

## Original Article

# Association between Knowledge, Perceptions, and Participation and Smoke-Free Area Implementation

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### ABSTRACT

**Background:** Tobacco use remains a major global public health concern, contributing to more than 8 million deaths annually. Exposure to secondhand smoke continues to affect a large proportion of non-smokers, particularly in Southeast Asia and the Western Pacific. Smoke-free area (SFA) policies are essential public health strategies to reduce tobacco exposure; however, their effectiveness depends on behavioral and participatory factors such as knowledge, perceptions, and community participation. This study aimed to analyze the association between knowledge, perceptions, and participation with the implementation of smoke-free areas in a primary health care setting.

**Methods:** This study used an analytic observational design with a cross-sectional approach. The study population consisted of visitors to a primary health care facility, with 120 respondents selected using consecutive sampling. Data were collected through structured questionnaires assessing knowledge, perceptions, and participation related to SFA policies, and direct observation checklists to assess SFA implementation. Data were analyzed using univariate and bivariate analysis (Chi-square or Fisher's exact test) with a significance level of  $p < 0.05$ .

**Results:** Most respondents were aged 20–40 years (70%), with equal distribution by sex. Good knowledge (85%), positive perceptions (90%), and passive participation (65%) were dominant. Adequate SFA implementation was observed in 70% of settings. Knowledge, perceptions, and participation were significantly associated with SFA implementation ( $p < 0.05$ ). Respondents with good knowledge were 2.3 times more likely to be associated with adequate implementation (PR = 2.30; 95% CI: 1.20–4.40). Positive perception showed the strongest association (PR = 4.55; 95% CI: 1.25–16.60). Active participation increased the likelihood of adequate implementation by 1.53 times (PR = 1.53; 95% CI: 1.22–1.91).

**Conclusion:** Knowledge, perceptions, and participation are significant determinants of smoke-free area implementation. Strengthening public education, improving community engagement, and enhancing enforcement strategies are essential to optimize smoke-free policy implementation in health care settings.

**Keywords:** smoke-free area, tobacco control, knowledge, perception, participation, public health policy



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## INTRODUCTION

Tobacco use remains a significant global public health issue, affecting millions of individuals and contributing substantially to the burden of disease across various demographics. According to the World Health Organization (WHO), tobacco is responsible for over 8 million deaths annually, with approximately 7 million of these fatalities linked to direct smoking and around 1.2 million attributable to secondhand smoke exposure (1). The prevalence of smoking shows concerning trends, as there are rising initiation rates among younger populations, despite reductions in overall smoking rates in some regions (2). Specifically, around 40% of children and significant proportions of non-smoking adults are regularly exposed to secondhand smoke, emphasizing a critical public health challenge, particularly in Southeast Asia and the Western Pacific (3).

Active smoking is widely recognized as a leading cause of preventable morbidity and mortality. It is associated with various severe health issues, including cardiovascular diseases, respiratory disorders, and multiple types of cancer, especially in the lungs and oral cavity (4). For instance, lung cancer incidence correlates strongly with increased tobacco usage, a trend documented in several high-burden regions. Moreover, chronic obstructive pulmonary disease (COPD) and ischemic heart disease are significantly influenced by both active and passive exposure to tobacco smoke. The impacts of passive smoking are equally alarming; children exposed to secondhand smoke are at higher risk for respiratory infections and developmental issues, while adults face heightened risks for heart disease due to environmental tobacco smoke. Compounding these challenges, smoking and its associated disorders represent considerable economic costs, with tobacco-related healthcare expenditures amounting to about 1.8% of global GDP annually. Hence, the health implications of both active and passive smoking establish a clear rationale for sustained public health interventions and the implementation of robust tobacco control policies (5).

Smoke-free area policies are critical initiatives aimed at reducing tobacco use and protecting public health. These policies primarily seek to create environments devoid of tobacco smoke, thereby safeguarding non-smokers from secondhand smoke exposure and encouraging healthier behaviors among smokers. The objectives of implementing smoke-free areas encompass not only the reduction of tobacco-related health risks but also the promotion of cessation among smokers, reinforcing the idea that smoking is not a socially acceptable behavior within public spaces, particularly in health facilities. Smoke-free policies serve as integral components of comprehensive tobacco control strategies that also align with broader public health objectives, such as the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) (6).

