

Analysis of Factors Influencing Dentists' Compliance with Standard Precautions to Prevent Healthcare-Associated Infections (HAIs) in Community Health Centers of Jember Regency

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ABSTRACT

This study analyzed factors influencing dentists' compliance with standard precautions to prevent Healthcare-Associated Infections (HAIs) in 50 community health centers in Jember Regency. The population consisted of 53 dentists, all included as total samples. Data were collected using questionnaires and observations, then analyzed with Spearman correlation and ordinal logistic regression. Results showed that 77,4% of respondents had good knowledge, 94,3% had high motivation, and 86,8% demonstrated good attitudes, while overall compliance reached 73,6%. Knowledge, attitude, safety climate, facilities, training, and supervision significantly influenced compliance, whereas motivation, perception, and leadership support did not. Knowledge was the most dominant factor (OR=5,9; $p<0,05$), indicating that continuous education and training are crucial to improve infection prevention practices.

INTRODUCTION

Healthcare-Associated Infections (HAIs) remain a significant global health problem, including in Indonesia, as they increase hospitalization duration, treatment costs, morbidity, and mortality. WHO (2022) reports that one in ten patients worldwide suffers from HAIs, with higher prevalence in developing countries (15 per 100 patients) compared to developed countries (7 per 100 patients) (Karmidah et al., 2024). This shows that HAIs are both clinical and public health issues requiring effective prevention strategies. Dentistry is particularly vulnerable due to aerosol-generating procedures, improper sterilization, sharp object injuries, and poor hand hygiene compliance (Yildirim & Atas, 2021; Mustakim, 2020). Dentists are also reported as the group most exposed to occupational injuries among healthcare workers (Palingga et al., 2020).

Standard precautions are the cornerstone of infection prevention, yet compliance among dentists is still low. Studies in South Sumatra and RSIGM UMI showed that only 79.6% and 56.7% of dentists, respectively, fully implemented precautions, including PPE use (Arifin et al., 2021). Compliance is influenced by knowledge, attitude, and risk perception, availability of facilities and PPE, as well as leadership, training, and supervision (Sitorus & Prabawati, 2021; Siringo-Ringo et al., 2025; Azzahra et al., 2025; Palingga et al., 2020). The PRECEDE-PROCEED model emphasizes predisposing, enabling, and reinforcing factors by Green & Kreuter (2005), while the Health Belief Model (HBM) highlights perceptions of susceptibility, severity, benefits, and barriers by Rosenstock (1974). Integrating both frameworks provides a comprehensive approach to explain compliance behavior.

This study focuses on dentists in community health centers (Puskesmas) in Jember Regency, which are the frontline of healthcare services with frequent patient contact, making infection prevention crucial. The research contributes by examining compliance factors in a rarely studied context and by applying an integrated theoretical approach. Practically, the findings are expected to guide the Health Office and Puskesmas in enhancing education, supervision, and infrastructure to improve occupational safety and service quality..

LITERATURE REVIEW

Healthcare-Associated Infections (HAIs)

Healthcare-Associated Infections (HAIs) are infections acquired in healthcare facilities that can affect both patients and healthcare workers (Kementerian Kesehatan RI, 2017). Understanding the chain of infection is essential to prevent disease transmission. The infection chain includes six components: infectious agent (disease-causing microorganisms), reservoir (where the agent survives), portal of exit (pathogen exit route), mode of transmission (how the pathogen spreads), portal of entry (pathway into the host), and susceptible host (individuals with weakened immunity). Interrupting any component can stop the transmission process.

Standard Precautions

Standard Precautions are infection prevention measures applied consistently to all patients regardless of diagnosis, aimed at reducing the risk of disease transmission in healthcare facilities (Kementerian Kesehatan RI, 2017). Key elements include hand hygiene, personal protective equipment (PPE), patient equipment decontamination, environmental cleanliness, waste management, linen handling, healthcare worker protection, patient placement, cough/sneeze etiquette, safe injection practices, and lumbar puncture procedures. Implementing these elements ensures the safety of patients and healthcare workers while minimizing infection spread within healthcare settings.

