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Original Article

Enhancing safety climate through occupational safety and health practices mediating by management commitment in the hospital setting

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ABSTRACT

Introduction: Hospitals encounter problems sustaining a favorable safety climate due to their inherent complexity and ongoing needs. This study examines the relationship between occupational safety and health (OSH) practices and safety climates mediated by management commitment in hospitals.

Methods: Data was acquired from 400 healthcare professionals in hospitals in Kathmandu using a structured survey utilizing a cross-sectional quantitative approach. A stratified random sampling technique was employed to ensure representation across different healthcare professional roles in the hospital. The data was collected from February 15, 2023, to April 15, 2023. The complex relationships between OSH practices, management commitment, and safety climate were evaluated by Structural Equation Modeling (SEM).

Results: The result findings reveal that the safety climate is significantly influenced by OSH practices, as evidenced by a standardized regression weight of 0.75. This result suggests that better OSH practices result in enhanced safety perceptions. Although management commitment also serves as a critical mediating factor, its effect size is lower, indicating that it remains a critical factor despite its less pronounced impact than direct OSH interventions. The safety climate is primarily driven by OSH practices, as confirmed by the validated framework, and their effectiveness is further enhanced by management commitment. The study's uniqueness was that it inspected the mediating role management commitment plays in the relationship between OSH practices and safety climate.

Conclusion: Hospitals should enhance OSH practices and promote management commitment to improving the safety climate. Future studies should examine additional mediators, use longitudinal studies, and analyze several healthcare settings to further investigate safety climate dynamics.

Keywords: Management Commitment, Occupational Safety and Health (OSH), Safety Climate, Structural Equation Modeling (SEM)

Introduction

Ensuring hospital safety is essential due to the complexities and risks inherent in healthcare services. There are different kinds of hazards in their workplace that workers have faced to possible risks.[1] A robust Safety Climate, reflective

of employees' collective beliefs regarding the significance of safety, is crucial for minimizing medical errors and protecting both patients and healthcare personnel.[2,3] Efficient OSH practices—such as safety training, risk management, and safety communication—are essential in cultivating a safety culture, especially in high-pressure hospital environments.[4,5]

The effectiveness of OSH practices predominantly relies on Management Commitment, which comprises leadership emphasizing safety in decision-making and resource allocation. Research suggests that robust management commitment strengthens employees' safety attitudes, hence improving the overall safety climate.[6,7] Hospitals encounter difficulties in establishing safety environment and occupational safety and health standards due to operational complexities and stress, especially in the absence of managerial commitment.[8] OSH practice is inadequate, as the majority of workplaces lack appropriate safety and preventive measures, hence exposing workers to hazards in the context of Nepal.[9] The mental and psychological health of healthcare personnel should be prioritized, and their protection should be of the utmost importance.[10] Many hospitals are challenged with developing and maintaining a safe organizational environment, especially in limited resource settings where operational complexity, high stress and variable managerial support may prevail.[11,12,13] This challenge becomes even more visible in the context of Nepal, where very few workplaces have sufficient safety and preventive measures to ensure proper safety of all concerned.[14,15] In addition, previous research has mostly studied direct OSH interventions that specifically address elements that contribute to or detract from better management safety practices and thus, only a few studies have looked at the mediating effect of management commitment on how OSH practices might influence climate for safety.[16] The gaps are even more in developing country contexts, where resource limitations and management practices differ more widely.[17, 18]

The study aims to examine the influence and to assess the mediation effect of Management Commitment between OSH practices and Safety Climate in the hospital setting. It also aims to test the framework model of the study in the hospital setting. This study investigates the relationship between OSH practices (independent variable) and safety climate (dependent variable) in a hospital environment, with management commitment serving as a mediating variable. It proposes that efficient occupational safety and health practices enhance the safety climate, and that management commitment reinforces this relationship, amplifying the influence of OSH practices on the safety climate. This model will be validated to ascertain whether the relationship is true inside the hospital setting.

H1: A significant relationship exists between OSH practices and the Safety Climate in the hospital set-up.
H2: Management commitment mediates the effect of OSH practices on safety climate in the hospital context.
H3: The proposed framework model can explain the relationships amidst OSH practices, management commitment, and safety climate in the hospital set-up.