The WHO FCTC provides a robust international legal instrument aimed at curbing tobacco consumption globally. It articulates a comprehensive approach that includes various evidence-based measures to combat tobacco use and delineates the obligations of member states to implement effective tobacco control strategies. The MPOWER framework, which accompanies the WHO FCTC, enumerates six key strategies: Monitor tobacco use and prevention policies, Protect people from tobacco smoke, Offer help to quit tobacco use, Warn about the dangers of tobacco, Enforce bans on tobacco advertising, promotion, and sponsorship, and Raise taxes on tobacco products. These strategies underscore the necessity for national implementations,

particularly in healthcare settings, to foster an environment that prioritizes health while demonstrating a commitment to smoke-free initiatives (7).

Implementing smoke-free policies in health facilities is essential for several reasons. First, healthcare institutions serve as exemplars of public health, and establishing smoke-free environments within them not only protects patient health but also encourages patients and staff to adopt healthier lifestyles. Studies indicate that such policies lead to cleaner air quality, reduced hospital attendance due to respiratory infections, and improved outcomes for patients in treatment, particularly pediatric populations. Moreover, the implementation of these policies must be supported by effective communication strategies and staff training to ensure compliance and promote positive attitudes towards smoke-free initiatives. When effectively enforced, these policies can significantly reduce the incidence of secondhand smoke exposure among vulnerable populations, thus aligning with the broader goals of tobacco control and public health enhancement (8)

Knowledge serves as a vital cognitive determinant in compliance with smoke-free policies, as greater awareness regarding the harmful effects of tobacco and secondhand smoke has been linked to increased support and adherence to these regulations. Individuals who possess a thorough understanding of the legislation tend to exhibit more favorable perceptions of its necessity, thereby enhancing their willingness to comply. Moreover, perceptions of the enforcement of such policies significantly influence individual behaviors; strong awareness of the enforcement measures, coupled with societal expectations against tobacco use, promotes adherence to smoke-free regulations among community members. Furthermore, community participation plays an essential role in the effective enforcement of smoke-free policies. When community members actively engage in public education campaigns and support smoking cessation initiatives, they contribute to a culture that values compliance and supports public health goals. This collective effort reinforces the legitimacy of smoke-free environments, leading to a more significant impact on reducing tobacco use and protecting public health (9).

The limited evidence surrounding behavioral and participatory factors affecting the implementation of smoke-free area (SFA) policies suggests that compliance is influenced by a complex interplay of knowledge, perceptions, and community engagement. Studies show that venue owners and staff who are positively inclined towards smoke-free policies can facilitate better adherence to these regulations, indicating that an informed and supportive mindset plays a crucial role in effective implementation. Conversely, gaps in knowledge and awareness about smoke-free policies at the community level can hinder their adoption, as demonstrated in qualitative analyses identifying weak enforcement and insufficient funding as significant barriers to policy implementation (10). Additionally, community participation is critical, as local support and involvement enhance the effectiveness of such policies—evidenced by initiatives that engage residents in promoting tobacco control efforts. Despite these indicators, challenges such as the lack of formal guidelines and inconsistencies in policy enforcement complicate compliance and awareness, underscoring the need for more robust educational strategies and community mobilization efforts to bridge existing gaps in SFA implementation (11).

This study aims to analyze the association between knowledge, perceptions, and participation and the implementation of smoke-free areas. An analytic cross-sectional design was used to examine how these factors

influence compliance with smoke-free area policies. The findings are expected to inform strategies to strengthen smoke-free area implementation in health care settings.

