about the dangers of smoking, demonstrating superior comprehensibility compared to text-only warnings in raising awareness about the health consequences of tobacco consumption.¹³ Relative to text-only warnings, pictorial labels garner stronger cognitive and emotional reactions, eliciting more negative pack attitudes and smoking attitudes while effectively increasing intentions to quit.¹⁴ Despite these established benefits, the efficacy of health warning labels varies significantly across different demographics and cultural contexts, with specific evidence suggesting that young adults may respond

differently to standardised messaging due to unique social motivations and risk perceptions.¹⁵

In contrast, the effectiveness of these PHWs in influencing knowledge, attitude, and practice towards smoking habits has been reported in studies.^{16–18} A study by the Institute of Public Health (IPH) explored the impact of PHWs on cigarette boxes among Malaysian adults.¹⁸ The findings indicated that the majority of respondents noticed the PHWs, and there was a significant association between exposure to PHWs and increased knowledge about the health risks of smoking. The study also found that PHWs were more effective in influencing non-smokers' attitudes towards avoiding smoking than smokers.¹⁶ However, the practice of smoking was less affected, suggesting that while PHWs can raise awareness,^{14,18} There may not be sufficient evidence to change behaviour among established smokers,¹⁹ while another study shows a significant reduction in tobacco consumption.¹⁵

The effect of pictorial health warnings (PHWs) on cigarette packages in shaping smoking-related knowledge, attitudes, and behaviours among athletes in Malaysia has received limited attention. Evidence from the general population may not fully reflect the experiences of athletes, who may face different levels of performance demands, competitive stress, and sport-related environments. Thus, it is important to examine how PHW interventions affect athletes. Understanding their responses to these warnings can help determine whether current tobacco control strategies are effective for this group. Such evidence is important to guide the development of more targeted approaches to support smoking cessation and reduce smoking among athletes in Malaysia.

MATERIALS AND METHODS

Study design

We employed a cross-sectional study design to investigate the relationship between PHWs and KAP related to smoking among university athletes.

Sampling method

A convenience sampling method was used to recruit participants. This non-probability sampling technique involved selecting participants who were willing to participate in the study.

Participants' characteristics

They must be current UiTM Shah Alam students and athletes at least at the university level before or during the data collection. We collected the data from January 2024 to August 2024.

Study procedures

We initiated this study after receiving ethical approval from the Faculty of Sport and Recreation (FSR) ethical committee (FREC/04/2023/ (UG/MR/ 0146). We collected data by distributing a structured questionnaire via an online survey platform (Google Forms). The questionnaire consists of consent to participate, demographic details, and PHW and KAP questionnaires in Malay.

Study instruments

This study used the PHW and KAP questionnaires.¹⁷ The PHW Questionnaire consists of 22 items designed to assess various aspects of feeling fear (3 items), warning credibility (7 items), influence on perception (7 items), and picture content (5 items). Each item is rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The PHW questionnaire has been validated with a Cronbach's alpha of more than 0.80.¹⁷ For KAP, questions were adapted from a previous study.²⁰ The questions were translated into the Malay language by an expert. The questionnaire contains 10 items to measure knowledge, 5 items to measure attitude, and 5 items to measure practice.

Data screening and cleaning

A total of 134 responses were collected. After screening the inclusion criteria, 68 university student-athletes were included in the final analysis.

Statistical analysis

The data were analysed using IBM SPSS Statistics version 30. Descriptive statistics were used to summarise the study variables. Spearman's rank correlation coefficient was used to examine the associations between pictorial health warnings (PHW) and knowledge, attitude, and practice (KAP). The Mann–Whitney U test was performed to compare PHW and KAP domain scores between smokers and non-smokers. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 68 university athletes participated in the study, with most being male (69.1%), aged 18–25 years, and from the Faculty of Sports and Recreation (FSR). Nearly half (44%) were pursuing a bachelor's degree, while the rest had diploma or lower qualifications. Most participants were non-smokers (66.2%), whereas 33.8% were smokers. The majority competed at the national level. Participant characteristics are presented in Table I.