This research has important implications for improving hospital workplace safety by examining the association between OSH practices and management commitment to create a safety climate in the hospitals. Best OSH practices are essential for improving safety protocols to reduce hazards amongst healthcare workers in sensitive settings like hospitals. This study can be beneficial in the context of resource-limited settings like Nepal. This research provides valuable insights into improving safety standards, protecting healthcare personnel, and fostering a healthier work environment. The study aims is to offer guidance for hospital leaders and policymakers looking to improve both workers' safety and patients' well-being while verifying a framework that connects OSH practices, management commitment and safety climate.

Methods

This study was carried out in two major hospitals in Kathmandu: Tribhuvan University Teaching Hospital (TUTH), the largest public hospital, and Kathmandu Medical College Teaching Hospital (KMCTH), the largest private hospital, after ethical approval from the respective hospitals and governing body of the country- Nepal Health Research Council (NHRC) and the samples were collected randomly. They were hospitals with various healthcare settings representing rich sampling for OSH practices, Management Commitment, and Safety Climate. The participants were selected from the hospitals of Kathmandu using a stratified random sampling design. This approach ensures that all healthcare practitioners have an equal opportunity to be part of the sample and, hence, better representation in the data. The sample size included 358 individuals, chosen from hospitals in Kathmandu. The sample size was chosen according to the requirements for performing Structural Equation Modeling (SEM).

A structured survey questionnaire was used to collect primary data, divided into two main sections. The first section included socio-demographic variables, which included questionnaires related to variables such as gender, profession, qualification, experience, and employment status. The second section included questions about OSH Practices, Management Commitment, and Safety Climate variables. Most of the questionnaires were obtained through in-person interviews, while others were disseminated to healthcare personnel at the selected hospitals using printed forms. Participants received comprehensive instructions for survey completion, and subsequent reminders were dispatched to increase response rates. The data collection took about eight weeks, from February 15, 2023, to April 15, 2023.

The data collected through the questionnaire survey was evaluated using various statistical methods and tools to generate results that can be transformed into research findings for numerous purposes.[11] Data analysis was carried out in 4 sections; Preliminary analysis, Descriptive analysis, Inferential analysis and Reliability & Validity analysis.

The data was screened for missing values and outliers in the preliminary analysis and then assessed for normality. A comprehensive normality test of data was performed to satisfy the assumptions required for parametric statistical analyses. The procedure encompassed multiple stages, comprising visual examination (histograms and Q-Q plots), statistical analysis (skewness and kurtosis), and outlier management (z-score approach). The histograms illustrated the distribution shape, but the Q-Q plots contrasted the observed quantiles with the anticipated quantiles from a normal distribution. Skewness and kurtosis were calculated to check out whether the data was normally distributed or not. Skewness measures how symmetric a distribution is, and kurtosis measures how tailed it is. Values within the interval of ±1 were considered acceptable for normality. [20] The skewness and kurtosis values indicate that data is normally distributed, hence justifying the use of parametric tests. No significant variances are apparent that would indicate a necessity for transformation or other modifications. The Z-Score Method was employed to enhance the precision of normality testing, and outliers were found and eliminated by this method. Data points having a z-score over ±3 was considered outliers and subsequently eliminated from the study.[19] These steps were taken to ensure the accuracy, normality, and reliability of the data; 42 responses were removed from 400 responses, resulting in a final sample size of 358.

Results

The socio-demographic variables were summarized using descriptive statistics.

Table 1: Frequency distribution of socio-demographic variables

Socio-demographic Variable		Frequency
Gender	Male	114(31.8%)
	Female	244 (68.2%)
Profession	Nurse	165 (46.1%)
	Doctor	137 (38.3%)
	Technical Support staffs	56 (15.6%)
Qualification	Diploma	57(15.9%)
	Bachelor	230 (64.2%)
	Master	71 (19.8%)
Experience (years)	1 to 3	103 (28.8%)
	3 to 5	59 (16.5%)
	Above 5	196 (54.7%)
Employment Status	Permanent	141(39.4%)
	Contract	217 (60.6%)

The socio-demographic data of the sample (N = 358) revealed several key characteristics. The gender distribution revealed that females comprise 68.2% and males comprise 31.8% of the sample. The participant's professions were primarily nurses (46.1%), followed by doctors (38.3%) and technical support staff (15.6%). With educational qualifications, 64.2% possessed a bachelor's degree, 19.8% possessed a master's degree, and 15.9% earned a diploma. The participants exhibited variability in years of experience, with 54.7% possessing over 5 years, 28.8% having 1 to 3 years, and 16.5% with 3 to 5 years of expertise. Ultimately, 60.6% of the participants were engaged in contract employment, whilst 39.4% had permanent positions. The findings comprehensively analyze the sample's socio-demographic attributes related to the overall study's conclusions about occupational health and safety practices.