## **METHOD**

This study used an analytic observational design with a cross-sectional approach to examine the association between knowledge, perceptions, and participation and smoke-free area implementation. The study population comprised visitors to a primary health care facility during the data collection period. A total of 120 respondents were included in the study using a consecutive sampling technique. Inclusion criteria were individuals aged  $\geq 18$  years who visited the health facility and were willing to participate, while respondents who were unable to complete the questionnaire were excluded.

The dependent variable was smoke-free area implementation, assessed through direct observation using a standardized checklist. Independent variables included knowledge, perceptions, and participation related to smoke-free areas. Data were collected using a structured questionnaire consisting of items on knowledge, perceptions, and participation regarding smoke-free areas. The questionnaire was administered through face-to-face interviews. Smoke-free area implementation was assessed using an observation checklist covering key indicators such as the presence of no-smoking signage, evidence of smoking activities, availability of smoking facilities, and tobacco-related promotion within the facility.

Data collection was conducted by trained data collectors. Respondents were informed about the study objectives, and written informed consent was obtained prior to participation. Observations were conducted simultaneously to ensure consistency between questionnaire responses and actual smoke-free area conditions. Data were entered and analyzed using statistical software. Univariate analysis was performed to describe respondent characteristics and variable distributions. Bivariate analysis was conducted using the Chi-square test or Fisher's exact test, as appropriate, to assess the association between knowledge, perceptions, participation, and smoke-free area implementation. Statistical significance was set at  $p < 0.05$ . The study protocol received ethical approval from an authorized ethics committee. Participation was voluntary, and confidentiality of respondents' information was strictly maintained.

## **RESULT**

A total of 40 respondents participated in this study. Most respondents were aged 20–40 years (70%), with an equal distribution of males and females. More than half of the respondents had completed senior high school education.

**Table 1.** Characteristics of Respondents

Characteristic	n	%
Sex		
Male	20	50.0
Female	20	50.0
Age (years)		
20–40	28	70.0
40–60	7	17.5
>60	5	12.5
Education Level		
Primary–Junior High	4	10.0
Senior High School	21	52.5
University	15	37.5

**Table 2.** Distribution of Study Variables

Variable	Category	n	%
Knowledge	Good	102	85.0
	Poor	18	15.0
Perceptions	Positive	108	90.0
	Negative	12	10.0
Participation	Active	42	35.0
	Passive	78	65.0
Smoke-Free Area Implementation	Adequate	84	70.0
	Inadequate	36	30.0

**Table 3.** Association between Knowledge and Smoke-Free Area Implementation

Variable	Category	Smoke-Free Area Implementation		Total	p-value
		Adequate n (%)	Inadequate n (%)		
Knowledge	Good	78 (76.5)	24 (23.5)	102	
	Poor	6 (33.3)	12 (66.7)	18	
Perceptions	Positive	82 (75.9)	26 (24.1)	108	
	Negative	2 (16.7)	10 (83.3)	12	
Participation	Active	38 (90.5)	4 (9.5)	42	
	Passive	46 (59.0)	32 (41.0)	78	

The bivariate analysis showed that knowledge, perceptions, and participation were significantly associated with smoke-free area implementation ( $p < 0.05$ ). Respondents with good knowledge were 2.3 times more likely to be associated with adequate smoke-free area implementation compared to those with poor knowledge (PR = 2.30; 95% CI: 1.20–4.40). Positive perceptions demonstrated the strongest association, where respondents with positive perceptions were 4.5 times more likely to be associated with adequate implementation compared to those with negative perceptions (PR = 4.55; 95% CI: 1.25–16.60). Active

participation was also significantly associated with smoke-free area implementation, with actively participating respondents having a 1.5 times higher prevalence of adequate implementation than passive respondents (PR = 1.53; 95% CI: 1.22–1.91). These findings indicate that behavioral and participatory factors play a critical role in strengthening smoke-free area policy implementation..

