Chirurgia (2026) 121: 172-181
No. 2, March - April

http://dx.doi.org/10.21614/chirurgia.3271

Continuous Training, Protocol Adherence and Safety Culture in Anaesthesia and Intensive Care Units in Romania: A Cross-Sectional Study

Gabriel Petre Gorecki[1,2], Ovidiu Horea Bedreag[3,4]*, Dorel Săndesc[3,4], Horațiu Moldovan[5,6,7], Dan Gabriel Costea[8], Anamaria Hărăbor[9,10], Dan Nicolae Păduraru[5,8], Alexandru Cosmin Palcău[8], Magdalena Miulescu[9,11], Ioana Roșca[5,12], Dragos Predescu[13]*, Silviu Constantinoiu[5,7,8]

[1]Department of Anesthesia and Intensive Care, Titu Maiorescu University, Faculty of Medicine, Bucharest, Romania
[2]Department of Anesthesia and Intensive Care, CF2 Clinical Hospital, Bucharest, Romania
[3]Department of Anesthesia and Intensive Care, Victor Babeș University of Medicine and Pharmacy, Timișoara, Romania
[4]Pius Brânzeu Clinical County Hospital, Timișoara, Romania
[5]Faculty of Medicine, Carol Davila University of Medicine and Pharmacy, Bucharest Romania
[6]Department of Cardiovascular Surgery, Clinical Emergency Hospital Bucharest, Bucharest, Romania
[7]Academy of Romanian Scientists, Bucharest, Romania
[8]Department of General Surgery, CF2 Clinical Hospital, Bucharest, Romania
[9]Dunărea de Jos University, Faculty of Medicine and Pharmacy, Galați, Romania
[10]Buna Vestire Clinical Hospital of Obstetrics and Gynecology, Galați, Romania
[11]Sf. Ioan Emergency Clinical Hospital for Children, Galați, Romania
[12]Prof. Panait Sârbu Clinical Hospital of Obstetrics and Gynecology, Bucharest, Romania
[13]Department of General and Esophageal Surgery, St. Mary Clinical Hospital, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania

***Corresponding author:**
Ovidiu Horea Bedreag, MD
Department of Anesthesia and Intensive Care, Victor Babeș University of Medicine and Pharmacy, Timișoara, Romania
E-mail: bedreag.ovidiu@umft.ro
Dragos Predescu, MD
Department of General and Esophageal Surgery, St. Mary Clinical Hospital
Carol Davila University of Medicine and Pharmacy, Bucharest, Romania
E-mail: drpredescu@yahoo.com

Received: 14.01.2026
Accepted: 30.03.2026

Rezumat

Formarea continuă, respectarea protocoalelor și cultura siguranței în secțiile de Anestezie și Terapie Intensivă din România: studiu transversal

Introducere: Asigurarea unor servicii medicale sigure şi de înaltă calitate în unitățile de Anestezie şi Terapie Intensivă (ATI) depinde de formarea profesională continuă, respectarea protocoalelor de siguranță şi existența unei culturi organizaționale suportive. Evaluarea interacțiunii dintre aceşti factori este esențială pentru îmbunătățirea siguranței pacientului şi a satisfacției personalului medical.
Metode: A fost realizat un studiu transversal, prin chestionar online, în noiembrie 2024, pe un eşantion de 109 profesioniști din domeniul sănătății care activează în unități ATI din România. Chestionarul a evaluat oportunitățile de dezvoltare profesională, respectarea procedurilor de siguranță, comunicarea, suportul managerial şi nivelul de satisfacție profesională, utilizând scale Likert cu cinci trepte. Analiza statistică a inclus metode descriptive, testele Chi-pătrat şi Mann–Whitney U, precum şi corelații Spearman.
Rezultate: Satisfacția față de instruire s-a corelat semnificativ cu percepția pregătirii pentru situații de urgență (ρ=0.44, p<0.01). Respectarea protocoalelor a fost asociată pozitiv cu percepția unei culturi a siguranței bine dezvoltate (ρ=0.39, p<0.01). Suportul managerial a fost corelat pozitiv atât cu satisfacția profesională (ρ= 0.48, p< 0.01), cât

şi cu disponibilitatea de a raporta incidentele (ρ=0.42, p< 0.01). Personalul din spitalele private a raportat un nivel uşor mai ridicat de deschidere față de feedback şi acces la instruire.
Concluzii: Rezultatele evidențiază necesitatea implementării instruirii interdisciplinare, a unui leadership empatic şi a unor sisteme de feedback constructive pentru consolidarea culturii siguranței şi a motivației profesionale în unitățile ATI.