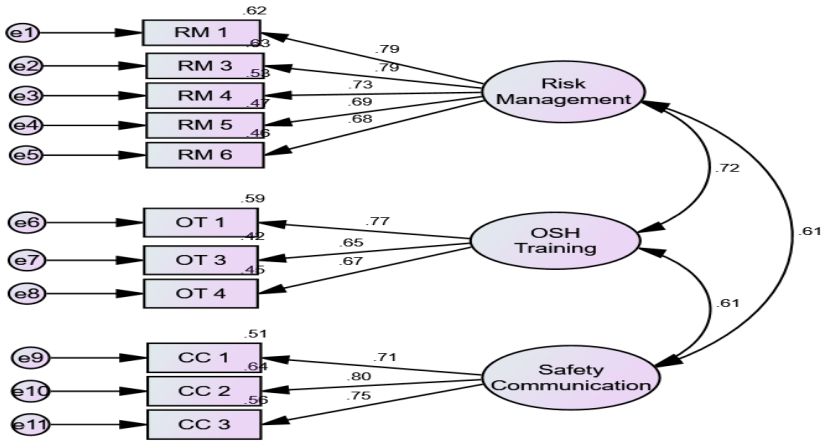

Figure 1: Measurement model of OSH

The primary data was analyzed using SEM in AMOS for inferential analysis. The process began with validating the measurement model through CFA, ensuring the constructs were accurately assessed. Next, the SEM model was evaluated to explore the direct effects of OSH practices on the Safety Climate while also examining the mediating role of Management Commitment. The model's fit was assessed using essential indices such as the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Tucker-Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). Finally, hypothesis testing was performed by analyzing the path coefficients to determine the significance of the proposed relationships, with the mediating effect of Management Commitment assessed through bootstrapping methods.

A first-order CFA of OSH practice was conducted through AMOS to examine the measurement model and removed items that did not load on factors > 0.5. Numerous fit indices were used including GFI, SRMR, CFI, TLI, RMSEA, Pclose, and CMIN/df to investigate the model fit.[21-24] The analysis revealed that the three-factor OSH model (encompassing Risk Management, OSH Training, and Safety Communication System) exhibited excellent fit with GFI = 0.964, SRMR = 0.037, CFI = 0.977, TLI = 0.969, RMSEA = 0.050, Pclose = 0.447, and CMIN/df = 1.957. Construct's reliability was assessed through Cronbach's alpha and composite reliability. Cronbach's alpha values for all constructs were not less than 0.70[25] and CR values between 0.739 and 0.855, exceeding the benchmark,[26] confirming strong reliability. Aver%age Variance Extracted (AVE) values, all exceeding 0.50, confirmed adequate convergent validity.[27]

Table 2: Factor Loadings, Reliability and Convergent Validity Metrics

Items	Factor Loadings	Cronbach's alpha	Composite Reliability	Average variance Extracted
Risk Management		0.814	0.855	0.52
RM1	0.788			
RM3	0.792			
RM4	0.730			
RM5	0.685			
RM6	0.680			
OSH Training (OT)		0.701	0.739	0.49
OT1	0.766			
OT3	0.650			
OT4	0.672			
Safety Communication System (SCS)		0.746	0.799	0.57
CC1	0.715			
CC2	0.799			
CC3	0.749			

Discriminant validity was evaluated through a combination of the Fornell-Larcker Criterion and the HTMT ratio, ensuring a robust assessment. While the Fornell-Larcker method showed acceptable results, the HTMT ratio further confirmed discriminant validity with all values below the 0.85 threshold.[28]