Compliance

Compliance refers to the extent to which an individual's actions align with established rules, procedures, or instructions (Husain & Santoso, 2022). It consists of three dimensions: belief in the rules, genuine acceptance of the rules, and actual enactment of the rules (Blass, 2000). Compliance is influenced by internal factors such as self-control and psychological conditions, as well as external factors including social environment, policies, and demographics (Brown, 2008; Sprague et al., 2001; Stearns, 2014; Way, 2016). It can be measured through direct observation or evaluation of work outcomes, often using structured questionnaires with clear indicators (Notoatmodjo, 2012).

Health Behavior

Health behavior refers to beliefs, perceptions, and actions individuals take to maintain, restore, or improve their health. It includes preventive, illness, and sick-role behaviors, influenced by predisposing factors (knowledge, education, occupation), enabling factors (facilities, access, cost), and reinforcing factors (environmental support). Key elements involve perceived threat of disease, expected benefits, barriers, cues to action, sociodemographic factors, and self-efficacy, with behavior often measured using questionnaires based on health guidelines (Pakpahan et al., 2021).

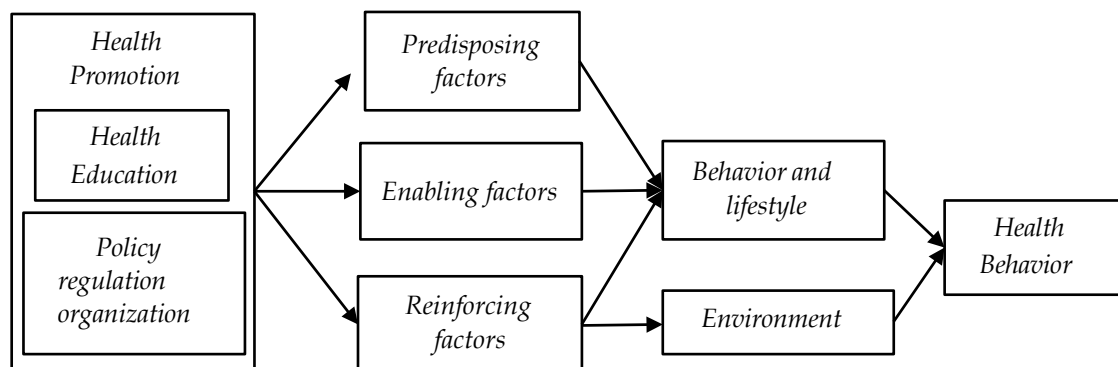


Figure 1. Factors Influencing Behavior According to Lawrence Green
(Pakpahan et al., 2021)

Health Belief Model (HBM)

The Health Belief Model explains health-related behavior through perceptions of susceptibility, severity, benefits, and barriers, along with self-efficacy and cues to action. Developed in the 1950s, the model highlights that preventive behavior is shaped by individual perceptions and modifying factors such as demographics and motivation. Its six components—perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy—provide a systematic framework to understand and predict compliance with health practices (Rosenstock, 1974; Mckellar & Sillence, 2020; Fransiska et al., 2022).

