



MIXED METHODS STUDY

Safety Culture in Italian Hospitals: a Mixed Methods Study among surgical healthcare professionals

Domenica Gazineo¹, Elvio Di Rado², Lea Godino³

1 Governo Clinico e Qualità, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

2 IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

3 Medical Genetics Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

Findings:

Safety culture was generally positive, with higher scores for Safety Climate and Other Conditions and lower ratings for hospital management and working conditions. Nurses, younger professionals, and staff with limited operating-room experience reported less favorable perceptions. Focus groups confirmed the importance of trust, collaboration, and experience, while highlighting communication and organizational weaknesses and recommending continuing education, simulation, non-punitive audits, and greater involvement in decision-making.

ABSTRACT

INTRODUCTION: Safety culture is crucial in surgical settings, which are characterized by high technical complexity and strong interdependence among healthcare professionals. In Italy, studies adopting a mixed-methods approach to explore professionals' perceptions and the organizational actions aimed at promoting safety remain limited.

METHODS: A convergent parallel mixed-methods design was adopted. The quantitative phase consisted of the online administration of the validated Italian version of the Safety Attitudes Questionnaire (SAQ), while the qualitative phase involved focus groups analyzed using an inductive thematic approach. The two components were integrated through a comparative matrix.

RESULTS: The highest SAQ scores were observed for the Safety Climate and Other Conditions dimensions, whereas less positive perceptions emerged for Perception of Hospital Management and Working Conditions. Significant differences were associated with professional role, gender, and years of experience in the operating room. The qualitative analysis identified five main themes: safety as a relational climate; the role of experience and training; communication and organizational challenges; the operating room as an identity-forming space of safety; and improvement strategies, including continuous training, simulation activities, non-punitive audits, and greater professional involvement in decision-making processes. The mixed-methods integration revealed strong convergence between quantitative and qualitative findings, while also highlighting organizational needs not captured by the questionnaire alone.

CONCLUSIONS: Safety culture in Italian surgical settings appears overall positive but shows critical issues related to managerial and organizational dimensions. Strengthening structured training, interprofessional communication, and the involvement of healthcare professionals in decision-making processes represents a strategic lever to promote safety-oriented behaviors.

KEYWORDS: *Safety culture, Operating room, Healthcare professionals, Mixed methods*

Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda
Ospedaliera Universitaria di Bologna, via Giuseppe
Massarenti 11, 40138, Bologna (BO) ITALY



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STUDIO A METODI MISTI

La cultura della sicurezza negli ospedali italiani: uno studio mixed methods rivolto ai professionisti di area chirurgica

Domenica Gazineo¹, Elvio Di Rado², Lea Godino³¹ Governo Clinico e Qualità, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy² IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy³ Medical Genetics Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

Riscontri:

La cultura della sicurezza è risultata complessivamente positiva, con punteggi più elevati per Safety Climate e Other Conditions e valori inferiori per percezione della direzione ospedaliera e condizioni di lavoro. Infermieri, professionisti più giovani e personale con minore esperienza in sala operatoria hanno riportato percezioni meno favorevoli. I focus group hanno confermato il ruolo centrale di fiducia, collaborazione ed esperienza, evidenziando criticità comunicative e organizzative e proponendo formazione continua, simulazione, audit non punitivi e maggiore partecipazione decisionale.

ABSTRACT

INTRODUZIONE: La cultura della sicurezza è cruciale nei contesti chirurgici, caratterizzati da elevata complessità tecnica e interdipendenza tra professionisti. In Italia mancano studi che esplorino con approccio mixed-methods le percezioni degli operatori e le azioni organizzative per promuovere la sicurezza.

METODI: È stato adottato un disegno a metodo misto convergente parallelo. La fase quantitativa ha previsto la somministrazione online del Safety Attitudes Questionnaire (SAQ) nella versione italiana validata, mentre la fase qualitativa ha utilizzato focus group analizzati mediante approccio tematico induttivo. Le due componenti sono state integrate tramite una matrice comparativa.

RISULTATI: I punteggi più elevati del SAQ riguardano le dimensioni Safety Climate e Other Conditions, mentre le percezioni meno positive emergono per Perception of Hospital Management e Working Conditions. Differenze significative sono associate a ruolo professionale, genere e anni di esperienza in sala operatoria. L'analisi qualitativa ha identificato cinque temi principali: la sicurezza come clima relazionale; il ruolo dell'esperienza e della formazione; criticità comunicative e organizzative; la sala operatoria come luogo identitario di sicurezza; e proposte di miglioramento, tra cui formazione continua, simulazioni, audit non punitivi e maggiore partecipazione ai processi decisionali. L'integrazione mixed-methods ha evidenziato una forte convergenza tra risultati quantitativi e qualitativi, rivelando anche bisogni organizzativi non rilevabili tramite il solo questionario.

