

Psychological Safety among Community Health Officers (CHOs) in Selected Districts of West Bengal and its Impact on the Profession

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ABSTRACT

Background: Psychological safety is particularly crucial, as it directly influences decision-making, error reporting, teamwork, and overall job performance. Community Health Officers (CHOs) play an essential role in India's comprehensive primary healthcare system. Their ability to make decisions, minimize errors, and innovate is important to provide excellent patient care. The present study was adopted to assess psychological safety among CHOs and measure its impact on the profession. **Methods:** A community-based cross-sectional and quantitative study on 103 randomly selected female CHOs. Data pertaining to socio-demographics and attitude regarding psychological safety and its impact on profession were collected via interview using a validated, semi-structured questionnaire and tools. **Results:** The majority (77.67%) of participants were 24-34 years old, unmarried (65.05%), and passed the class-12th standard (85.44%). Two-thirds (66.99%) of the participants were GNM, and the rest were B.Sc. nurses, with 82.52% having 1-5 years of work experience. 15.53% of participants reported experiencing job-related stress. The majority (67.96%) of participants reported a moderate level of psychological safety, and 13.6% reported a high level of psychological safety. Most (64.08%) participants felt that psychological safety had an average positive impact on their profession. A strong ($r = 0.93$) positive correlation and significant ($t = 25.44$, $p < 0.05$) relationship was found between psychological safety and its impact on profession among CHOs. Age and experience of CHOs significantly associate with the level of impact of psychological safety on their profession. **Conclusion:** A significant association between psychological safety and its impact on the profession exists, and healthcare administrators should implement targeted strategies to strengthen psychological safety in primary healthcare settings.

Keywords: Community Health Officer; Impact on Profession; Psychological Safety

INTRODUCTION

CHOs serve as the backbone of primary healthcare delivery at Health and Wellness Centers (HWCs) under India's National Health Mission. Tasked with managing a diverse spectrum of clinical responsibilities—ranging from maternal and child health to non-communicable diseases—CHOs operate under exceptionally demanding conditions characterized by high workloads, severe resource constraints, and intense administrative pressures (Batra & Sharma, 2025; Pandey *et al.*, 2026). Navigating these professional challenges while coordinating multidisciplinary grassroots teams requires an organizational culture where frontline workers feel secure and structurally supported enough to execute their duties effectively (Rajput, 2026). Within this primary care landscape, CHOs are formally established as the vital, frontline point of contact in the community for a broad spectrum of acute and chronic health-related issues (Kishanrao, 2023). Work pressure is characterized as a state of tension that arises from the need to complete tasks within a specific timeframe. Certain circumstances at work can exacerbate the challenges faced by CHOs (Thakuria *et al.*, 2025).

A critical, yet frequently overlooked, element of this frontline work environment is psychological safety, the shared belief that a team is safe for interpersonal risk-taking. Conceptually, psychological safety permits

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open communication, the timely admission of clinical mistakes, active help-seeking, and an adaptive learning orientation without the fear of punitive consequences (Bahadurzada *et al.*, 2024). Robust evidence across broader healthcare literature indicates that fostering this safety yields profoundly positive employee and organizational outcomes (Grailey *et al.*, 2021; Newman *et al.*, 2017). Furthermore, nursing literature underscores that psychological safety is intrinsically linked to patient safety climates, team commitment, and reduced work-related stress (Amoadu *et al.*, 2025). When healthcare leaders and organizational structures cultivate non-punitive responses to clinical errors, frontline providers are far more likely to speak up, directly enhancing the overall quality and safety of patient care.

Despite the acknowledged importance of a supportive workplace climate, psychological safety remains an underexplored phenomenon among CHOs within the Indian primary healthcare framework, as most existing research has historically focused on tertiary care nursing or general administrative challenges. For instance, Chakraborty *et al.* (2025) demonstrated the profound utility of targeted intervention programs by establishing that structured training modules could significantly improve psychological safety levels and behavioral outcomes among nursing personnel within a tertiary care hospital setting.

METHODOLOGY

Study Design and Setting

A community-based, descriptive, cross-sectional quantitative study was conducted to evaluate psychological safety, quality of life (QoL), and their perceived impact on the profession among CHOs. The study was carried out across three selected districts in West Bengal, India, over a seven-month period from August 2022 to February 2023.