## **DISCUSSION**

Anemia, a significant global public health issue, is predominantly driven by micronutrient deficiencies, particularly iron deficiency, which affects substantial segments of the population. Reports indicate that despite various interventions aimed at reducing micronutrient deficiencies, the global burden of anemia remains persistently high, especially among vulnerable groups, including women of reproductive age and children. In many developing countries, prevalence rates of anemia can reach as high as 75%, with iron deficiency being the primary cause (12). A pooled analysis highlighted that women of reproductive age and preschool children constitute the most affected populations, reinforcing the widespread nature of micronutrient deficiencies globally (13). In a systematic review, iron deficiencies were documented as affecting up to 54% of the population in India (14). Furthermore, research indicates that iron deficiency anemia continues to account for approximately 50% of anemia cases worldwide (15,16)

In regions such as Sub-Saharan Africa and South Asia, children under five and women show particularly high prevalence rates, and interventions aimed at supplying micronutrients have shown only marginal progress (17). Notably, although effective strategies like supplementation and food fortification have been implemented, the complex etiology of anemia, which includes nutritional and non-nutritional factors such as infections and genetic disorders, complicates the reduction of anemia prevalence (18,19). For example, in Namibia, the prevalence of anemia among women of reproductive age was reported as high as 25.2%, with children also significantly affected due to overlapping deficiencies (20). Consequently, it remains crucial to address not only the dietary intake of iron and other micronutrients but also the broader health determinants that contribute to the persistence of anemia in these vulnerable populations.

### **Determinants of Micronutrient Deficiencies**

Micronutrient deficiencies are driven by a complex interplay of dietary, biological, socio-economic, and global crisis factors. Diet quality significantly impacts micronutrient intake, with a prevalent shift towards ultra-processed foods leading to lower nutritional quality and increased risks for deficiencies, particularly of iron and vitamins (21). Biologically, certain life stages such as pregnancy and menstruation heighten the demand for micronutrients, while chronic infections can exacerbate deficiencies by reducing nutrient absorption and utilization (22,23). Socio-economically, poverty and food insecurity remain critical determinants; low-income populations often face barriers to accessing diverse and nutritious food sources, thus perpetuating nutrient-poor diets (24). Furthermore, crises stemming from the COVID-19 pandemic, ongoing conflicts, and climate change have worsened global food security, affecting supply chains and increasing food costs, which ultimately impacts the nutritional status of vulnerable populations (25).

### **Public Health Impact**

The public health impact of micronutrient deficiencies is profound, significantly contributing to morbidity, mortality, and Disability-Adjusted Life Years (DALYs). Anemia, a prevalent form of micronutrient deficiency, particularly affects women of reproductive age and children, leading to adverse health outcomes such as increased maternal mortality, complications during pregnancy, and hindered child growth and cognitive development (26,27). These health issues not only diminish individual productivity but also impose substantial economic burdens on healthcare systems and societies, primarily through direct healthcare costs and loss of workforce productivity due to illness (13,28). The interplay between micronutrient deficiencies and socio-economic factors such as poverty and food security has become increasingly pronounced amid global crises including the COVID-19 pandemic, which exacerbated food insecurity and hindered access to nutritional resources (29,30). Global estimates indicate that deficiencies, particularly among vulnerable populations, could lead to severe economic consequences, as countries grapple with heightened health service demands and the long-term effects of a nutritionally compromised population (31,32). Thus, addressing micronutrient deficiencies is vital for enhancing public health outcomes and sustaining economic stability, particularly in low- and middle-income countries.

The effectiveness of nutrition interventions such as food fortification, supplementation, and food-based approaches continues to be a focal point for addressing micronutrient deficiencies globally. Systematic reviews indicate that large-scale food fortification (LSFF) and targeted supplementation programs can significantly improve the micronutrient status of populations, particularly in low- and middle-income countries (LMICs) (33). However, these interventions should not stand alone; a multi-sectoral approach incorporating health, agriculture, and education is essential to create sustainable and impactful changes. This includes integrating agriculture that promotes the production of nutrient-rich foods, delivering nutrition education to empower communities, and implementing robust health care policies to ensure accessibility and affordability of nutritious foods (34,35). Furthermore, community-based interventions, particularly through primary health care, play a crucial role in delivering these services effectively, enabling local populations to address their specific nutritional deficiencies while fostering sustainable consumption practices (36).