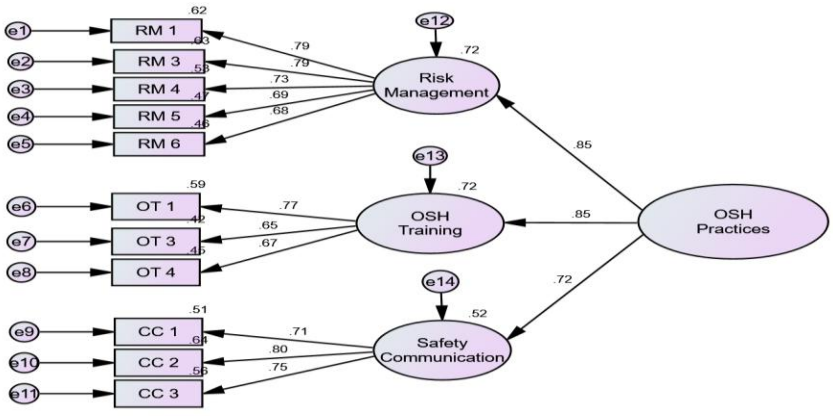

Figure 2: Second-order CFA of OSH

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Subsequently, a second-order Confirmatory Factor Analysis (CFA) was performed in AMOS to assess the model and remove items that did not load on factors > 0.5. To investigate model fit, numerous fit indices were used, including GFI, SRMR, CFI, TLI, RMSEA, Pclose, and CMIN/df.[13,14,15,16] The analysis revealed that the three-factor OSH model (encompassing Risk Management, OSH Training, and Safety Communication System) exhibited excellent fit with GFI = 0.964, SRMR = 0.037, CFI = 0.977, TLI = 0.969, RMSEA = 0.050, Pclose = 0.447, and CMIN/df = 1.957.

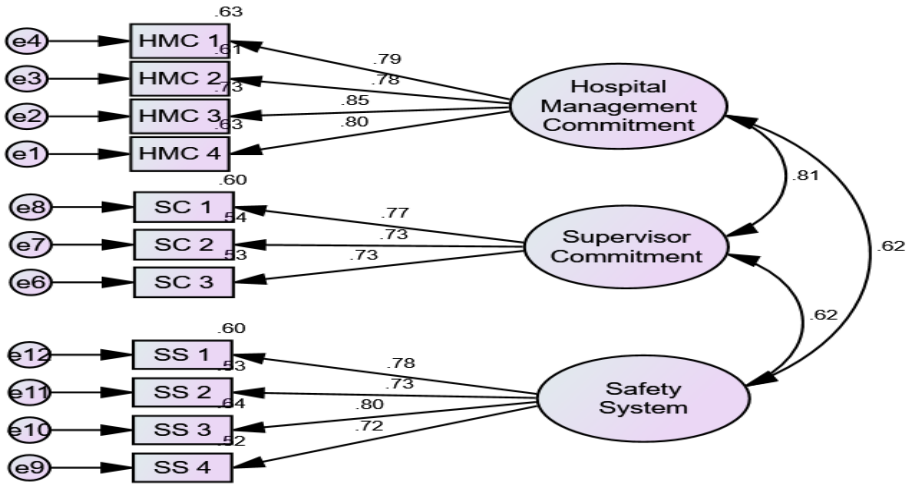

Figure 3: Measurement model of safety climate

A first-order CFA of Safety Climate was performed utilizing AMOS to assess the measurement model. Items with factor loadings below 0.5 were excluded. To investigate model fit, numerous fit indices were used, including GFI, SRMR, CFI, TLI, RMSEA, Pclose, and CMIN/df.[13,14,15,16]The analysis revealed that the three-factor OSH model (encompassing Hospital Management Commitment, Supervisor Commitment, and Safety System) exhibited excellent fit with GFI = 0.963, SRMR = 0.038, CFI = 0.981, TLI = 0.974, RMSEA = 0.051, Pclose = 0.443, and CMIN/df = 1.924.

Construct's reliability was assessed through Cronbach's alpha and composite reliability. Cronbach's alpha values for all constructs were not less than 0.70[25] and CR values between 0.790 and 0.881, exceeding the benchmark,[26] confirming strong reliability. Average Variance Extracted (AVE) values, all exceeding 0.50, confirmed adequate convergent validity.[27]

Table 3: Factor Loadings, Reliability and Convergent Validity Metrics

Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Hospital Commitment to Safety		0.879	0.881	0.649
HMC1	0.793			
HMC2	0.778			
HMC3	0.853			
HMC4	0.796			
Supervisor's Commitment to safety		0.790	0.790	0.557
SC1	0.775			
SC2	0.732			
SC3	0.731			
Safety System		0.842	0.842	0.573
SS1	0.775			