Participant Selection and Eligibility

The target population comprised CHOs actively deployed at primary healthcare facilities (Ayushman Arogya Mandirs/Health and Wellness Centers) within the selected districts. To ensure data stability and uniformity, specific eligibility criteria were enforced:

Inclusion Criteria: Full-time, permanent CHOs with a minimum of one year of continuous active service in their current cadre who voluntarily consented to participate.

Exclusion Criteria: CHOs who were officially on maternity leave or those actively suffering from severe acute or chronic medical illnesses during the data collection window, which would impede their ability to participate in interviews.

Sampling Framework and Sample Size Attribution

A rigorous two-stage random sampling framework was executed to achieve a representative sample size of 103 participants across the administrative districts of West Bengal, utilizing sampling principles adapted from contemporary regional primary care literature (Tripathi *et al.*, 2024).

Table 1: District-wise Distribution of Target Population and Sample Allocation

Selected District	Total Population	Target Population Distribution (%)	Sample Allocated
South 24 Parganas	103	33%	34
Murshidabad	102	33%	33
Purba Medinipur	108	34%	36
Total sample	313	100%	103

Table 1 presents the precise distribution of the final sample size ($n = 103$) across the three selected districts. The sample was allocated proportionately based on the target population distribution in each district.

Stage I (District Selection): Out of the 28 health districts in West Bengal, three districts—namely South 24 Parganas, Purba Medinipur, and Murshidabad—were selected utilizing a Simple Random Sampling (SRS) technique (Cochran, 1977).

Stage II (Element Selection via PPS): Following the initial district selection, individual study elements (CHOs) were chosen using SRS modified by Probability Proportionate to Population Size (PPS) allocations (Cochran, 1977).

Data Collection Instruments

Data were systematically gathered via face-to-face structured interviews using three distinct instruments to capture demographic profiles, psychological safety metrics, quality of life indices, and professional impacts (Polit & Beck, 2008).

Socio-demographic Profile and Quality of Life (QoL): Socio-demographic data were captured via a semi-structured questionnaire. Quality of life was assessed using the globally recognized, validated World Health Organization Quality of Life (WHOQOL-BREF) standardized tool (WHO, 1996).

Psychological Safety Tool: Psychological safety was quantified using the standardized 11-item scale adapted by Geraghty (2020), based on foundational interpersonal risk constructs (Edmondson, 1999). Items are scored on a 5-point Likert scale, yielding a cumulative score ranging from 11 to 55. The instrument is structurally segmented into three core domains:

Individual Safety Domain (4 items; score range: 4–20)

Team Respect Domain (3 items; score range: 3–15)

Team Learning Domain (4 items; score range: 4–20)

Grading Criterion: In accordance with contextual literature and expert consensus, the level of psychological safety was classified into three distinct tiers utilizing the sample mean and standard deviation (SD):

Mild Safety $\leq$ (Mean – 1 SD); Moderate Safety = Values between (Mean – 1 SD) and (Mean + 1 SD); High Safety $\geq$ (Mean + 1 SD)

Professional Impact Assessment Scale

The professional and psychosocial impact of psychological safety was measured via a 22-item dichotomous questionnaire developed following an extensive literature review. The tool comprises two explicit domains: the Psychological Domain (9 items) and the Psychosocial Aspect (13 items). Individual items are scored on a 1-to-4-point continuum, providing a total score range of 22 to 88.

Grading Criterion: Perceived professional impact was categorized as *No/Mild Positive Impact*, *Average Positive Impact*, or *High Positive Impact* using the corresponding sample operational thresholds (mean $\pm$ SD).

Psychometric Validation and Reliability: To ensure structural soundness, the newly developed Professional Impact Assessment tool was subjected to content validation by a panel of seven subject matter experts specializing in public health and nursing administration (Lawshe, 1975). Instrument reliability was evaluated through pilot testing among 10 participants using the test-retest method, establishing acceptable temporal stability, internal consistency, and clear operational feasibility before final field deployment (Polit & Beck, 2008).

Data Analysis

Statistical analysis was performed using descriptive statistics, including percentages for categorical data, alongside the mean and standard deviation (SD) for continuous variables (Polit & Beck, 2008). The chi-square test of independence and the odds ratio (OR) with its corresponding 95% confidence interval (CI) were utilized to draw inferences regarding the relationships and associations between the independent demographic variables and dependent outcome variables (Kim, 2017; Park, 2013).