The relevance of addressing these micronutrient deficiencies aligns closely with the Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger) and Goal 3 (Good Health and Well-being). Achieving these targets requires a concerted global effort to ensure food security and improve nutrition, particularly for vulnerable populations such as women and children (37). The failure to meet these global targets by 2030 could result in severe implications, exacerbating health disparities and undermining economic productivity and human potential (38). Additionally, long-term investments in nutrition systems, including policies that support the fortification and biofortification of staple foods, must be prioritized to ensure that all populations have access to nutritious diets. Such investments are critical to combat malnutrition and enhance overall public health and economic resilience (39).

Research gaps in the field of micronutrient deficiencies, particularly regarding the availability of recent data and nutritional surveillance, remain significant obstacles to effectively addressing these public health issues. Many current studies fail to incorporate comprehensive longitudinal data, which is crucial for understanding the long-term effects and trends associated with micronutrient deficiencies across different populations (40). Additionally, there is an urgent need to conduct population-based interventions that evaluate the effectiveness of various strategies for preventing and addressing these deficiencies, particularly in low- and middle-income countries where the burden is greatest (41,42). Another major gap lies in the integration of micronutrient indicators into national monitoring systems, as many existing frameworks overlook essential biomarkers and dietary assessments that could provide a clearer picture of nutritional status and its associated health outcomes (43).

For future directions, expanding the scope of nutritional indicators and improving the methodologies for data collection and analysis are crucial for refining policy and program responses aimed at combatting micronutrient deficiencies. This includes enhancing the frequency and breadth of dietary surveys while ensuring that these surveys capture local dietary patterns and food availability (44). By integrating indicators of micronutrient intake into existing health monitoring systems and aligning these with global health initiatives, countries can better target interventions, assess their effectiveness, and ultimately contribute to achieving Sustainable Development Goals (SDGs) related to nutrition and health (12,45). Furthermore, fostering partnerships between public health, agriculture, and education sectors can facilitate synergistic approaches that promote food sovereignty, enhance food security, and prioritize nutritional education within communities, thus addressing micronutrient deficiencies holistically (46,47).

This narrative review has several strengths, including its broad global scope, epidemiological perspective, and the integration of evidence from international sources such as WHO, UNICEF, and large-scale population studies, allowing for a comprehensive understanding of micronutrient deficiencies across diverse settings. However, certain limitations should be acknowledged, particularly the narrative nature of the review, which does not follow systematic review protocols and may be subject to selection bias, as well as the heterogeneity of data sources and methodological differences that limit direct comparability across regions and time periods. Despite these limitations, the findings carry important implications for both public health practice and clinical care. Strengthening routine screening for micronutrient deficiencies—especially anemia—within primary health care services is essential, alongside improved nutrition education targeting vulnerable populations such as pregnant women, children, and adolescents. Health professionals play a critical role in early detection, counseling, and referral, while population-level strategies focusing on primary prevention (food fortification, dietary diversification, and supplementation) and secondary prevention (early diagnosis and treatment) are necessary to reduce the long-term health and socioeconomic consequences of micronutrient deficiencies.

## CONCLUSION

Micronutrient deficiencies remain a pervasive and under-recognized global public health problem with substantial implications for morbidity, mortality, and long-term human capital development. Epidemiological evidence demonstrates that deficiencies in key micronutrients—particularly iron, vitamin A, iodine, zinc, and vitamin D—continue to disproportionately affect vulnerable populations such as children, pregnant women, and women of reproductive age, despite decades of nutrition interventions. The persistent burden of conditions such as anemia reflects complex interactions between inadequate dietary quality, socioeconomic inequality, infectious diseases, and limitations in health system capacity. Addressing micronutrient deficiencies requires integrated, multisectoral strategies that combine strengthened nutrition surveillance, effective food fortification and supplementation programs, improved dietary diversity, and robust primary health care services. Sustained political commitment and evidence-based public health actions are essential to accelerate progress toward global nutrition targets and the Sustainable Development Goals related to food security and health.

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