SS2	0.727
SS3	0.798
SS4	0.724

Discriminant validity was evaluated through a combination of the Fornell-Larcker Criterion and the HTMT ratio, ensuring a robust assessment. While the Fornell-Larcker method showed acceptable results, the HTMT ratio further confirmed discriminant validity with all values below the 0.85 threshold.[28]

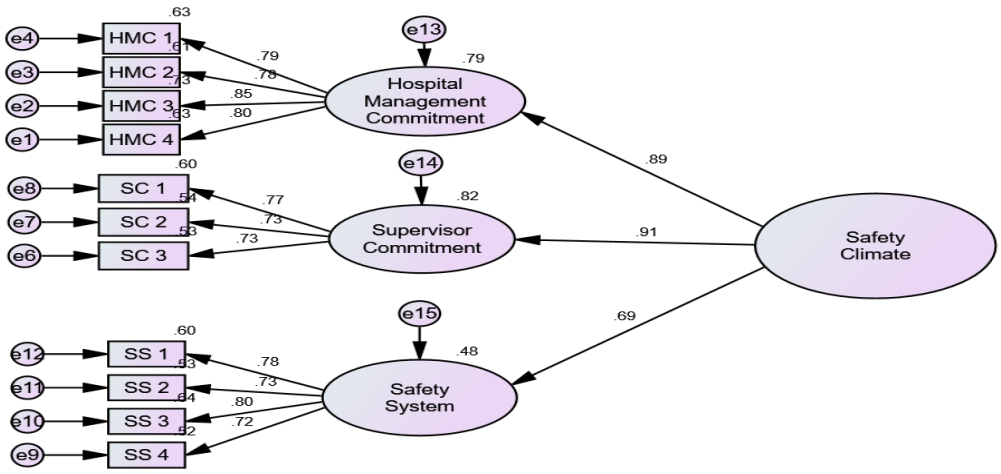

Figure 4: Higher order of safety climate

Subsequently, a second-order CFA of Safety Climate was performed utilizing AMOS to assess the measurement model. Items with factor loadings below 0.5 were excluded. To investigate model fit, numerous fit indices were used including GFI, SRMR, CFI, TLI, RMSEA, Pclose, and CMIN/df.[13-16] The analysis revealed that the three-factor OSH model (encompassing Hospital Management Commitment, Supervisor Commitment, and Safety System) exhibited excellent fit with GFI = 0.963, SRMR = 0.038, CFI = 0.981, TLI = 0.974, RMSEA = 0.051, Pclose = 0.443, and CMIN/df = 1.924.

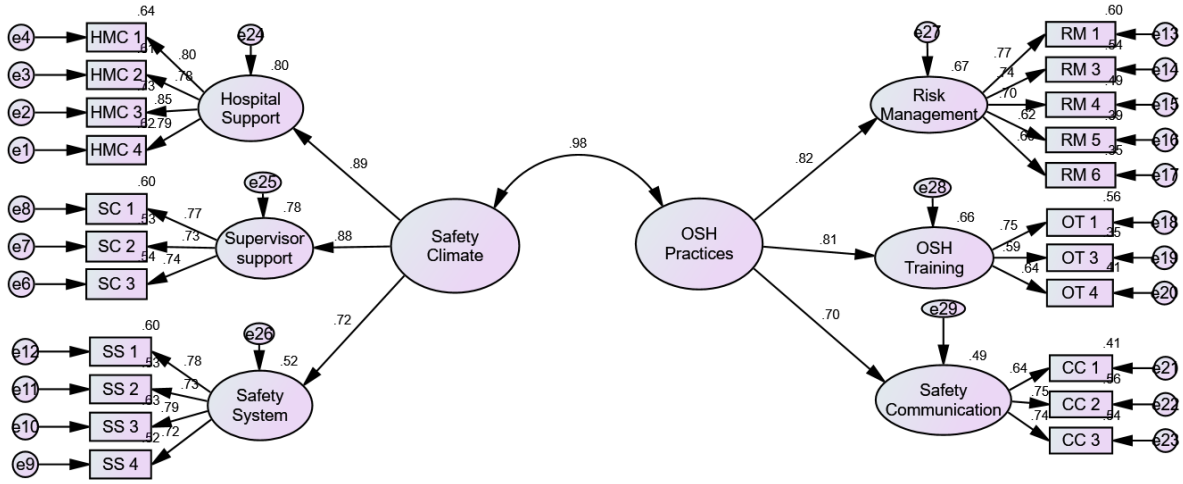

Figure 5: Structural model of the study

The association between OSH practices and Safety Climate was tested using a structural model in AMOS. Items with factor loadings ≤ 0.5 were removed during the CFA. The model's overall fit was assessed using several indices, including GFI, CMIN/df, Pclose, SRMR, CFI, RMSEA, and TLI, in