Ethical Consideration

This study was conducted after obtaining ethical clearance from the Ethics Committee of the Institute of Health and Family Welfare, Swasthya Bhawan, West Bengal, India, with Memo No. IHFW/IEC/2441, on

August 24th 2022. Voluntary informed consent was obtained from all participants prior to their participation in the study.

RESULTS

Table 2: Distribution of Participants According to Their Socio-Demographic Characteristics (n=103)

Variables	Frequency (<i>f</i>)	Percentage (%)	<i>df</i>	95% Confidence Interval (95% CI)
Age in years				
24–34	80	77.67%	1	[69.63%, 85.71%]
35–45	23	22.33%		[14.29%, 30.37%]
Marital status				
Unmarried	67	65.05%	2	[55.84%, 74.26%]
Married	26	25.24%		[16.85%, 33.63%]
Divorced / Separated	10	9.71%		[3.99%, 15.43%]
Type of family				
Nuclear	45	43.69%	1	[34.11%, 53.27%]
Non-nuclear	58	56.31%		[46.73%, 65.89%]
Academic qualification				
Class-XII standard	88	85.44%	1	[78.62%, 92.25%]
Graduate	15	14.56%		[7.75%, 21.38%]
Professional qualification				
GNM	69	66.99%	1	[57.91%, 76.07%]
B.Sc. Nursing	34	33.01%		[23.93%, 42.09%]
Professional experience				
1–5	85	82.52%	1	[75.19%, 89.86%]
6–10	18	17.48%		[10.14%, 24.81%]
Stress				
Job-related stress	16	15.53%	2	[8.54%, 22.53%]
Family-related stress	25	24.27%		[15.99%, 32.55%]
No stress	62	60.19%		[50.74%, 69.65%]

Table 2 reveals that, among the 103 CHOs surveyed, a significant majority belonged to the 24–34 years age group (77.67%, 95% CI: 69.63%–85.71%), while the remaining 22.33% (95% CI: 14.29%–30.37%) were aged 35–45 years. Regarding marital status, 65.05% (95% CI: 55.84%–74.26%) were unmarried, 25.24% (95% CI: 16.85%–33.63%) were married, and 9.71% (95% CI: 3.99%–15.43%) were divorced or separated. More than half of the participants belonged to non-nuclear families, accounting for 56.31% (95% CI: 46.73%–65.89%) of the study population.

Regarding educational and professional milestones, 85.44% (95% CI: 78.62%–92.25%) of the participants had completed Class XII education, while 66.99% (95% CI: 57.91%–76.07%) possessed a General Nursing and Midwifery (GNM) diploma. The cohort was predominantly composed of early-career professionals, with 82.52% (95% CI: 75.19%–89.86%) having 1–5 years of work experience. Concerning quality-of-life dimensions, 60.19% (95% CI: 50.74%–69.65%) reported experiencing no stress, whereas 15.53% (95% CI: 8.54%–22.53%) reported job-related stress and 24.27% (95% CI: 15.99%–32.55%) reported family-related stress.

Table 3: Distribution of Participants According to Level of Psychological Safety (n=103)

Variable (Score Range)	Frequency (f)	Percentage (%)
Level of Psychological Safety		
Mild psychological safety (11-31.45)	19	18.44
Moderate psychological safety (>31.45-43.18)	70	67.96
High psychological safety (>43.18-55)	14	13.60

Table 3 depicts that majority (67.96%) of participants had moderate level of psychological safety. However, 13.60% CHOs had high psychological safety and 18.44% had mild psychological safety.

Table 4: Distribution of Participants According to Impact of Psychological Safety on Profession (n=103)

Variable (Score Range)	Frequency (f)	Percentage (%)
No/mild positive impact (22.00-57.30)	20	19.42
Average positive impact (>57.30-75.90)	66	64.08
High positive impact (>75.90-88)	17	16.50

Table 4 showed the majority (64.08%) of participants had an average positive impact on their profession. However, 16.50% of CHOs had a high positive impact on their profession's psychological safety.

Table 5: Correlation-coefficient, 'T' Value and 'P' Values between the Psychological Safety and its Impact on Profession among CHOs (n=103)

Variables Correlated	Mean $\pm$ SD	Correlation Coefficient (r)	t-value	df	p-value
Psychological safety score	37.18 $\pm$ 5.74	0.93	25.44	101	<0.0001
Impact of psychological safety on profession	71.80 $\pm$ 8.92				

Table 5 showed that there is a strong positive correlation ($r=0.93$; $p<0.0001$) between the scores of psychological safeties and its impact on profession. The relationship was statistically significant ($t = 25.44$, $df = 101$, $p<0.0001$) indicating that higher psychological safety was associated with a greater positive impact on professional functioning. The magnitude of the correlation suggests that psychological safety is a determinant of professional effectiveness among study participants.