Cuvinte cheie: unitatea de Terapie Intensivă, formare profesională, culturã a siguranței, managementul asistenței medicale, respectarea protocoalelor, suport organizațional

Abstract

Background: High-quality and safe care in Anaesthesia and Intensive Care Units (AICUs) relies on continuous professional development, strict adherence to safety protocols, and a supportive organisational culture. Understanding how these factors interact is essential for improving both patient safety and staff well-being.
Methods: A cross-sectional online survey was conducted in November 2024 among 109 healthcare professionals working in Romanian AICUs. The questionnaire assessed access to professional training, compliance with safety procedures, communication quality, managerial support, and job satisfaction, using five-point Likert scales. Data were analysed using descriptive statistics, Chi-square tests, Mann–Whitney U tests, and Spearman's correlation coefficients.
Results: Training satisfaction was significantly associated with perceived preparedness for emergency situations (ρ=0.44, p<0.01). Adherence to safety protocols correlated positively with perceptions of a strong safety culture (ρ=0.39, p<0.01). Managerial support showed a moderate positive correlation with job satisfaction (ρ=0.48, p<0.01) and willingness to report incidents (ρ=0.42, p<0.01). Respondents from private hospitals reported slightly higher openness to feedback and more frequent training opportunities compared to those from public institutions.
Conclusions: The findings underscore the importance of interdisciplinary training, empathetic leadership, and constructive feedback mechanisms in fostering a positive safety culture and enhancing professional motivation in AICU settings.

Keywords: Intensive Care Unit, professional training, safety culture, healthcare management, protocol compliance, organisational support

Introduction

High-quality care in Anaesthesia and Intensive Care Units (AICUs) is a multidimensional construct that integrates technical competence, adherence to safety protocols, and a strong organisational safety culture. Given the high-risk nature of intensive care settings, continuous professional training and teamwork coordination are key determinants of both patient safety and staff performance (1,2). The intensive care environment requires healthcare professionals to make rapid, complex decisions under pressure; therefore, maintaining up-to-date knowledge and consistent protocol compliance is vital to preventing adverse events (3,4).

Recent research highlights that professional development and regular simulation-based training enhance clinical confidence and reduce occupational stress, ultimately improving patient outcomes (5,6). Similarly, adherence to clearly communicated and standardised safety protocols is associated with lower rates of hospital-acquired infections and higher procedural accuracy (7,8). Moreover, a supportive organisational climate, characterised by open communication, mutual respect, and non-punitive error reporting has been recognised as an essential component of a robust safety culture in AICUs (9,10).

However, comparative studies between public and private healthcare systems remain limited, particularly within Eastern European contexts such as Romania, where differences in resources, managerial models, and institutional cultures may influence staff perceptions and service quality (11,12). Understanding how healthcare professionals in these settings perceive professional training, protocol compliance, and managerial support can inform strategies to strengthen the safety culture and overall quality of intensive care services.

Fig. 1 presents a conceptual matrix illustrating the interplay between continuous training, protocol adherence, and safety culture as mutually reinforcing determinants of patient safety and quality of care in Romanian Anaesthesia and Intensive Care Units (AICUs).

Accordingly, this study aims to: (O1) analyse healthcare staff perceptions of professional training opportunities and preparedness for emergency management; (O2) investigate perceptions of

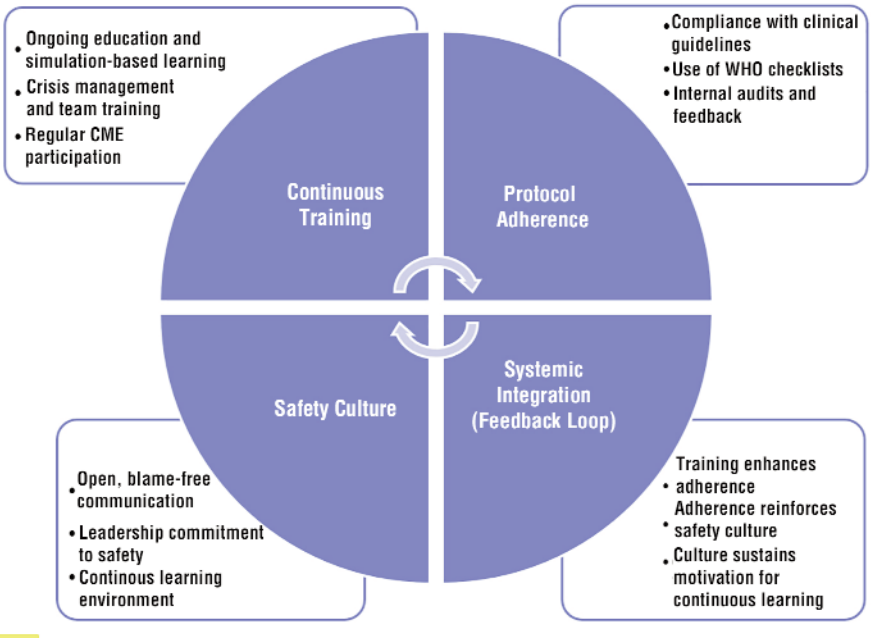

Figure 1. Conceptual matrix - Continuous training, protocol adherence, and safety culture in anaesthesia and Intensive Care Units in Romania

compliance with safety protocols and infection-prevention measures; and (O3) examine professional satisfaction and the perceived level of managerial and collegial support.

Based on previous evidence, the following hypotheses were formulated:

H1. ICU staff perceive opportunities for professional training as satisfactory.

H2. Compliance with safety protocols and infection-prevention measures is perceived positively by ICU personnel.

H3. Staff satisfaction is directly correlated with the level of managerial support and involvement in decision-making processes.

The findings of this study aim to contribute to the understanding of how educational and organisational factors interact to shape safety culture in Romanian AICUs and to provide practical recommendations for healthcare leaders seeking to improve the quality and resilience of critical care services.