line with the recommended criteria.[13-16] The three-factor model of OSH Practices and Safety Climate showed an excellent model fit with Pclose = 0.985, CMIN/df = 1.547, GFI = 0.928, CFI = 0.969, TLI = 0.964, SRMR = 0.042, and RMSEA = 0.039.

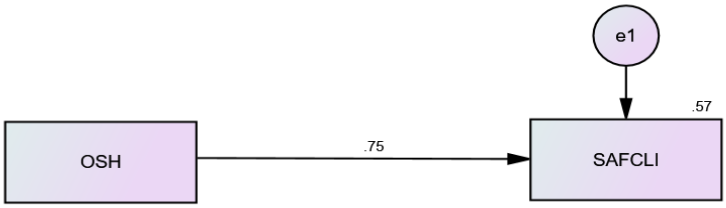

Figure 6: Path analysis (OSH to Safety climate)

The path analysis illustrates a strong positive relationship between OSH Practices and the Safety Climate, with a standardized regression weight of 0.75. This indicates that improvements in OSH Practices lead to significant enhancements in the Safety Climate, explaining 75% of its variance. The error term (0.57) suggests that 57% of the variance in Safety Climate is attributed by other factors.

The regression analysis further confirms this relationship, with an unstandardized regression weight of 0.878 (SE = 0.040, CR = 21.716, **p < .001), indicating a significant positive effect. The high critical ratio and low p-value underscore the strength and significance of OSH Practices in improving Safety Climate within the organization.

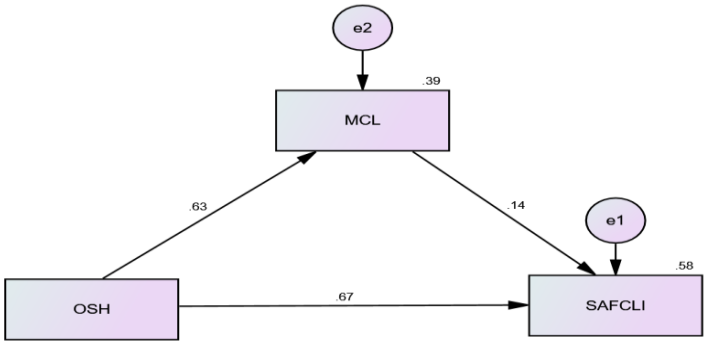

Figure 7: Mediation Analysis

The model reveals that OSH Practices have a substantial direct effect on both Management Commitment and Safety Climate. The standardized regression weights show that improvements in OSH Practices lead to a 63% increase in Management Commitment and a 67% improvement in Safety Climate. Additionally, Management Commitment positively influences Safety Climate, with a more minor but significant effect (standardized regression weight of 0.14), indicating its supportive role in shaping Safety Climate.

Table 4: Regression Weights

Path			Estimate	Standard error	Critical Ratio	P value
MCL	<---	OSH	0.837	0.055	15.138	***
SAFCLI	<---	OSH	0.780	0.051	15.246	***
SAFCLI	<---	MCL	0.118	0.038	3.078	0.002

The analysis further confirms these relationships, with unstandardized regression weights of 0.837 for OSH to Management Commitment, 0.780 for OSH to Safety Climate, and 0.118 for Management Commitment to Safety Climate. Although the direct effect of OSH Practices on Safety Climate is

more substantial, Management Commitment also contributes positively. Error variances suggest that other factors not included in the model influence Management Commitment (39% unexplained variance) and Safety Climate (58% unexplained variance). OSH Practices and Management Commitment are critical drivers of a favorable Safety Climate.