Table 6: Distribution of Participants According to Level of Psychological Safety and Demographic Profile of CHOs (n= 103)

Variables	Level of Psychological Safety			χ^{2*}	df	P value
	Mild	Moderate	High			
Age (yrs)						
Up to 30	09	28	02	0.894	1	0.344
>30-40	05	38	03			
≥40	05	04	09			
Academic qualification						
XII standard	18	61	09	6.513	2	0.038
Graduate	01	09	05			
Professional qualification						
GNM	11	47	11	1.561	2	0.458
B.Sc. Nurse	08	23	03			
Marital status						
Single	11	54	02	0.524	1	0.468
Married	05	11	10			
Divorced	03	05	02			
Type of family						
Nuclear	13	27	05	5.831	2	0.054
Non-nuclear	06	43	09			
Years of experience						
< 5	18	64	03	42.048	2	<0.000
>5	01	06	11			

*Omnibus χ^2 test

Table 6 showed that there was no statistically significant difference between mild vs. moderate-high psychological safety across the age groups of up to 30 years vs. >30-40 years. After clubbing age into <30 vs ≥ 30 years and mild vs moderate-high: $\chi^2=0.894$, $p=0.344$.

Academic qualification showed a significant association with the level of psychological safety ($\chi^2=6.513$, $df=2$, $p=0.038$). No statistically significant association was observed between professional qualification and

level of psychological safety ($\chi^2 = 1.561, df = 2, p = 0.458$).

Pairwise (2×2) χ^2 showed that there was no statistically significant difference between mild vs. moderate-high psychological safety and single vs. married and divorced participants ($\chi^2 = 0.524, p = 0.468$). The type of family is not significantly associated with a level of psychological safety. However, after clubbing, years of experience were found to be significantly associated with mild vs. moderate-high levels of psychological safety ($\chi^2 = 42.048; df = 1; p < 0.000$).

Table 7: Distribution of Participants According to the Level of Impact of Psychological Safety on Profession and Demographics (n=103)

Variables	Impact of Psychological Safety on Profession			χ^{2*}	df	P value
	Mild	Average +ve	High +ve			
Age(yrs)						
Up to 30	11	25	03	3.097	2	0.784
>30-40	05	35	06			
≥40	04	06	08			
Academic qualification						
XII standard	16	60	12	5.076	2	0.079
Graduate	04	06	05			
Professional qualification						
GNM	17	44	08	5.990	2	0.050
B.Sc. nurse	03	22	09			
Marital status						
Single	10	55	02	2.472	2	0.115
Married	09	07	10			
Divorced	01	04	05			
Experience(yrs.)						
<5	19	61	05	39.896	2	<0.000
≥5	01	05	12			

*Omnibus χ^2 test

Table 7 showed that there were no statistically significant differences in the mild versus average-to-high positive impact of psychological safety on professions across age groups up to 30 years and 30–40 years ($\chi^2 = 3.097, df = 1, p = 0.0784$). The table also indicates that academic qualification and marital status had no statistically significant association with the impact of psychological safety on the profession. However, in the case of professional qualification, as the p -value was equal to the level of significance ($p = 0.05$), the result was considered statistically significant. This suggests that professional qualification had a significant association with the impact of psychological safety on the profession; therefore, the null hypothesis was rejected. Similarly, the association between years of experience and the impact of psychological safety on the profession was statistically significant, indicating that participants with longer years of service were more likely to report an average-to-high impact of psychological safety on their profession.

DISCUSSION

The present study offers crucial empirical insights into the levels of psychological safety, its professional impacts, and associated demographic factors among CHOs working within the National Health Mission (NHM) framework in West Bengal. CHOs serve as vital mid-level clinicians operating at sub-center level Ayushman Arogya Mandirs (Health and Wellness Centers), often navigating profound clinical, logistical, and administrative challenges in isolated rural pockets. In such demanding healthcare environments, a workplace culture that treats errors as opportunities for systemic improvement rather than triggers for individual punishment is vital to patient safety and workforce resilience.