Table I. Participants' characteristics

Demographic	n(%)
<i>Gender</i>	
Male	47(69.1)
Female	21(30.9)
<i>Age</i>	
18-21	28(41.2)
22-25	28(41.2)
26-29	10(14.7)
>30	2(2.9)
<i>Races</i>	
Malay	50(95.6)
Indigenous Malay	3(4.4)
<i>Faculties</i>	
Sport science	40(58.8)
Non-sport science	28(41.2)
<i>Education level</i>	
SPM	5(7.4)
Matriculation/A level	2(2.9)
Diploma	30(44.1)
Degree	30(44.1)
Other	1(1.5)
<i>Smoking status</i>	
Smoker	23(33.8)
Non-smokers	45(66.2)
<i>Highest Competitive Level</i>	
University level	16(23.5)
National level	48(70.6)
International level	4(5.9)

Table II. The PHW domains showed moderate responses, with mean scores ranging from 2.57 to 3.21, indicating varying perceptions of fear, credibility, influence, and picture content. For KAP, participants demonstrated relatively higher mean knowledge (3.47)

and attitude levels (3.37), while practice scored lower (2.15).

Table II. Domain characteristics for PHW and KAP

Measures	Domain	Mean (SD)
PHW	Feeling Fear	
	Smoker	1.84 (0.92)
	Non-smoker	3.06 (0.87)
	Warning Credibility	
	Smoker	2.80 (0.82)
	Non-smoker	3.42 (0.59)
	Perception of influence	
	Smoker	2.88 (0.88)
	Non-smoker	
	Picture Content	
KAP	Smoker	2.86 (0.99)
	Non-smoker	3.19 (0.70)
	Knowledge	
	Smoker	3.21 (0.61)
	Non-smoker	3.60 (0.45)
	Attitude	
	Smoker	3.05 (0.60)
	Non-smoker	3.53 (0.59)
	Practice	
	Smoker	2.25 (0.34)
	Non-smoker	2.11 (0.58)
	Perception of influence	
	Smoker	1.96 (0.96)
	Non-smoker	2.88 (0.88)
	Picture Content	
	Smoker	2.86 (0.99)
	Non-smoker	3.19 (0.70)

Table III shows correlations between the PHW domains and KAP. Knowledge was significantly positively correlated with all PHW domains ($p < 0.05$). Attitude was significantly correlated with all except picture content. No significant correlations were found between any PHW domain and practice

Table III. Correlation between PHW and KAP

	Feeling fear	Warning credibility	Perception on Influence	Picture content
PHW				
KAP				
Knowledge	$r = 0.390^*$	$r = 0.570^*$	$r = 0.452^*$	$r = 0.456^*$
Attitude	$r = 0.447^*$	$r = 0.432^*$	$r = 0.385^*$	$r = 0.220$
Practice	$r = -0.097$	$r = -0.102$	$r = 0.147$	$r = -0.017$

* $P < 0.05$ = significant difference

Table IV compares pictorial health warning (PHW) domains between smokers and non-smokers using the Mann–Whitney U test. Significant differences were found for fear, warning credibility, perception of influence, knowledge, and attitude, with non-smokers reporting higher mean ranks than smokers ($p < .05$). Fear showed the largest effect size ($r = 0.57$). In contrast, no

significant differences were observed for picture content ($p=.202$) or practice ($p=.793$).

Table IV. Mann-Whitney test between smoking athletes and non-smoking athletes

Variables	Smoking status	Mean Rank	Median (IQR)	Mann-Whitney (U)	Z	p-value	Effect size (r)
Fear	Smoker	19.15	2.00(1.00)	870.50	4.704	<0.001	0.57
	Non-smoker	42.34	3.00(1.50)				
Warning Credibility	Smoker	23.96	3.00(1.00)	760.00	3.207	0.001	0.39
	Non-smoker	39.89	3.42(1.00)				
Perception of influence	Smoker	22.00	2.00(1.17)	805.00	3.742	<0.001	0.45
	Non-smoker	40.89	3.00(1.33)				
Picture Content	Smoker	36.66	3.00(1.33)	614.50	1.275	0.202	0.15
	Non-smoker	30.28	3.16(1.25)				
Knowledge	Smoker	25.61	3.00(1.10)	722.00	2.732	0.006	0.33
	Non-smoker	39.04	3.80(0.95)				
Attitude	Smoker	25.26	3.00(1.00)	730.00	2.843	0.004	0.34
	Non-smoker	39.22	3.80(1.00)				
Practice	Smoker	35.37	2.20(0.60)	497.50	-0.263	0.793	0.03
	Non-smoker						

DISCUSSION

Health information improves health literacy and helps people understand the risks of smoking. Studies have shown that pictorial health warnings (PHWs) on cigarette packages increase awareness and knowledge of the harmful effects of smoking. In Malaysia, most people noticed PHWs, which were associated with greater awareness of smoking-related health risks.¹⁹ Graphic images and strong messages can evoke emotional responses and create negative attitudes towards smoking, as well as prevent smoking initiation among non-smokers and encourage quitting for smokers. Research in Malaysia indicates that PHWs are more effective in influencing non-smokers' attitudes than smokers.¹⁶