Materials and Methods

Study Design and Participants

This study employed a cross-sectional quantitative design using an online survey conducted between 4 and 28 November 2024. The research targeted medical professionals working in Anaesthesia and Intensive Care Units (AICUs) across Romania. A convenience sampling strategy was applied due to accessibility and time constraints. Participation was voluntary, and inclusion criteria required respondents to be currently employed in an AICU as medical doctors, residents, or nurses.

A total of 109 valid responses were collected. The sample included 52.3% nurses, 22.9% ICU specialists, 17.4% residents, and 5.5% senior consultants (*Fig. 2*).

Most participants were employed in public hospitals (59.6%), with the remainder in private healthcare institutions (40.4%) (*Fig. 3*).

Data Collection Instrument

Data were collected via a structured questionnaire

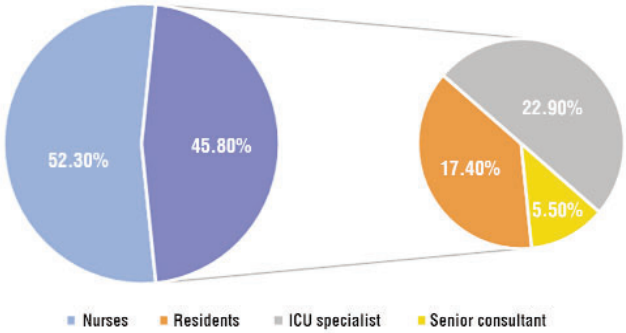

Figure 2. Distribution of Participants (nurses versus doctors) and Workplace Setting

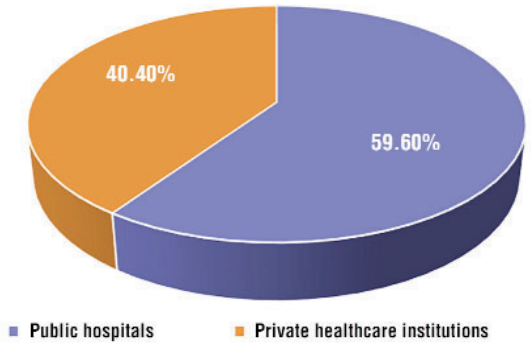

Figure 3. Type of Healthcare Institution

developed using Google Forms, designed to assess perceptions of quality and safety within AICU services. The instrument contained 20 items divided into five thematic domains:

- Professional training and competence;
- Technological resources and infrastructure;
- Compliance with safety protocols and infection-prevention measures;
- Communication, teamwork, and managerial support;
- Difficulties encountered and improvement measures.

Items were formulated based on validated instruments from previous studies [1–3] and adapted to the Romanian healthcare context. Responses were measured using a five-point Likert scale ranging from 1 ("very unsatisfactory" or "to a very small extent") to 5 ("very satisfactory" or "to a very large extent"). The questionnaire also included demographic and professional variables such as age, gender, position, professional experience, and hospital type.

Data Analysis

All data were processed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarise demographic and categorical variables.

Internal reliability of the questionnaire was assessed through Cronbach's alpha (α), with a coefficient of 0.70 considered acceptable for internal consistency. Differences between public and private hospital respondents were tested using Chi-square (χ^2) tests for categorical variables and the Mann-Whitney U test for ordinal or non-normally distributed data.

Associations between key constructs (e.g., professional training, adherence to protocols, satisfaction, and managerial support) were examined using Spearman's rank correlation coefficient (ρ). Where appropriate, simple logistic regression models were applied to explore predictors of positive safety perceptions. Statistical significance was set at $p < 0.05$ for all tests.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2013 revision). Participation in the study was entirely voluntary and anonymous, with no personal identifiers collected. Completion of the online questionnaire was taken to indicate informed consent.

Limitations

The use of convenience sampling limits the generalisability of findings to the broader population of ICU staff. Additionally, the reliance on self-reported data introduces potential response bias. Despite these limitations, the method provided a rapid and cost-effective means of capturing a wide range of professional perspectives across diverse institutions.

Results

Profile of the Sample

A total of 109 valid responses were analysed. The majority of respondents were female (83.5%) and aged between 35-44 years (35.8%), followed by those aged 26-34 years (25.7%). More than half of the participants (54.1%) reported over ten years of professional experience. In terms of professional role, 52.3% were nurses, 22.9% ICU specialists, 17.4% residents, and 5.5% senior consultants. Most respondents worked in public hospitals (59.6%), while 40.4% were employed in private healthcare institutions (*Table 1*).

Table 1. Demographic and professional profile of respondents (n = 109)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Female	91	83.5
	Male	18	16.5
Age (years)	26–34	28	25.7
	35–44	39	35.8
	45–54	27	24.8
	≥55	15	13.8
Professional role	Nurse	57	52.3
	ICU Resident	19	17.4
	ICU Specialist	25	22.9
	Senior Consultant	8	7.3
Experience (years)	<2	5	4.6
	3–5	23	21.1
	6–10	22	20.2
	>10	59	54.1
Hospital type	Public	65	59.6
	Private	44	40.4

Source: Author's analysis (SPSS v.26)

Professional Training: Opportunities and Adequacy

Perceptions regarding opportunities for continuous professional training varied across institutional types.

