

Short Communications

Organizational, environmental, and sustainability of inputs to the implementation of a smoke-free area policy: A path analysis of Makassar's health facilities

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ABSTRACT

Background: The implementation of smoke-free policies in healthcare facilities represents a critical public health strategy; however, maintaining sustainable compliance remains a challenge globally. While healthcare institutions are expected to exemplify tobacco control measures, the effectiveness of smoke-free policies depends on multiple factors at the institutional and governmental levels. **Objective:** This study aimed to examine the influence of organizational, environmental, and sustainability factors on input indicators for smoke-free area policy implementation in healthcare facilities in Makassar, Indonesia. **Methods:** A quantitative correlational study was conducted across seven healthcare facilities that provide inpatient services. Using random cluster sampling, 232 healthcare workers were selected from a population of 736. Path analysis was employed to evaluate causal relationships between independent variables (organizational, environmental, and sustainability factors) and dependent variables (input indicators, including written policies, monitoring personnel, and promotional media). Data were collected through validated questionnaires and analyzed via structural equation modeling. **Results:** Path analysis revealed that sustainability factors significantly influenced input indicators, particularly written policies (t statistic = 2.592, $p < 0.05$, $\beta = 0.194$). Key sustainability components, including funding stability, partnerships, organizational capacity, program evaluation, adaptation, and strategic planning, have demonstrated positive effects on policy implementation. Organizational and environmental factors had no significant impact on the input indicators. **Conclusion:** Sustainability factors emerged as crucial determinants for the successful implementation of smoke-free policies in healthcare facilities in Makassar city. Future research should investigate the barriers to policy implementation and explore additional input indicators to increase the effectiveness of smoke-free policies.

KEYWORDS

Smoke-free policy; health facilities; policy implementation; environmental health; public health administration; path analysis

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INTRODUCTION

Tobacco consumption remains a critical global public health challenge, representing one of the leading preventable causes of mortality and morbidity worldwide [1–3]. The World Health Organization (WHO) reports approximately six million tobacco-related deaths annually, exceeding the combined mortality from HIV/AIDS, tuberculosis, and malaria [4,5]. Projections indicate that this figure could increase to eight million deaths by 2030, despite the widespread implementation of control policies [6]. The tobacco epidemic presents particular challenges in Indonesia, where annual tobacco-related mortality has reached 225,720 [7]. Global Adult Tobacco Survey (GATS) data reveal minimal progress in reducing tobacco use, with the prevalence decreasing marginally from 36.1% in 2011 to 34.5% (70.2 million people) in 2021 [8]. The gender disparity is stark, with male smokers comprising 65.5% of users compared with 3.3% of female users, making Indonesia the country with the highest male smoking prevalence globally [9].

Indonesia's tobacco control measures remain notably ineffective [10]. As the sole Asian nation yet to ratify the WHO Framework Convention on Tobacco Control (FCTC), Indonesia lacks comprehensive tobacco control frameworks [11]. Research in low- and middle-income countries has demonstrated that robust organizational support, including formal policies and enforcement mechanisms, significantly influences smoking rates and regulatory compliance [12,13]. WHO evidence indicates that comprehensive smoke-free environments represent the only effective protection against tobacco smoke exposure [14]. In Indonesia, Health Law No. 36 of 2009 mandates that local governments establish smoke-free areas, defined as spaces prohibiting tobacco production, sale, advertising, promotion, and use [15,16].

Makassar city's implementation of Regional Regulation No. 4 of 2013 regarding smoke-free areas faces significant challenges, particularly in the healthcare sector [17]. Law No. 44 of 2009 concerning hospitals states that every hospital must enforce the entire hospital environment as a nonsmoking area [18]. While healthcare facilities are mandated to maintain smoke-free environments and serve as model institutions for tobacco control [19,20], compliance remains problematic [21,22]. The GATS data indicate that 14.2% of health facilities continue to permit smoking activities, undermining their role in public health promotion [23]. This study aimed to analyze how organizational, environmental, and sustainability factors influence smoke-free policy implementation in healthcare settings, focusing specifically on input indicators that shape policy effectiveness.

MATERIALS AND METHODS

Study design and setting

This quantitative study employed a correlational design with path analysis to investigate the causal relationships between organizational, environmental, and sustainability factors (independent variables) and input indicators (dependent variables) in implementing smoke-free policies [24]. The study was conducted in Makassar city, Indonesia, under the guidance of Regional Regulation No. 14 of 2013, concerning smoke-free areas. The research focused on health facilities and examined input variables, including written policies, monitoring personnel, and promotional media implementation.