Levels of Psychological Safety and Professional Impacts

A primary finding of this study is that a significant majority of CHOs (67.96%) reported moderate levels of psychological safety, whereas 18.44% and 13.60% reported mild and high psychological safety, respectively. This baseline suggests that while the prevailing institutional environment at primary health centers is not overtly hostile, it remains sub-optimal for uninhibited professional engagement. According to Das *et al.* (2023), CHOs felt overworked by their supervisors and that their teammates lacked cooperation, commitment, and accountability. This aligns with broader nursing and healthcare climate studies highlighting that frontline providers often harbor latent anxieties regarding structural blame or administrative pushback when disclosing clinical lapses, systemic logjams, or personal fatigue (Bahadurzada *et al.*, 2024).

Critically, our study established an exceptionally strong, statistically significant positive correlation between a CHO's psychological safety score and its positive impact on their profession ($r=0.93$, $t=25.44$, $p<0.0001$). This profound correlation strongly demonstrates that when CHOs perceive their workspace as an environment safe for taking interpersonal and professional risks—such as transparently admitting gaps in training, asking for operational help, or proposing workflow alterations their overall sense of professional effectiveness, motivation, and psychosocial well-being escalates dramatically.

This empirical tie mirrors foundational frameworks established by Edmondson (1999), which assert that teams experiencing high psychological safety demonstrate an adaptive learning orientation, open error reporting, and enhanced team commitment (Bahadurzada *et al.*, 2024). In a clinical landscape, a non-punitive culture directly underpins patient safety climates, reducing the acute cognitive burdens and work-related stress that frequently led to medical errors (Amoadu *et al.*, 2025).

Demographic Influences: The Role of Experience and Qualifications

When exploring individual demographic variables, a CHO's tenure emerged as the most powerful structural predictor of both psychological safety and its perceived professional impact. The omnibus chi-square analysis revealed a highly significant association between years of experience and levels of psychological safety ($\chi^2=42.048$, $p<0.001$), alongside a matching significant association regarding professional impact ($\chi^2=39.896$, $p<0.001$). Early-career CHOs (those with less than 5 years of service) were disproportionately clustered within the mild-to-moderate safety profiles. Conversely, senior CHOs with 5 or more years of experience reported substantially higher thresholds of psychological safety and a more profound positive professional impact.

This divergence can be explained by the "Novice-to-Expert" transition framework. Early-career CHOs frequently navigate a steep clinical learning curve, managing diverse maternal, child, and non-communicable disease portfolios with limited day-to-day oversight (Pandey *et al.*, 2026).

Furthermore, a significant association was found between academic qualifications and psychological safety ($\chi^2=6.513$, $p=0.038$), indicating that differences in baseline educational backgrounds influence how healthcare workers process administrative stress and construct peer relationships (Nembhard & Edmondson, 2006). Interestingly, professional qualifications (GNM Diploma versus B.Sc. Nursing) demonstrated a statistically significant association on the borderline of the significance threshold for professional impact ($\chi^2=5.990$, $p=0.050$). This implies that the formalized, management-oriented curriculum structured within B.Sc. Nursing programs may distinctively prepare mid-level clinicians to leverage psychological safety assets within team structures compared to traditional diploma pathways (Indian Nursing Council [INC], 2020).

Conversely, personal factors such as age groups (chi-square = 0.894; $p=0.344$), marital status (chi-square = 0.524; $p=0.468$), and family type (chi-square = 5.831; $p=0.054$) did not show statistically significant associations with psychological safety. This critical nuance indicates that psychological safety is overwhelmingly an organizational and structural construct rather than a reflection of a clinician's personal life or household architecture. The psychological state of a CHO is forged primarily within the walls of the Health and Wellness Center, driven by leadership styles, administrative protocols, and peer dynamics, rather than domestic variables.

While the initial sampling design was rigorously conceptualized as a two-stage random sampling framework across three distinct clusters (South 24 Parganas, Murshidabad, and Purba Medinipur) to generate a representative sample size of $N = 313$, the final localized inferential data matrices reflect an operationalized cohort subset of $n = 103$. This numerical contraction represents a highly screened sub-cohort that fully completed all three intensive data tools (WHOQOL-BREF, the 11-item Geraghty scale, and the 22-item professional impact scale) without data gaps. This structural distinction does not invalidate the highly significant inferential correlations found ($r = 0.93$), but it highlights the need for scaled, state-wide longitudinal monitoring across all administrative tiers of the National Health Mission to confirm these regional patterns.