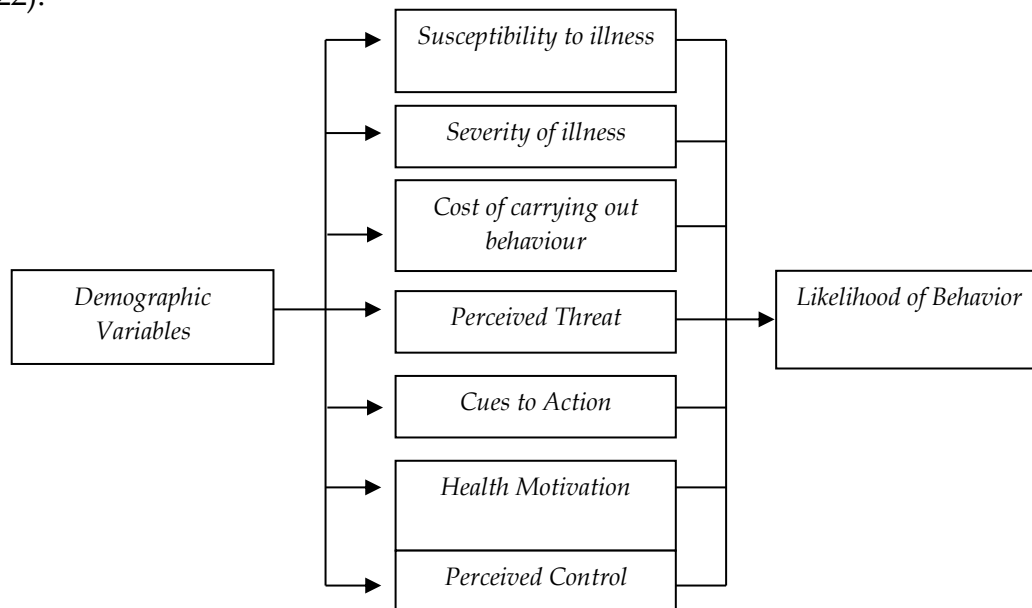


Figure 2. Systematic Overview of the Health Belief Model
(Mckellar & Sillence, 2020)

METHODOLOGY

This study was conducted in 50 public health centers (Puskesmas) across Jember Regency from April to July 2025. The population consisted of all dentists working in these centers (n = 50), who were also the sample. Primary data were collected through questionnaires, interviews, and direct observation, while secondary data were obtained from the Jember Health Office records on dentists. The study procedure included obtaining research permits, pre-testing the questionnaire for validity and reliability, technical socialization via Zoom, distributing the main questionnaire, conducting field observations, and analyzing the data. Data were collected using Likert scales and the Compliance with Standard Precautions Scale (CSPS). Data analysis was performed using SPSS 23.0, including univariate (descriptive), bivariate (Spearman correlation), and multivariate (ordinal regression) analyses to identify factors influencing compliance. Questionnaire validity was confirmed if $r\text{-count} > r\text{-table}$, and reliability was assessed using Cronbach's Alpha (0–1 scale). Ethical considerations included informed consent, anonymity, and confidentiality.

RESEARCH RESULT

Age of Respondents

Age is an important demographic variable that can affect dentists' clinical experience, perceptions, and compliance with standard precautions. Among 53 dentist respondents practicing at community health centers in Jember Regency, the age distribution is presented in Table 1.

Table 1. Age Distribution of Dentist Respondents

No.	Age (years)	Frequency (n)	Percentage (%)
1.	21-30	6	11,3
2.	31-40	17	32,1
3.	41-50	19	35,8
4.	> 50	11	20,8
Total		53	100

Based on Table 1, most dentist respondents were aged 31–50 years (67.9%), indicating a productive professional phase with significant practice experience at Puskesmas. Senior dentists (>50 years) accounted for 20.8%, while the youngest group (21–30 years) comprised only 11.37%.

Respondent Gender

Gender is an important demographic characteristic that can influence work behavior, risk perception, and compliance with standard precautions. Based on data collected from 53 dentist respondents at Puskesmas in Jember Regency, the gender distribution is presented in Table 2.

Table 2. Respondent Distribution by Gender

No.	Gender	Frequency (n)	Percentage (%)
1.	Male	8	15,1
2.	Female	45	84,9
Total		53	100

Based on Table 2, the majority of respondents were female (84.9%), while male respondents accounted for only 15.1%. This proportion reflects the general trend in Indonesia, where the dentistry profession is predominantly female, according to data from the Ministry of Health of the Republic of Indonesia (2023).

Education Level of Respondents

Education level is an important characteristic that can influence knowledge, skills, and the application of safe and standardized dental practices. Based on the data, all respondents (n = 53) had a Bachelor of Dentistry degree. The distribution is presented in Table 3.