Participants and sampling

The study population included all healthcare workers employed at seven health facilities providing inpatient services in Makassar. These facilities included Makassar City Regional General Hospital and six health centers: Antang Perumnas, Jongaya, Pattingalloang, Tamalate, Jumpandang Baru, and Mamajang. The selection criteria for facilities specifically targeted those offering inpatient services to evaluate potential smoking activities comprehensively. The sample size was determined via specialized health study software, which yielded a sample of 232 respondents. A cluster random sampling technique, a probability sampling method, was employed to ensure proportional allocation across research locations [25]. This approach maintains representativeness while accounting for the organizational structure of healthcare facilities.

Data collection and instrumentation

Data were collected via a structured questionnaire administered to healthcare workers. The questionnaire was designed to assess various determinants of smoke-free area policy implementation, incorporating measures for organizational, environmental, and sustainability factors as well as input indicators.

Validity and reliability assessment

The instrument has been rigorously validated via multiple approaches. The construct validity was evaluated via convergent and discriminant validity tests. The measurement model evaluation required loading factors exceeding 0.70 for each indicator on its intended variable, ensuring adequate convergent validity. The reliability assessment utilized composite reliability metrics, with values above 0.8 indicating high reliability and values above 0.6 suggesting acceptable reliability. Additionally, Cronbach's alpha was calculated to assess response consistency, with coefficients ≥ 0.6 considered good and those ≥ 0.3 deemed sufficient. These comprehensive psychometric analyses confirmed the instrument's robust measurement properties for investigating the determinants of the implementation of smoke-free areas in Makassar's health facilities.

Ethical considerations

This study was conducted after ethical approval was obtained from the Research Ethics Committee of the Faculty of Public Health, Hasanuddin University (Protocol Number: 7722093008, 8123/UN.14.1/TP.01.02/2022). This study adhered to fundamental ethical principles in research involving human subjects. All participants were provided detailed information about the study objectives and procedures before providing their consent. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without any consequences.

Statistical analysis

The analytical approach employed both descriptive and inferential statistical methods via structural equation modeling (SEM). Initial data screening was performed to assess normality, missing values, and outliers. Descriptive statistics were computed to summarize the demographic characteristics of the respondents and the distributions of the key variables. Path analysis, implemented through SEM, was used to test the hypothesized causal relationships between organizational, environmental, and sustainability factors (exogenous variables) and input indicators (endogenous variables) of smoke-free policy implementation.

The model's goodness of fit was evaluated via multiple indices, including the chi-square test, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). Model modification was performed when necessary, guided by theoretical considerations and modification indices. Direct and indirect effects were calculated to assess the strength and significance of the relationships between variables. Standardized path coefficients were estimated to facilitate interpretation of the relative importance of the different factors. Statistical significance was set at $p < 0.05$, and all analyses were conducted via the appropriate statistical software. The final model provided insights into the complex interrelationships among the factors influencing the implementation of smoke-free areas in Makassar city health facilities.

RESULTS

Demographic characteristics of the participants

The study sample comprised 232 healthcare workers from seven facilities in Makassar city. The majority of the respondents (42.7%, $n=99$) were nursing staff, followed by cleaning/security personnel (25.4%, $n=59$) and medical support staff (20.7%, $n=48$). Nearly half of the participants (47.4%, $n=110$) had more than 10 years of service experience. Makassar city hospitals had the greatest workplace concentration (65.9%, $n=153$) of respondents (Table 1).

Table 1. Demographic characteristics of healthcare workers in Makassar city health facilities

Characteristics	n	%
Position/assignment		
Top/middle manager	7	3
Medical services	4	1,7
Nursing	99	42,7
Medical support	48	20,7
General administration	15	6,5
Cleaning/security staff	59	25,4
Length of service		
< 1 Years	37	15,9
1-5 Years	47	20,3
6-10 Years	38	16,4
>10 Years	110	47,4
Workplace health facilities		
Jumpandang Baru Health Center	17	7,3
Mamajang Health Center	14	6
Tamalate Health Center	13	5,6
Jongaya Health Center	14	6
Pattingalloang Health Center	11	4,7
Antang Perumnas Health Center	10	4,3
Makassar City Hospital	153	65,9

Remarks: Data are presented as numbers (percentages). The health facilities included one regional hospital and six health centers providing inpatient services.