Athletes, who are generally more health-conscious and informed about their bodies, may be even more receptive to the information provided by PHWs, potentially leading to heightened awareness of the specific impacts of smoking on athletic performance.²¹ Smokers had significantly lower muscle strength in the

shoulder and lower limb compared to non-smokers, while smokers showed less agility and speed than non-smokers. However, there are no significant differences in muscle endurance and flexibility between the two groups.²¹ Research suggests that these visual warnings enhance awareness of health risks, fostering more negative attitudes towards smoking. Smokers often report heightened motivation to quit, whereas non-smokers tend to perceive smoking as harmful. However, this perception may not significantly influence smoking habits.^{11,16,19} Studies in Malaysia suggest that, although PHWs can raise awareness and negatively influence attitudes, they may not be enough to change the smoking behaviour of established smokers.¹⁸ The study in Indonesia also reported that the same PHW is inadequate to reduce cessation rather than induce desensitisation to the PHW.¹⁵ Athletes who are already smokers may exhibit greater resistance to altering their habits due to nicotine dependence or the social norms prevalent within their sport. However, the distinctive environments of athletes, which emphasise health and performance, could provide additional motivation for them to quit smoking. In addition, smoking among elite athletes has become part of a coping mechanism to help them cope with the high pressure of high-profile competition.⁶

Graphic health warnings can enhance public awareness, encourage cessation, and promote concern about the emotionally charged messages. The value of graphic warnings lies in their ability to make the potential health risks associated with smoking more tangible for the smoker, thereby enhancing the likelihood that they will contemplate taking action to mitigate this risk.¹⁶ In addition, due to our predominantly Malay-Muslim participants and the lack of non-Malay participants in this study, some opinions, i.e., attitudes, may be shaped by participants' sociocultural and religious beliefs.²² The present study showed PHWs have an impact on knowledge and awareness about the harm of smoking, as also reported previously. However, the findings indicate that PHWs were more effective among non-smokers than smokers. Non-smokers reported significantly higher levels of fear, warning credibility,

perceived influence, knowledge, and positive attitudes, with fear showing the largest effect size. In contrast, smokers may be less responsive to PHWs due to cognitive dissonance or optimistic bias, reducing the impact of the warnings.

PHWs failed to influence the practices among athletes; thus, it was similar to the previous study in the general population. The previous study also showed that greater exposure to the truth anti-smoking campaign is significantly associated with reduced intention and current use of e-cigarettes among young people. This study showed that PHWs were positively associated with increased knowledge among participants and awareness about the harms of smoking among athletes, consistent with previous findings.¹⁸ However, similar to patterns seen in the general population, these improvements did not translate into changes in smoking-related practices. Evidence from broader health communication research demonstrates that behavioural change is more likely when individuals experience frequent and repeated exposure to health messages.¹⁴ The anti-smoking campaign showed that higher weekly exposure significantly reduced both intentions and current use of e-cigarettes among young people. Additionally, findings from randomised controlled trials have shown that repeated exposure to graphic health warnings can increase quit-related thoughts and strengthen cessation intentions over time, reinforcing the importance of sustained message repetition.¹⁴

In the context of this study, most participants were non-smokers, meaning their exposure to cigarette boxes, and therefore, to PHWs was minimal. This limited and inconsistent contact with the warnings reduces the likelihood of behavioural influence, helping explain the non-significant relationship between PHWs and practice. Taken together, these findings suggest that while PHWs can effectively shape knowledge and attitudes, meaningful changes in smoking behaviour depend heavily on the frequency, duration, and context of exposure to these health messages. However, we can hypothesise that the insignificant effects due to a few of the existing PHWs were misunderstanding or inability to

understand PHWs deeply or collectively, such as displaying gangrene, premature birth, etc., as reported in a previous study.¹¹ As recommended from an Australian perspective, the issues regarding the design of PHW, such as the usage of pictures and the potential adverse outcome, are very critical.¹⁸ This aspect might be a factor that should be further evaluated in the Malaysian athlete context to relate the PHW to health and performance.