In public hospitals, 41.5% of respondents rated training opportunities as satisfactory and 13.8% as very satisfactory. In private hospitals, these proportions were slightly higher, with 45.4% and 22.7% respectively. Dissatisfaction was more prevalent in public institutions (29.3%) than in private ones (18.1%) (*Table 2*).

The Chi-square test indicated a significant difference between the two sectors ($\chi^2 = 5.12$, $p < 0.05$), suggesting that private hospital staff perceive greater access to development opportunities (*Table 2*).

When assessing the adequacy of current training programmes, both groups expressed moderate satisfaction. In public hospitals, 40.0% of participants considered training to meet their needs "to a large extent," compared with 36.3% in private institutions (*Table 3*). However, the proportion who rated training as "to a very large extent" was higher in private hospitals (15.9%) than in public ones (12.3%).

The Mann-Whitney U test indicated no statistically significant difference between public and private hospitals regarding the perceived adequacy of professional training programmes, suggesting that staff across both sectors share similar views on the relevance and effectiveness of their current training opportunities (*Table 3*).

Table 2. Evaluation of opportunities for continuous training by hospital type; Chi-square test for association between hospital type and perceived access to professional development opportunities

Level of Satisfaction	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
Very unsatisfactory	9	7 (10.8)	2 (4.5)
Unsatisfactory	18	12 (18.5)	6 (13.6)
Neutral	16	10 (15.4)	6 (13.6)
Satisfactory	47	27 (41.5)	20 (45.4)
Very satisfactory	19	9 (13.8)	10 (22.7)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	χ^2 (df)	p-value	
Pearson Chi-square	5.12 (1)	< 0.05	

Source: Author's analysis (SPSS v.26)

Table 3. Adequacy of training programmes by hospital type; Mann-Whitney U test for adequacy of training programmes by hospital type

Response Level	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
To a very small extent	7	5 (7.7)	2 (4.5)
To a small extent	19	13 (20.0)	6 (13.6)
Neutral	26	13 (20.0)	13 (29.5)
To a large extent	42	26 (40.0)	16 (36.3)
To a very large extent	15	8 (12.3)	7 (15.9)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	U-value	p-value	
Mann–Whitney U	1312.5	> 0.05	

Source: Author's analysis (SPSS v.26)

Preparedness for Emergency Situations

Perceptions of preparedness for clinical emergencies were generally positive and consistent across settings. In public hospitals, 49.2% of respondents considered ICU staff well prepared "to a large extent," compared with 47.7% in private hospitals. The share of those who rated preparedness "to a very large extent" was also similar (33.8% and 34.0%, respectively) (*Table 4*).

The Mann-Whitney U test showed no statistically significant difference between public and private hospitals regarding staff preparedness for emergency situations. This suggests a comparable level of perceived readiness to handle critical incidents across both institutional sectors (*Table 4*).

Table 4. Staff preparedness for emergency situations by hospital type; Mann–Whitney U Test for Preparedness for Emergency Situations by Hospital Type

Response Level	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
To a very small extent	3	2 (3.1)	1 (2.2)
To a small extent	12	7 (10.8)	5 (11.3)
Neutral	4	2 (3.1)	2 (4.5)
To a large extent	53	32 (49.2)	21 (47.7)
To a very large extent	37	22 (33.8)	15 (34.0)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	U-value	p-value	
Mann–Whitney U	1408.0	> 0.05	

Source: Author's analysis (SPSS v.26)

Protocol adherence and infection prevention

Most respondents reported high compliance with safety protocols in their departments (*Table 5*). In public hospitals, 43.1% indicated adherence "to a large extent" and 33.8% "to a very large extent." Private hospitals showed nearly identical results (45.4% and 36.3%, respectively). Only a small minority rated adherence as low (<8% overall).

A moderate, positive, and statistically significant correlation was found between adherence to safety protocols and overall satisfaction. This indicates that stronger compliance with established procedures is associated with higher perceived quality and satisfaction among ICU personnel (*Table 5*).

Perceptions of the effectiveness of infection-prevention measures also demonstrated strong positive trends, with 38.5% of public and 38.6% of private respondents describing them as effective and

Table 5. Compliance with safety protocols and infection-prevention measures; Spearman's rank correlation between protocol adherence and overall satisfaction

Response Level	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
To a very small extent	5	3 (4.6)	2 (4.5)
To a small extent	3	2 (3.1)	1 (2.2)
Neutral	15	10 (15.4)	5 (11.3)
To a large extent	48	28 (43.1)	20 (45.4)
To a very large extent	38	22 (33.8)	16 (36.3)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	Correlation Coefficient (ρ)	p-value	
Spearman's rho	0.39	< 0.01	

Source: Author's analysis (SPSS v.26)

Table 6. Effectiveness of infection-prevention measures; Mann-Whitney U Test for Effectiveness of Infection-Prevention Measures by Hospital Type

Response Level	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
Ineffective	9	5 (7.7)	4 (9.1)
Neutral	20	12 (18.5)	8 (18.2)
Satisfactory	8	5 (7.7)	3 (6.8)
Effective	42	25 (38.5)	17 (38.6)
Very effective	30	18 (27.7)	12 (27.3)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	U-value	p-value	
Mann–Whitney U	1430.0	> 0.05	

Source: Author's analysis (SPSS v.26).

roughly 27% as very effective (*Table 6*).