Measurement model assessment

This measurement model demonstrated robust psychometric properties. All indicators achieved satisfactory convergent validity, with loading factors ranging from 0.766-1.000, exceeding the threshold of 0.70 (Figure 1). Discriminant validity was confirmed through a cross-loading examination and average variance extracted (AVE) analysis ($AVE > 0.5$).

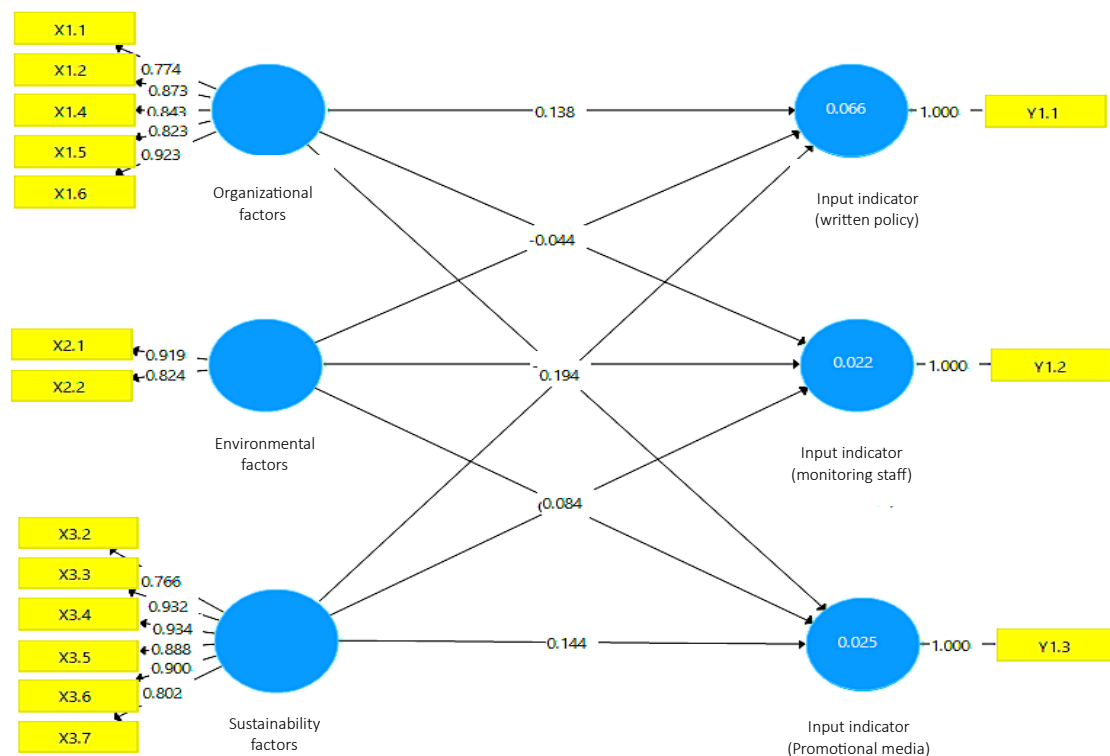


Figure 1. Path diagram showing standardized factor loadings for the measurement model of smoke-free policy implementation. Remarks: Values on paths represent standardized factor loadings. All loadings exceed the 0.70 threshold for acceptable convergent validity.

Reliability analysis

The constructs demonstrated excellent reliability, with composite reliability values ranging from 0.864–1.000, substantially exceeding the standard threshold of 0.80 (Table 2). Specifically, sustainability factors (0.950), organizational factors (0.928), and environmental factors (0.864) all exhibited high internal consistency. The input indicators for the written policy, promotion media, and monitoring personnel achieved perfect reliability scores (1.000).

Table 2. Composite reliability scores for the study constructs

Variables	Composite Reliability
Sustainability factors	0,950
Environmental factors	0,864
Organizational factors	0,928
Input indicator (Written policy)	1,000
Input indicator (Promotion media)	1,000
Input indicator (Monitoring Personnel)	1,000

Remarks: Values above 0.80 indicate high reliability; values above 0.60 indicate acceptable reliability.

Path analysis

Path analysis revealed that sustainability factors were the only significant predictors of input indicators, specifically for written policies ($\beta=0.194$, $t=2.592$, $p=0.010$), see in Table 3. Within the sustainability construct, three components demonstrated particularly strong factor loadings: partnerships (X3.3), organizational capacity (X3.4), and adaptation (X3.6). Neither environmental nor organizational factors had significant direct effects on any input indicator (all $p>0.05$).