Table 3. Respondent Characteristics by Education

No.	Education	Frequency (n)	Percentage (%)
1.	Bachelor (S1)	53	100
Total		53	100

Based on Table 3, all respondents (n = 53) held a Bachelor of Dentistry degree, indicating a uniform educational background that meets the minimum standard required for professional practice in Indonesia.

Respondents' Work Experience

Work experience reflects professional exposure that may influence knowledge, technical skills, and compliance with standard precautions. The distribution is shown in Table 4.

Table 4. Respondent Distribution by Work Experience

No.	Work Experience (Years)	Frequency (n)	Percentage (%)
1.	< 5	11	20,8
2.	6 – 10	9	17,0
3.	11 – 20	22	41,5
4.	> 20	11	20,8
Total		53	100

Based on Table 4, most respondents (41.5%) had 11–20 years of work experience, reflecting stable careers with solid clinical expertise. Equal proportions (20.8%) had <5 years or >20 years of experience, while the smallest group (17.0%) had 6–10 years.

Employment Status of Respondents

Employment status influences job stability, work motivation, and involvement in professional development. Distribution is presented in Table 5.

Table 5. Respondent Distribution by Employment Status

No.	Employment Status	Frequency (n)	Percentage (%)
1.	PNS	47	88,7
2.	PPPK	2	3,8
3.	BLUD Contract	4	7,5
Total		53	100

Based on Table 5, the majority of respondents (88.7%) were civil servants, followed by BLUD contract employees (7.5%) and PPPK staff (3.8%), indicating stable government employment dominance among dentists at Puskesmas.

Knowledge Level of Respondents

Distribution of knowledge level of respondents is presented in Table 6.

Table 6. Respondent Distribution by Knowledge Level

No	Knowledge Category	Frequency (n)	Percentage (%)
1.	Good	41	77,4
2.	Fair	12	22,6
Total		53	100

Based on Table 6, most respondents (77.4%) demonstrated good knowledge, while 22.6% had sufficient knowledge. None were categorized as poor.

Motivation Level of Respondents

Distribution of motivation level is presented in Table 7.

Table 7. Respondent Distribution by Motivation Level

No	Motivation Category	Frequency (n)	Percentage (%)
1.	Good	50	94,3
2.	Fair	3	5,7
Total		53	100

Based on Table 7, almost all respondents (94.3%) showed high motivation, with only 5.7% in the sufficient category, and none in the poor category.

Respondents' Perception Level

Distribution of respondents' perception level is presented in Table 8.

Table 8. Dentist Perception Characteristics

No.	Persepsi	Frequency (n)	Percentage (%)
1.	Fair	50	94,3
2.	Good	3	5,7
Total		53	100

Based on Table 8, the majority (94.3%) reported perceptions in the sufficient category, while 5.7% were in the good category. No poor perceptions were reported.

Respondents' Attitudes

Distribution of respondents' attitude is presented in Table 9.

Table 9. Dentist Attitude Characteristics

No.	Attitude	Frequency (n)	Percentage (%)
1.	Good	46	86,8
2.	Fair	7	13,2
Total		53	100

Based on Table 9, most respondents (86.8%) had a good attitude, and 13.2% had a sufficient attitude. None showed poor attitudes.

Workplace Safety Climate

Distribution of workplace safety climate is presented in Table 10.

Table 10. Respondent Distribution by Workplace Safety Climate

No.	Safety Climate	Frequency (n)	Percentage (%)
1.	Good	37	69,8
2.	Fair	16	30,2
Total		53	100

Based on Table 10, most respondents (69.8%) rated their workplace safety climate as good, while 30.2% considered it sufficient. No poor ratings were reported.

Facilities and Infrastructure

Distribution of facilities and infrastructure is presented in Table 11.

Table 11. Respondent Distribution by Facilities and Infrastructure

No.	Facilities and Infrastructure	Frequency (n)	Percentage (%)
1.	Good	42	79,2
2.	Fair	11	20,8
Total		53	100

on Table 11, the majority (79.2%) assessed facilities and infrastructure as good, while 20.8% rated them sufficient. None considered them inadequate.