The Mann-Whitney U test revealed no statistically significant difference between public and private hospitals in staff perceptions of the effectiveness of infection-prevention measures. This suggests that both sectors maintain a comparable level of implementation and confidence in infection-control practices (*Table 6*).

Incident Reporting Culture

The extent to which staff felt encouraged to report errors or incidents without fear of repercussion differed slightly between the two hospital types. In private hospitals, 61.4% of respondents stated that they were always encouraged to report incidents, compared to 52.3% in public hospitals (*Table 7*).

The Chi-square test indicated a statistically significant association between hospital type and encouragement to report incidents. Staff in private hospitals reported a more open and supportive reporting culture compared to those in public institutions (*Table 7*).

Table 7. Encouragement to report incidents without fear of repercussions; Chi-square test for encouragement to report incidents by hospital type

Response	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
Always	61	34 (52.3)	27 (61.4)
Sometimes	27	17 (26.2)	10 (22.7)
Rarely	10	7 (10.8)	3 (6.8)
Never	11	7 (10.8)	4 (9.1)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	χ^2 (df)	p-value	
Pearson Chi-square	4.02 (1)	0.045	

Source: Author's analysis (SPSS v.26).

Communication and Involvement in Decision-Making

Perceived communication and cooperation within ICU teams were positive in both contexts (*Table 8*). Approximately 71% of respondents in public hospitals and 72.7% in private hospitals declared themselves satisfied or very satisfied with teamwork and communication.

A moderate, positive, and statistically significant correlation was observed between team communication and job satisfaction. This suggests that better communication and cooperation within ICU teams are associated with higher levels of professional satisfaction among staff (*Table 8*).

Regarding involvement in decision-making processes, 41.5% of staff in public and 45.4% in private institutions reported being involved "in most cases. A further 29.2% in public and 31.8% in private hospitals stated that they were always involved (*Table 9*).

Table 8. Satisfaction with communication and team cooperation; Spearman's rank correlation between team communication and job satisfaction

Response	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
Very satisfied	34	20 (30.8)	14 (31.8)
Satisfied	44	26 (40.0)	18 (40.9)
Neutral	16	10 (15.4)	6 (13.6)
Dissatisfied	11	7 (10.8)	4 (9.1)
Very dissatisfied	4	2 (3.1)	2 (4.5)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	Correlation Coefficient (ρ)	p-value	
Spearman's rho	0.41	< 0.01	

Source: Author's analysis (SPSS v.26).

Table 9. Involvement in clinical decision-making; Mann–Whitney U test for involvement in clinical decision-making by hospital type

Response	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
Always	33	19 (29.2)	14 (31.8)
In most cases	47	27 (41.5)	20 (45.4)
Rarely	24	16 (24.6)	8 (18.2)
Never	5	3 (4.6)	2 (4.5)
Total	109	65 (100.0)	44 (100.0)
Statistical Test	U-value	p-value	
Mann–Whitney U	1394.5	> 0.05	

Source: Author's analysis (SPSS v.26).

The Mann-Whitney U test showed no statistically significant difference between public and private hospitals regarding staff involvement in clinical decision-making. This indicates that ICU personnel across both sectors perceive a similar degree of participation in patient-care planning and treatment decisions (*Table 9*).

Managerial Support and Recognition

Evaluation of managerial support revealed that respondents in both systems expressed broadly positive perceptions. In public hospitals, 40.0% rated support as good and 26.2% as very good, compared to 38.6% and 27.3%, respectively, in private institutions. A small proportion expressed dissatisfaction (12.3% in public, 9.1% in private) (*Table 10*).

Correlation analysis indicated a significant positive relationship between perceived managerial support and overall job satisfaction ($\rho = 0.68$, $p < 0.01$), as well as between managerial support and willingness to report incidents ($\rho = 0.62$, $p < 0.01$). These findings confirm the critical role of leadership and organisational climate in fostering a strong safety culture.

Comparative and Correlational Analyses

The correlation and comparative analyses provide valuable insights into the relationships between professional training, protocol adherence, safety culture, and managerial support within Anaesthesia and Intensive Care Units (AICUs) (*Table 11*).

First, the positive and statistically significant correlation between satisfaction with professional training and perceived preparedness for emergencies ($\rho=0.44$, $p<0.01$) demonstrates that staff who benefit from regular and relevant training feel more competent and confident in managing critical situations. This finding supports the idea that continuous education enhances self-efficacy and operational readiness, reinforcing the essential role of institutional investment in training programmes.

Similarly, a moderate positive association was identified between compliance with safety protocols and the perceived strength of safety culture ($\rho = 0.39$, $p < 0.01$). This relationship suggests that well-implemented and consistently monitored protocols not only standardise clinical practice but also foster a collective awareness of patient safety. When staff perceive that safety procedures are respected and valued, they are more likely to engage in preventive behaviours and teamwork.

The strongest relationships were found between managerial support and job satisfaction ($\rho=0.68$, $p< 0.01$) and between managerial support and willingness to report incidents ($\rho = 0.62$, $p < 0.01$). These results underline the critical influence of leadership style and organisational climate in promoting both psychological safety and staff morale. Supportive management encourages transparent communication, reduces fear of blame, and sustains a learning-oriented environment, core components of a mature safety culture.