Table 5: Hypothesis result

Hypothesis	Hypothesis statement	Decision
H1	OSH practices significantly influence the safety climate.	Supported
H2	Management commitment mediates the association between OSH practices and safety climate.	Supported
H3	The proposed framework model explains the association among OSH practices, management commitment and safety climate.	Supported

For the reliability and validity analysis, an Exploratory Factor Analysis was conducted in SPSS to ascertain the factor components of variables, which included principal component extraction and varimax rotation. In order to maintain construct fidelity between theory and findings, items with factor loadings greater than 0.50 were retained, while those that loaded low or cross-loaded onto multiple factors were eliminated. Internal consistency was evaluated using Cronbach's Alpha and Composite Reliability; values exceeding 0.7 suggest the measure's reliability. Convergent, discriminant, content, and construct validity were checked to assess the validity. When the loadings of factors exceeded 0.5 and AVE above 0.5, the convergent validity was supported. The Fornell-Larcker Criterion, along with the Heterotrait-Monotrait (HTMT) ratio thus proved discriminant validity even further. CFA helps to establish construct validity and content validity through expert assessments.

Discussion

This study examined the impact of OSH practices on Safety Climate in hospitals, examined the mediating effect of Management Commitment, and validated the suggested framework connecting these factors. The results indicate that OSH practices significantly enhance Safety Climate, evidenced by a standardized regression weight of 0.75, underscoring their essential contribution to safety perceptions.[4] The mediation analysis indicated that Management Commitment affects Safety Climate, but to a lesser degree, with a standardized weight of 0.14. Although Management Commitment improves safety, the direct impact of OSH practices is more significant, underscoring the necessity of emphasizing successful OSH implementation.

The suggested model was validated, establishing both direct and mediated effects of OSH practices on Safety Climate. Nevertheless, the error variations suggest that additional factors, including corporate culture and communication, may also affect the Safety Climate.[8] The study highlighted the necessity of continual improvement of OSH practices to cultivate a favorable Safety Climate in hospitals while admitting the importance of Management Commitment.

The results also underscore the important impact of staff engagement and involvement in promoting a safe climate within hospitals. Best OSH practices form the foundation for safety in a hospital, but the participation of hospital staff at all levels can complement OSH and make it more effective. Staff should be encouraged to actively report safety concerns and participate in safety audits and planning events. More importantly, staff should be encouraged to develop an attitude

around ownership and accountability, which would help reinforce a positive safety climate. A collaborative process supported by sound OSH principles and visible commitment from managers could help develop a more agile, effective safety culture. It would be interesting for future studies to examine the interaction effect of employee involvement with OSH practices and Management Commitment in shaping Safety Climate toward safety outcomes as a whole. Further studies need to investigate more mediators and the ongoing impacts of occupational safety and health practices on safety outcomes.

Conclusions

This study emphasizes the importance of OSH practices in maintaining a safe working environment in hospitals. The results indicate a significant direct influence of occupational safety and health practices on the safety climate, highlighting the necessity of effectively executed safety regulations in enhancing staff safety perceptions. However, management commitment is a mediating factor; its statistically significant impact is less evident than the direct effect of occupational safety and health practices. Nonetheless, managerial commitment is crucial for reinforcing and maintaining the positive outcomes of safety behaviors.

Hospitals should emphasize the immediate execution and ongoing improvement of occupational safety and health practices to improve the safety climate substantially. Management commitment is a crucial supporting element, having an indirect influence that enhances the efficacy of safety standards over time. Future research should examine additional elements to enhance a safe environment and assess the long-term impact of occupational safety and health practices and management commitment in diverse healthcare settings.

Novelty of the Study

The study's uniqueness was that it inspected the mediating role management commitment plays in the relationship between OSH practices and safety climate, an area that has been left unrevealed. Previous studies have examined these factors separately, while this study focuses on how management commitment influences the effectiveness of OSH practices at hospitals. Furthermore, by testing the framework model in a specific context, such as hospitals in Kathmandu, this study offers new evidence on the safety climate dynamics of healthcare environments, especially from a developing country context.

Instructional Review Committee (IRC) of hospitals approved this study in order to collect data. The study was approved. All the participants in this study were voluntarily participated. Participants in this study were provided with informed consent in written form and confidentiality was maintained throughout the study. The data retrieved is anonymous, to protect the identities of the respondents.

The cross-sectional study approach makes it difficult to find causal relationships across variables. Furthermore, using self-reported data may result in biases, including social desirability bias. Subsequent studies may address these limitations by employing a longitudinal strategy and incorporating diverse data sources to enhance the findings.

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