Leadership Support

Distribution of leadership support is presented in Table 12.

Table 12. Respondent Distribution by Leadership Support

No.	Kategori Dukungan Pimpinan	Frequency (n)	Percentage (%)
1.	Good	41	77,4
2.	Fair	11	20,8
3.	Poor	1	1,9
Total		53	100

Based on Table 12, most respondents (77.4%) rated leadership support as good, 20.8% as sufficient, and only 1.9% as poor.

Training

Distribution of training is presented in Table 13.

Table 13. Respondent Distribution by Training

No.	Training	Frequency (n)	Percentage (%)
1.	Good	34	64,2
2.	Fair	18	34,0
3.	Poor	1	1,9
Total		53	100

Based on Table 13, most respondents (64.2%) rated training as good, 34.0% as sufficient, and 1.9% as poor, highlighting the need for improved training coverage.

Supervision

Distribution of supervision is presented in Table 14.

Table 14. Respondent Distribution by Supervision

No.	Supervision	Frequency (n)	Percentage (%)
1.	Good	43	81,1
2.	Fair	10	18,9
Total		53	100

Based on Table 14, most respondents (81.1%) perceived supervision as good, while 18.9% rated it as sufficient. None rated it as poor.

Compliance Level of Respondents

Distribution of supervision is presented in Table 15.

Table 15. Dentist Compliance Characteristics

No.	Compliance	Frequency (n)	Percentage (%)
1.	Good	13	24,5
2.	Fair	26	49,1
3.	Poor	14	26,4
Total		53	100

Based on Table 15, nearly half of respondents (49.1%) showed moderate compliance, while 24.5% had good compliance and 26.4% low compliance.

Factors Affecting Compliance

Distribution of supervision is presented in Table 16.

Table 16. Factors Influencing Compliance with Standard Precautions

No.	Compliance Factors	Significance	Correlation Coefficient
1.	Knowledge	0,007*	0,366*
2.	Motivation	0,108	0,223
3.	Perception	0,108	0,223
4.	Attitude	0,028*	0,302*
5.	Workplace safety climate	0,001*	0,445*
6.	Facilities and infrastructure	0,022*	0,314*
7.	Leadership support	0,223	0,170
8.	Training	0,018*	0,323*
9.	Supervision	0,017*	0,327*

Based on Table 16, bivariate analysis showed that knowledge, attitude, safety climate, facilities, training, and supervision had significant positive associations with compliance, though the strength varied from low to moderate. In contrast, motivation, perception, and leadership support were not significantly related.

The Most Dominant Factor Influencing Dentists' Compliance with Standard Precautions to Prevent Healthcare-Associated Infections (HAIs) at Puskesmas in Jember Regency

Based on the data analysis, the distribution of respondents' compliance can be seen in the following tables.

Table 17. Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
<i>Intercept Only</i>	60,789			
<i>Final</i>	41,086	19,703	6	0,003

Table 18. Goodness-of-Fit

	Chi-Square	df	Sig.
<i>Pearson</i>	23,783	32	0,852
<i>Deviance</i>	26,649	32	0,734

Table 19. Pseudo R Square

<i>Cox and Snell</i>	0,310
<i>Nagelkerke</i>	0,354
<i>McFadden</i>	0,178

Based on Tables 17, 18, and 19, the regression model used in this study was valid and fit the data. First, the -2 Log Likelihood decreased significantly, and the significance value ($p = 0.003$) indicated that including independent variables improved the model. Second, the Goodness-of-Fit test using Pearson showed a significance of 0.852, confirming the model's suitability with the observed data. However, the independent variables explained only 35.4% of the variation in compliance (Nagelkerke $R^2 = 0.354$), suggesting that the remaining 64.6% was influenced by other factors outside the model.