Comparative analysis between public and private hospitals revealed that staff in private institutions reported slightly higher mean scores in training access ($U = 1312.5$, $p = 0.043$) and openness to incident reporting ($U = 1286.0$, $p = 0.045$). Although differences were moderate, they point towards a more proactive approach to continuous learning and non-punitive feedback in the private sector. This may be attributed to differences in resource allocation, managerial flexibility, or institutional culture.

Table 10. Perceived managerial support and recognition; Spearman's rank correlations between managerial support, job satisfaction, and incident reporting

Response	Total (n)	Public Hospitals (n, %)	Private Hospitals (n, %)
Very good	29	17 (26.2)	12 (27.3)
Good	43	26 (40.0)	17 (38.6)
Satisfactory	10	5 (7.7)	5 (11.4)
Neutral	15	9 (13.8)	6 (13.6)
Unsatisfactory	12	8 (12.3)	4 (9.1)
Total	109	65 (100.0)	44 (100.0)
Relationship	Correlation Coefficient (ρ)	p-value	
Managerial support ⇔ Job satisfaction		0.68	< 0.01
Managerial support ⇔ Willingness to report incidents		0.62	< 0.01

Source: Author's analysis (SPSS v.26).

Table 11. Correlations and comparative results

Relationship / Variable Pair	Test / Statistic	Coefficient (ρ / Mean Rank)	p-value
Training satisfaction ⇔ Preparedness for emergencies	Spearman's ρ	0.44	<0.01
Compliance with safety protocols ⇔ Perceived safety culture	Spearman's ρ	0.39	<0.01
Managerial support ⇔ Job satisfaction	Spearman's ρ	0.68	<0.01
Managerial support ⇔ Willingness to report incidents	Spearman's ρ	0.62	<0.01
Public vs. Private: Training access (mean rank)	Mann–Whitney U	1312.5	0.043
Public vs. Private: Openness to incident reporting (mean rank)	Mann–Whitney U	1286.0	0.045

Source: Author's analysis (SPSS v.26).

Overall, the data confirm high levels of protocol adherence and preparedness, coupled with moderate satisfaction with professional training and positive team dynamics. The private sector exhibited marginally better perceptions in training availability and error-reporting culture, while public hospitals demonstrated comparable performance in protocol compliance and teamwork. The results collectively support hypotheses H1, H2, and H3, underscoring the intertwined roles of training, safety culture, and managerial support in sustaining quality care within intensive care units.

Discussion

The present study examined the interrelationships between continuous professional training, adherence to safety protocols, and managerial support as determinants of safety culture and job satisfaction within Anaesthesia and Intensive Care Units (AICUs). The results confirmed the proposed hypotheses H1, H2, and H3, showing that these three components are interconnected and mutually reinforcing in influencing the quality and safety of critical care practice.

The positive correlations identified between professional training and preparedness for emergencies, as well as between protocol adherence and perceived safety culture, align with previous research highlighting that continuous education enhances both technical proficiency and self-efficacy in clinical decision-making (13,14). Similar studies have shown that structured training improves response times and accuracy in critical care situations (15,16). The current findings suggest that ICU staff who report higher satisfaction with training also feel better equipped to manage emergencies and are more engaged in maintaining high safety standards (17,18).

The association between managerial support, job satisfaction, and incident-reporting behaviour reinforces the idea that leadership style is an important determinant of organisational climate and safety performance (19). Evidence shows that supportive leadership reduces burnout, enhances communication, and promotes transparency in reporting adverse events (20). The results of this study confirm that staff who perceive strong managerial support are more likely to report incidents openly and to express higher levels of professional satisfaction (21,22). This outcome is consistent with organisational psychology models that emphasise the role of trust and feedback in sustaining a positive safety culture (23).

The comparison between public and private hospitals revealed slightly higher scores in the private sector for openness to incident reporting and access to professional development opportunities (24). This difference may be explained by more flexible managerial practices, faster resource allocation, and performance-based incentives in private institutions (25). Public hospitals, while offering comparable levels of protocol adherence, may be constrained by administrative and structural rigidity, limiting opportunities for innovation in training and safety management (4).

From a managerial perspective, the findings underline the importance of integrating interdisciplinary training programmes, empathetic leadership, and constructive feedback systems into the strategic development of ICU services (26,27). Simulation-based team training has been proven to enhance both individual competence and team communication in high-risk clinical settings (28). Leadership development focused on emotional intelligence and feedback can foster a supportive organisational culture that encourages collaboration and continuous learning (29). Moreover, the promotion of a non-punitive incident-reporting culture is essential for strengthening patient safety and enabling collective learning from errors.

Ensuring patient safety and maintaining high standards of clinical care are fundamental priorities in modern anaesthesia and intensive care practice. In Romania, as in many healthcare systems undergoing continuous transformation, the pursuit of excellence in anaesthetic and critical care services depends strongly on three interrelated pillars: continuous professional training, adherence to clinical protocols, and a sustainable safety culture. Continuous training guarantees that healthcare professionals remain up to date with evolving evidence, technologies, and guidelines, particularly in high-risk and rapidly changing clinical environments. Adherence to standardised protocols ensures consistency of care, minimising the risk of preventable errors and variability in practice. Meanwhile, cultivating a strong safety culture promotes open communication, mutual trust, and the non-punitive reporting of incidents, essential features of resilient healthcare organisations.