This study also revealed that there was an insignificant difference in the practices between smoking athletes and non-smoking athletes, similar to the previous study by Amirah et al.²³ Mustafa et al. found that good knowledge about the harmful effects of smoking was associated with a low prevalence of tobacco.²⁴ However, a previous study indicated that among medical students who recognised the dangers of smoking, 35.17% still identified as smokers.²⁵ This finding highlights the complexity of smoking behaviour, where awareness alone may not be sufficient to deter individuals from smoking. Therefore, it is essential to implement comprehensive interventions that educate and address the underlying factors contributing to smoking habits among athletes and other populations. Knowledge of smoking was also associated with gender and educational status.^{23,24} Poor knowledge might lead to increased use of cigarettes.²⁶ Thus, it is difficult to conclude that knowledge and attitude can affect the practice in the smoking context either in the general population or in athletes' populations.

Feeling fear, warning credibility, and perception of influence differed significantly between smokers and non-smokers, whereas picture content did not. These findings indicate that non-smoking athletes exhibited significantly higher knowledge and more favourable attitudes towards pictorial health warnings than smoking athletes. In addition, non-smokers reported stronger emotional reactions, greater perceived credibility, and stronger perceived influence of the warning labels.¹² In addition, a study conducted in Cyprus found that smokers rarely noticed the pictorial health warnings (PHWs) on cigarette packages, although approximately 59.4% considered the health warnings to be effective.²⁷

Non-smokers manifested more awareness and positive opinions about the warnings. Furthermore, pictures illustrating the most aggressive health conditions became the most effective of the warnings. This study also showed that most smokers were very concerned with the premature birth compared to other health warning pictures. The findings are in support of the role of pictorial warnings as a method of tobacco control and quitting smoking. A similar study found that anti-smoking advertisements create fear toward smoking.²⁸

The findings of this study underscore the superior effectiveness of pictorial health warnings over text-only formats in eliciting adaptive cognitive and emotional responses.²⁹ Specifically, pictorial warnings have been shown to attract and hold attention better while communicating health risks more effectively than text-only alternatives.²⁹ Research indicates that these visual warnings generate greater fear, harm perception, and intentions to quit compared to standard text labels, particularly when themes emphasise specific consequences such as harm to others or comparative risks.³⁰ However, the effectiveness of these warnings is not uniform across all populations, as demographic and cultural factors play a significant role in shaping smoking behaviours and responses to anti-smoking campaigns.^{5,15,31} In China, messages emphasising the harm of second-hand smoke to family members and children received the highest evaluations, particularly in terms of credibility and perceived effectiveness for smoking prevention, and were regarded as more credible by smokers than messages focused on self-harm.³²

Thus, the PHW also needs to consider athletic aspects for targeting athletes or a physically active population. This aligns with evidence from waterpipe and e-cigarette-specific research, which demonstrates that tailored pictorial warnings elicit greater attention, negative affect, and cognitive elaboration than generic text warnings.^{30,33} Such targeted messaging is particularly salient for athletes, who may be more responsive to information highlighting the direct impact of tobacco use on athletic performance and physical capacity rather

than general health outcomes.³⁴ Therefore, interventions that frame tobacco risks in terms of compromised endurance, reduced oxygen efficiency, and slower recovery times may resonate more strongly with this demographic than generic warnings emphasising long-term morbidity or mortality.³⁵

The limitations of the study were acknowledged. First, the sample size was somewhat small because the study was of limited duration, and few responses were excluded during the data cleaning process as participants were not eligible for athletic-level inclusion requirements. Second, the unbalanced distribution of smokers and non-smokers may have created a floor effect and lowered statistical power to detect group differences. This discrepancy is representative of the difficulties of recruiting smokers in athletic populations where rates of smoking are often low. Finally, the generalisability of the findings is limited by the use of a convenience sample drawn from a single institution. The cross-sectional design precluded causal inference and did not allow the intention-behaviour gap to be examined. Future studies should recruit larger and more diverse samples from multiple universities to improve statistical power, identify potential confounders, and improve the generalisability of the findings.

CONCLUSION

Pictorial health warnings on cigarette boxes have the potential to be effective in influencing athletes' knowledge and attitudes, but not their practices, in Malaysia. Thus, these findings were similar to those reported in the general population. The health-conscious nature of athletes and the emphasis on performance in their professional and social environments could make them particularly receptive to PHWs' messages. However, further research is needed to understand the specific impact of PHWs on athletes and how it would affect practices towards smoking cessation. Further exploration is necessary to develop targeted interventions that leverage the unique context of athletic communities.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

INSTITUTIONAL REVIEW BOARD (ETHIC COMMITTEE)

This study obtained ethical approval from the Universiti Teknologi MARA (UiTM) Ethics Committee (Approval No. FERC/04/2023/(UG/MR/0146)).

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