Table 20. Parameter Estimates

							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Standart Precaution Compliance = 1]	4,185	1,584	6,984	1	0,008	1,081	7,289
	[Standart Precaution Compliance = 2]	7,054	1,818	15,048	1	0,000	3,490	10,618
Location	Knowledge	1,775	0,760	5,453	1	0,020*	0,285	3,266
	Attitude	0,216	1,121	0,037	1	0,847	-1,980	2,413
	Workplace safety climate	1,720	0,996	2,982	1	0,084	-0,232	3,673
	Facilities and infrastructure	0,678	1,037	0,428	1	0,513	-1,354	2,710
	Training	0,156	0,718	0,047	1	0,828	-1,252	1,564
	Supervision	0,030	1,114	0,001	1	0,978	-2,154	2,215

*Significant at $p < 0.05$

Based on Table 20, the multivariate analysis showed that knowledge was the only variable significantly influencing compliance with standard precautions ($p = 0.020$). Other variables, such as attitude, safety climate, facilities, training, and supervision, were not significant in this model. The positive regression coefficient for knowledge indicated that higher knowledge levels increased the likelihood of compliance. Quantitatively, dentists with higher knowledge were 5.9 times more likely to comply with standard precautions compared to other factors, as reflected by the Odds Ratio (Exp(B)).

DISCUSSION

The Influence of Knowledge on Dentists' Compliance with Standard Precautions

Knowledge showed a significant association with compliance ($p = 0.007$; $r = 0.366$), indicating that a deeper understanding of infection prevention principles directly contributes to better adherence in clinical practice (Kamila et al., (2024); Palingga et al., 2020). In line with the Health Belief Model (HBM), knowledge functions as a critical predisposing factor that heightens awareness of risks and

motivates protective behavior. This highlights the necessity of continuous education and training programs as essential strategies to strengthen compliance and ensure that knowledge is not only acquired but also consistently applied in daily practice (Eksayudha, 2025).

The Influence of Motivation on Dentists' Compliance with Standard Precautions

Motivation did not show a significant relationship with compliance ($p = 0.108$; $r = 0.223$), though a weak positive correlation was found. This result contrasts with several studies emphasizing motivation as a core driver of compliance (Alshagrawi & Alhodaithy, 2024). The lack of significance may reflect external challenges such as heavy workloads, limited facilities, or insufficient managerial oversight (Houghton et al., 2013). As described in the PRECEDE-PROCEED model, genuine behavior change requires not only motivation but also enabling and reinforcing factors that support individuals in translating their intentions into consistent practice.

The Influence of Perception on Dentists' Compliance with Standard Precautions

Perception similarly did not demonstrate a significant relationship with compliance ($p = 0.108$; $r = 0.223$), despite showing a weak positive association. This finding diverges from the HBM perspective and other studies that identify perception of risk as a major determinant of adherence (Dawolo & Wulandari, 2024; Puspitasari, 2019). The limited influence of perception in this study suggests that improving compliance requires more than raising awareness of disease risks; it must be reinforced by structural support such as access to adequate PPE, strong organizational commitment, and consistent supervision.

The Influence of Attitude on Dentists' Compliance with Standard Precautions

Attitude was significantly related to compliance ($p = 0.028$; $r = 0.302$), aligning with the Theory of Planned Behavior and prior studies that stress the importance of positive attitudes in infection prevention (Ajzen, 1991; Fauzia et al., 2014). However, a favorable attitude alone is not sufficient to guarantee adherence. Without strong organizational support, reliable infrastructure, and continuous monitoring, even dentists with positive attitudes may find it difficult to consistently follow standard precautions. This indicates that attitude should be viewed as a necessary but not exclusive component of sustained compliance.

The Influence of Safety Climate on Dentists' Compliance with Standard Precautions

Safety climate showed the strongest correlation among organizational factors ($p = 0.001$; $r = 0.445$), confirming its role as a critical determinant of safe practices in line with organizational safety climate theory (Zohar & Luria, 2003; Wulandari & Djudiyah, 2024; Swanda & Basuki, 2023). A supportive and positive safety climate fosters collective responsibility and encourages individuals to comply more consistently with infection prevention measures. Still, compliance is a multidimensional outcome, and thus safety climate should be integrated with

other interventions, including training, facilities, and supervision, to establish a sustainable culture of safety.