Although each of these dimensions has been studied independently, their interdependence is of particular relevance in the Romanian anaesthesia and intensive care context, where systemic challenges, such as resource constraints, variable staffing levels, and evolving clinical governance structures, demand an integrated approach. The conceptual matrix presented here provides a structured framework for understanding and evaluating how continuous training, protocol adherence, and safety culture interact to influence patient outcomes and professional performance in Romanian Anaesthesia and Intensive Care Units (AICUs) (*Fig. 1*).

According to *Fig. 1*, continuous training, protocol adherence, and safety culture form a mutually reinforcing triad that underpins patient safety and quality of care in anaesthesia and intensive care. Continuous training empowers healthcare professionals to apply the latest evidence-based practices with competence and confidence; adherence to protocols translates that knowledge into consistent clinical performance; and a robust safety culture provides the psychological and organisational environment in which both can flourish. In the evolving healthcare landscape of Romania, strengthening these three dimensions in parallel is essential for building resilient AICUs capable of responding effectively to clinical complexity, technological advancement, and systemic pressures. The proposed framework thus offers not only a conceptual lens for analysis but also a strategic foundation for policy development, training initiatives, and institutional improvement in patient safety and critical care quality.

Limitations

This study has several limitations. The use of a convenience sample restricts the generalisability of the results to the broader population of ICU staff. The reliance on self-reported data introduces possible bias due to subjective perceptions and social desirability. In addition, the absence of objective indicators of clinical performance or patient outcomes prevents direct measurement of the impact of perceptions on safety results. Despite these constraints, the findings contribute valuable evidence on the professional and organisational dynamics affecting quality and safety in Romanian intensive care units.

Future Research Directions

Future research should employ longitudinal designs to examine how interventions in training and leadership influence safety culture over time. Cross-national comparative studies could identify cultural and systemic differences that affect the implementation of safety strategies. Furthermore, mixed-method approaches, integrating quantitative surveys with qualitative interviews or ethnographic observations, would provide a more comprehensive understanding of how professional training, management practices, and feedback systems interact to sustain safety and staff well-being in intensive care environments.

Conclusion

This study provides empirical evidence that continuous professional training, adherence to safety protocols, and supportive management are interdependent drivers of safety culture and job satisfaction in Anaesthesia and Intensive Care Units (AICUs). The findings confirm that staff who perceive greater access to relevant training and stronger managerial support report higher preparedness for emergencies, stronger commitment to safety, and greater willingness to report incidents.

Although no major performance differences were identified between public and private hospitals, the private sector showed slightly higher levels of openness to feedback and error reporting. These results highlight the need for an integrated organisational approach that combines interdisciplinary training, empathetic leadership, and constructive feedback mechanisms to enhance quality and resilience in intensive care.

Future initiatives should focus on institutionalising continuous learning and promoting leadership models that encourage transparency, collaboration, and learning from experience.

Authors' Contribution

Conceptualization, G.P.G., and O.H.B; methodology, G.P.G and DS.; software, D.G.C, H.M. and A.C.P.; validation, G.P.G., D.S., O.H.B. and S.C.; formal analysis, H.M, I.R., A.H and M.M; investigation, G.P.G. and D.N.P.; resources, G.P.G., D.G.C. and D.N.P.; data curation, H.M, D.S and A.C.P.; writing—original draft preparation, G.P.G and O.H.B.; writing— G.P.G and D.S.; visualization, AH and MM.; supervision, D.S. and S.C.; project administration, G.P.G, O.H.B. and I.R.. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest and Sources of Funding

The authors declare no conflict of interest. No artificial intelligence automatically generated text was inserted in this manuscript, and no image was previously published in another journal or is under consideration for publication elsewhere. This research received no external funding.

Ethics Approval and Consent to Participate

Not applicable.

Patient Consent for Publication

Not applicable.