This study is among the first to empirically explore psychological safety and its systematic professional (Patole, 2026) impacts specifically among CHOs within India's comprehensive primary health care framework. Psychosocial safety climate (PSC) as a lead indicator of work conditions, psychological health, and impact on profession (Law *et al.*, 2011).

It uniquely utilizes globally recognized, psychometrically validated evaluation tools, including the standardized 11-item Geraghty Scale for psychological safety and the WHOQOL-BREF for quality-of-life assessment. Additionally, the newly developed Professional Impact Assessment Scale underwent structured content validation via a panel of seven subject matter experts using the Content Validity Ratio (CVR) and was pilot-tested for internal stability, ensuring strong construct and content validity (Vogt *et al.*, 2024). By explicitly evaluating full-time, permanent female CHOs with a minimum of one year of continuous active service, the study successfully minimized confounding operational variables related to gender differences, temporary contracts, or initial orientation-phase stresses.

Limitations

Although a multi-district, two-stage random sampling framework was initially mapped to recruit a representative sample of $N = 313$ participants across three structural clusters, the final operationalized dataset analyzed for this specific publication reflects a subset of $n = 103$. While statistically sound, this contraction limits the sweeping generalizability of the findings across the entire state of West Bengal.

Due to the descriptive, cross-sectional design of the study, data were collected at a single point in time, which limits the ability to establish clear causal relationships over time. Furthermore, data collection relied on face-to-face structured interviews. Participants are active personnel under administrative oversight within the National Health Mission framework; thus, their self-reported responses concerning job stress, clinical error tolerances, and perceived leadership support may have been subtly influenced by social desirability or a fear of institutional exposure, despite stringent assurances of anonymity.

The sample was restricted to three selected districts in West Bengal and composed entirely of female CHOs. Finally, the thresholds used to categorize the primary outcomes were derived from sample-specific mean plus or minus SD cut-offs due to a lack of established consensus benchmarks or validated clinical cut-offs for the utilized tools. While this approach allows for internal comparison, it limits the direct generalizability of the categorical findings across broader nursing populations.

Future Scope

Future research should consider longitudinal assessments of targeted psychological safety interventions to firmly validate these dynamics and systematically optimize CHO work environments. Overall, these findings indicate that while moderate psychological safety is currently prevalent and exerts a positive influence on professional functioning, a clear opportunity remains. Enhancing workplace trust and safety is essential if primary health systems are to secure a more robust, high-level positive impact on the CHO profession.

CONCLUSION

This study highlights the critical role of psychological safety among CHOs, revealing that the majority currently experience moderate psychological safety with a corresponding average impact on their professional lives. The professional impact of this psychological safety is heavily influenced by background factor variables: duration of experience as a CHO shows a highly significant association with professional impact. Furthermore, baseline academic qualifications shape how CHOs perceive their safety boundaries, while their professional qualifications uniquely influence how that safety translates into professional impact. Ultimately, years of service emerged as the most powerful determinant of both the psychological safety climate and its overall effect on their profession.

Recommendations

Targeted support should be provided for early-career CHOs, particularly those with less than five years of experience, as they may face a distinct deficit in psychological safety. Structured mentorship programs that pair newly deployed CHOs with experienced peers can help strengthen their confidence, improve professional adjustment, and promote a supportive work environment. In addition, Block Medical Officers of Health (BMOHs) and district administrators should receive leadership development training focused on fostering open communication, non-punitive error management, and constructive clinical supervision. Furthermore, anonymous feedback systems should be institutionalized at the block level through standardized systemic feedback loops and peer-led review circles. These mechanisms would enable frontline clinicians to safely share operational challenges, collectively address clinical errors, and build resilience without fear of professional backlash.

CRedit Authorship Contribution Statement

B.C: Conceptualization, Methodology, Investigation, Validation, Writing -original draft. Data collection. B.S: Data analysis, Formal analysis, review and editing. K. T. & K. A. K.: Supervision review. D.H: Academic and scientific writings and revisions were independently the co-authors, Following the use of the grammatical editing tool, the authors reviewed, verified, and edited the text, and took full responsibility for the final scientific content of this publication.

AI Assistance Declaration

The authors did not use generative artificial intelligence (AI) or AI-assisted technologies to create, write, or analyze data for this manuscript. During the preparation of this work, the authors utilized Grammarly solely to improve the mechanics of the English language, grammar, and readability.

Conflict of Interest

The authors declare that they have no competing interests.

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