The Influence of Facilities on Dentists' Compliance with Standard Precautions

Facilities were significantly associated with compliance ($p = 0.022$; $r = 0.314$), with adequate PPE, sterilization tools, and other resources proven to directly support better adherence (Green & Kreuter, 2005; Tanjung & Susilawati, 2024). Nevertheless, the moderate correlation indicates that facilities alone are not enough to ensure compliance. Their effectiveness is maximized when combined with dentists' attitudes, regular training, and organizational supervision, pointing to the importance of a comprehensive and integrated approach to infection prevention in primary healthcare.

The Influence of Leadership Support on Dentists' Compliance with Standard Precautions

Leadership support was not significantly associated with compliance ($p = 0.223$; $r = 0.170$), although it remains essential in shaping safety culture and reinforcing organizational values (Swanda & Basuki, 2023). While some research by Pangaribuan et al., (2025) this study suggests that its influence may be weakened by practical barriers such as time constraints and lack of consistent engagement (Elizar, 2019). Therefore, leadership should be strengthened but must operate alongside more direct determinants, including provision of facilities and continuous training, to effectively boost compliance.

The Influence of Training on Dentists' Compliance with Standard Precautions

Training demonstrated a significant association with compliance ($p = 0.018$; $r = 0.323$), underscoring its importance in improving knowledge, skills, and confidence (Syahraini et al., 2025; Rosenstock, 1974). Effective training equips dentists with practical competence to implement infection prevention consistently. However, its long-term impact depends heavily on the quality, structure, and continuity of the programs. Structured and regular training sessions, followed by systematic evaluation, are therefore crucial to sustain and reinforce compliance in the long run.

The Influence of Supervision on Dentists' Compliance with Standard Precautions

Supervision was also significantly related to compliance ($p = 0.017$; $r = 0.327$), supporting evidence from safety climate theory and organizational behavior studies (Robbins & Judge, 2018; Neal & Griffin, 2004). Beyond monitoring, supervision provides feedback, guidance, and motivation that strengthen dentists' commitment to standard precautions. Consistent and systematic supervision ensures that protocols are not only followed but internalized as part of professional practice, thereby reinforcing a long-term culture of safety.

The Most Dominant Factor Influencing Dentists' Compliance

Multivariate analysis confirmed knowledge as the most dominant factor, with dentists who possessed higher knowledge being 5.9 times more likely to comply compared to those with lower levels. According to the HBM, knowledge not only raises risk perception but also strengthens awareness of disease severity, thereby driving protective behavior (Rosenstock, 1974). While other variables such as attitude, facilities, training, and supervision significantly support compliance, they serve as complementary elements. Thus, continuous education remains the cornerstone of compliance, essential for embedding infection prevention practices within the broader safety culture of primary healthcare.

CONCLUSION

- a. Knowledge significantly and positively affects dentists' compliance, and is confirmed as the most dominant factor by multivariate analysis.
- b. Attitude shows a positive and significant relationship with compliance, indicating that supportive attitudes enhance adherence.
- c. Safety climate, facilities, training, and supervision also have significant positive effects, collectively strengthening compliance in clinical practice.
- d. Motivation and perception, although positively correlated, do not show a statistically significant effect on compliance.
- e. Leadership support shows no significant effect, despite a very weak positive correlation.

RECOMMENDATION

Health institutions should strengthen human resources through knowledge-based empowerment, regular hands-on training, and continuous supervision. Dentists are encouraged to actively engage in professional development by updating knowledge and integrating standard precautions into daily practice. Future studies are recommended to include other variables such as workload, job stress, and team support, using longitudinal designs to provide stronger causal insights.

ADVANCED RESEARCH

This study has several limitations. First, geographical and time constraints posed challenges, as significant distances between community health centers prolonged data collection, while the researcher's role as a civil servant limited available time. To address this, enumerators were employed for efficient data gathering. Second, the researcher's dual role as a respondent at the workplace could potentially create bias. To maintain objectivity, data collection was excluded from the researcher's own workplace and assigned to independent enumerators.

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