References

1. Abuzied Y, Maymani H, AlMatouq B, AlDosary O Reducing the length of stay by enhancing the patient discharge process: using quality improvement tools to optimize hospital efficiency. Glob J Qual Saf Healthc. 2021;4(1):44-49.
2. Adeyemi C, Adegoke BO, Odugbose T The impact of healthcare information technology on reducing medication errors: A review of recent advances. Int J Front Med Surg Res. 2024; 5(2):20–29.
3. Ahmadipour M, Dehghan M, Ahmadinejad M, Jabarpour M, Mangolian Shahrbabaki P, Ebrahimi Rigi Z. Barriers to hand hygiene compliance in intensive care units during the COVID-19 pandemic: A qualitative study. Front Public Health. 2022;10:968231.
4. Ahsan MJ. Cultivating a culture of learning: the role of leadership in fostering lifelong development. The Learning Organization. 2025;32(2):282-306.
5. Elendu C, Amaechi DC, Okatta AU, Amaechi EC, Elendu TC, Ezeh CP, et al. The impact of simulation-based training in medical education: A review. Medicine (Baltimore). 2024;103(27):e38813.
6. Johnson J, Simms-Ellis R, Janes G, Mills T, Budworth L, Atkinson L, et al. Can we prepare healthcare professionals and students for involvement in stressful healthcare events? A mixed-methods evaluation of a resilience training intervention. BMC Health Serv Res. 2020;20(1):1094.
7. Sartelli M, Marini CP, McNelis J, Coccolini F, Rizzo C, Labricciosa FM, et al. Preventing and controlling healthcare-associated infections: The first principle of every anti-microbial stewardship program in hospital settings. Antibiotics (Basel). 2024;13(9):896.
8. Klompas M, Branson R, Cawcutt K, Crist M, Eichenwald EC, Greene LR, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and non-ventilator hospital-acquired pneumonia in acute-care hospitals: 2022 update. Infect Control Hosp Epidemiol. 2022;43(6):687-713.
9. Hoxha G, Simeli I, Theocharis D, Vasileiou A, Tsekouropoulos G, Sustainable healthcare quality and job satisfaction through organizational culture: Approaches and outcomes. Sustainability. 2024;16(9):3603.
10. Azoulay E, Barnes NK, Nainan-Myatra S, Delgado MCM, Arabi Y, Boulanger C, et al. HELLO: a protocol for a cluster randomized controlled trial to enhance interpersonal relationships and team cohesion among ICU healthcare professionals. Intensive Care Med Exp. 2024;12(1):90.
11. Druica E, Mihaila V, Burcea M, Cepoi V, Combining direct and indirect measurements to assess patients' satisfaction with the quality of public health services in Romania. Int J Environ Res Public Health. 2019;17(1):152.
12. Li L, Cui X, Feng W, Enhancing patient satisfaction in cross-regional healthcare: A cross-sectional study in the knowledge-based healthcare landscape. J Knowl Econ. 2024;15:14172–14198.
13. Kazamer A, Ilinca R, Nitu A, Iuonut AM, Bubenek-Turconi SI, Sendlhofer G, et al. A brief assessment of patient safety culture in anesthesia and intensive care departments. Healthcare (Basel). 2023;11(3):429.
14. Brown T, Yu ML, Hewitt A, Cousland R, Etherington J, Professionalism, resilience and reflective thinking: how do these influence occupational therapy student fieldwork outcomes? Occup Ther Health Care. 2022;36(4):327-352.
15. Smith A, Carey C, Sadler J, Smith H, Stephens R, Frith C, et al. Undergraduate education in anaesthesia, intensive care, pain, and perioperative medicine: The development of a national curriculum framework. Med Teach. 2019;41(3):340-346.
16. Chidini G, De Luca D, Calderini E, Catenacci SS, Marchesi T, Langer T, et al. Implementation of noninvasive neurally adjusted ventilatory assist in pediatric acute respiratory failure: a controlled before-after quality improvement study. J Anesth Analg Crit Care. 2021;1(1):1.
17. Yesilyaprak T, Demir Korkmaz F, The relationship between surgical intensive care unit nurses' patient safety culture and adverse events. Nurs Crit Care. 2023;28(1): 63-71.
18. Bourne RS, Jennings JK, Panagioti M, Hodkinson A, Sutton A, Ashcroft DM, et al. Medication-related interventions to improve medication safety and patient outcomes on transition from adult intensive care settings: A systematic review and meta-analysis. BMJ Qual Saf. 2022;31(8):609-622.
19. Haller G, Stoelwinder J, Myles PS, McNeil J, Quality and safety indicators in anesthesia: a systematic review. Anesthesiology. 2009;110(5):1158-75.
20. Figueroa CA, Harrison R, Chauhan A, Meyer L, Priorities and challenges for health leadership and workforce management globally: a rapid review. BMC Health Serv Res. 2019;19(1):239.
21. Peter KA, Voirol C, Kunz S, Gurtner A, Renggli F, Juvet T, et al. Factors associated with health professionals' stress reactions, job satisfaction, intention to leave and health-related outcomes in acute care, rehabilitation and psychiatric hospitals, nursing homes and home care organisations. BMC Health Serv Res. 2024;24(1):269.
22. Lee D, Yoon SN, Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. Int J Environ Res Public Health. 2021;18(1):271.
23. Damayanti A. Perum Damri Managerial Performance: The Role of Customer Focus and Continuous Improvement. Public Manag Account Rev. 2024;5(1):47–60.
24. Bhati D, Deogade MS, Kanyal D, Improving patient outcomes through effective hospital administration: A comprehensive review. Cureus. 2023;15(10):e47731.
25. De Rosis S, Cerasuolo D, Nuti S. Using patient-reported measures to drive change in healthcare: the experience of the digital, continuous and systematic PREMs observatory in Italy. BMC Health Serv Res. 2020;20(1):315.
26. Azimirad M, Magnusson C, Wiseman A, Selander T, Parviainen I, Turunen H. Identifying teamwork-related needs of the medical emergency team: Nurses' perspectives. Nurs Crit Care. 2022;27(6):804-814.
27. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AHS, Dellinger EP. Safe Surgery Saves Lives Study Group, et al. Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. BMJ Qual Saf. 2011;20(1):102-7.
28. Yang M, Wang Z, Cheng L, Chen E, Exploring satisfaction with air-HSR intermodal services: A Bayesian network analysis. Transp Res Part A Policy Pract. 2022; 156: 69–89.
29. Soori H, Errors in medical procedures. In: Errors in Medical Science Investigations. Singapore: Springer Nature Singapore; 2024. p. 205–224.