Table 3. Path coefficients for direct effects between factors and input indicators

Direct influence	Original Sample	T Statistics	p values
Sustainability factor → Input indicator (Written policy)	0,194	2,592	0,010
Sustainability factor → Input indicator (Promotion media)	0,144	1,831	0,068
Sustainability factor → Input indicator (Monitoring personnel)	0,084	1,020	0,309
Environmental factors → Input indicator (Written policy)	-0,044	0,740	0,460
Environmental factors → Input indicator (Promotion media)	0,067	1,027	0,305
Environmental factors → Input indicators (Monitoring personnel)	-0,032	0,453	0,651
Organizational factors → Input indicator (Written policy)	0,138	1,805	0,072
Organizational factors → Input indicators (Promotion media)	0,035	0,570	0,569
Organizational factors → Input indicators (Monitoring personnel)	0,108	1,582	0,115

Remarks: β represents the standardized path coefficient. Statistical significance was set at $p<0.05$. T statistics >1.96 indicate significant paths.

DISCUSSIONS

The implementation of smoke-free policies in healthcare facilities critically depends on robust partnerships among multiple stakeholders. Partnerships, as one of the constituents of sustainability, require substantial stakeholders from various fields, such as the government, nonprofit organizations, and local communities, to increase support and resources for written policies [26]. Through collaboration, organizations can access information, techniques, and best practices that can be used to strengthen written policies [27]. The effectiveness of multistakeholder engagement is evidenced by research conducted by Folkerth in 2020 in Kentucky, U.S., which revealed that collaborating with academics and community volunteers increased compliance with the region's smoke-free health policy. Community leaders and

advocates were then mobilized to educate City Council members on the benefits of smoke-free policies, with a focus on business, health, and tourism [28].

The collaborative framework established in Makassar demonstrated enhanced policy implementation through integrated support systems and resource sharing mechanisms [6,29,30]. Organizational capacity has emerged as a critical determinant of policy success, encompassing internal capabilities, including human resources, technology, and infrastructure [31]. Well-developed organizational infrastructures facilitate consistent policy implementation and standardization [32]. This finding aligns with comparative research in Cambodia, where significant deficiencies related to health organizational capacity issues resulted in fragmentation and hindered the implementation of social health protection policies, including health equity funds, community-based health insurance, and vouchers [29].

This study highlights the necessity for continuous capacity enhancement, particularly in terms of human resource development and technological infrastructure [33]. Policy adaptation mechanisms have proven essential for sustainable implementation in healthcare settings [34–36]. In Makassar city's health facilities, technological integration facilitates enhanced communication and educational outreach. Health facilities have implemented innovative educational programs through social media, digital posters, and waiting room videos to communicate policy importance, violation consequences, and smoking hazards. This adaptive approach enables proactive policy adjustments and innovative solution development [37].

Public health implications

The robust relationship between sustainability factors and smoke-free policy implementation has significant implications for public health governance and health care management. Healthcare institutions must develop comprehensive capacity-building frameworks that integrate leadership development, resource allocation, and monitoring. Strategic investment is required in three key areas: (1) administrative training programs focused on policy compliance and enforcement; (2) technological infrastructure for monitoring and evaluation; and (3) sustainable funding mechanisms for long-term program maintenance.

Limitations

Although this study provides valuable insights into policy implementation mechanisms, several limitations should be acknowledged. First, the research design did not capture longitudinal health outcomes associated with smoke-free policy implementation, including potential reductions in tobacco-related diseases, such as asthma, chronic obstructive pulmonary disease, and lung cancer. Second, this study did not assess patient satisfaction metrics or healthcare service quality indicators in smoke-free facilities. Future investigations should employ mixed methods approaches to examine both the economic impact of policy implementation and its effects on population health outcomes while considering variable implementation contexts across different healthcare settings.

CONCLUSIONS

This study demonstrated that sustainability factors serve as critical determinants in the successful implementation of smoke-free policies within healthcare facilities in Makassar city. Path analysis revealed significant positive associations between sustainability components, including funding stability, partnerships, organizational capacity, program evaluation, adaptation, strategic planning, and policy implementation effectiveness, particularly for written policies. These findings have important implications for health care facility management and policy development. To enhance smoke-free policy compliance, healthcare facilities should prioritize strengthening their sustainability frameworks, particularly through multistakeholder partnerships with tobacco control policy experts and implementation specialists. Future research should examine the specific mechanisms through which sustainability factors influence policy implementation, with particular attention given to the dynamic interplay between organizational capacity, partnership development, and adaptive policy management in healthcare settings.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision: NII, W, and FP.

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