CONCLUSIONI: La cultura della sicurezza nei contesti chirurgici italiani appare complessivamente positiva, ma presenta criticità nelle dimensioni manageriali e organizzative. Rafforzare la formazione strutturata, la comunicazione interprofessionale e il coinvolgimento dei professionisti nei processi decisionali rappresenta una leva strategica per promuovere comportamenti orientati alla sicurezza.

KEYWORDS: *Cultura della sicurezza, Sala operatoria, Professionisti sanitari, Metodi Misti*

Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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INTRODUCTION

Patient safety is a cornerstone of high-quality healthcare delivery [1]. A strong and shared safety culture among healthcare professionals is widely recognized as a key determinant of clinical outcomes and the prevention of adverse events [2,3]. Defined as the collective values, attitudes, competencies, and behaviours that shape professional practice [4–6], safety culture is particularly critical in surgical environments, where high technical complexity, continuous innovation, and close interprofessional interdependence characterize everyday clinical activities.

Within these settings, ongoing changes in care delivery models, evolving skill-mix configurations, and the introduction of new technologies require effective coordination and sustained collaboration among healthcare professionals. Previous research has demonstrated that support roles, structured delegation pathways, and targeted educational initiatives can enhance operational efficiency, teamwork, and patient safety [7–13]. Other studies have highlighted the importance of adaptive coordination within surgical teams [14] and identified variations in safety attitudes across professional groups, with potential implications for interprofessional collaboration and patient outcomes [15]. Furthermore, evidence consistently suggests that an appropriate skill mix, effective communication, and well-structured teamwork are associated with a reduced risk of adverse events [16–19].

Despite these findings, important gaps remain in the current evidence base. In Italy, little is known about how healthcare professionals working in surgical settings perceive patient safety culture and which organizational strategies they consider most effective for its

improvement. Addressing this gap is particularly important because the dynamics of operating room practice and interprofessional interactions may directly influence safety-related behaviours and ultimately affect the quality of care delivered to patients.

To address this issue, the present study employed a mixed-methods design to explore healthcare professionals' perceptions of patient safety culture within Italian surgical settings and to identify the organizational actions considered most important for fostering safety-oriented behaviours.

Specifically, the quantitative component examined safety attitudes among professionals working in surgical departments, whereas the qualitative component, based on focus groups, explored participants' views on the organizational changes and improvement strategies needed to strengthen patient safety culture and promote safer practices in operating rooms.

MATERIAL AND METHODS

Study Design

This study employed a convergent parallel mixed-methods design, in which the quantitative and qualitative components were conducted concurrently and analysed independently before being integrated during the interpretation phase [20]. This design was selected to provide a comprehensive understanding of patient safety culture in surgical settings by combining quantitative assessment of safety attitudes with qualitative exploration of healthcare professionals' experiences, perceptions, and recommendations. The integration of the two data strands enabled the development of meta-inferences that enriched the interpretation of findings and provided a more



Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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nuanced understanding of safety-related factors within the surgical environment.

Quantitative Phase

Design

The quantitative phase employed a cross-sectional survey design.

Recruitment and Data Collection

Participants were recruited through convenience sampling using professional social media networks. A study invitation containing a link to the online survey was disseminated through these channels. After reviewing the study information sheet and providing informed consent, participants anonymously completed the questionnaire via Microsoft Forms. Data were collected between June and September 2024.

Sample

Eligible participants were healthcare professionals who had been working continuously in surgical departments for at least six months and were able to understand and complete the questionnaire in Italian. Professionals temporarily assigned to surgical settings or absent from clinical practice for more than six months were excluded. These criteria were adopted to ensure that participants had sufficient and up-to-date experience of the surgical environment to provide informed responses regarding patient safety culture.

Instrument

Data were collected using the Italian version of the Safety Attitudes Questionnaire (SAQ), which was culturally adapted and psychometrically validated for use in Italian

healthcare settings [21–23]. The SAQ is one of the most widely used instruments for assessing patient safety culture and evaluates healthcare professionals' perceptions of safety, teamwork, communication, and error management.

In the Italian version, items are organized into eight dimensions representing key domains of patient safety culture: Teamwork Climate, Safety Climate, Job Satisfaction, Stress Recognition, Perception of Hospital Management, Perception of Unit Management, Working Conditions, and Other Questions. Together, these dimensions provide a comprehensive assessment of professionals' attitudes toward safety and the organizational factors that may influence safety-related behaviours within surgical settings.

Qualitative Phase



Design

The qualitative component adopted a qualitative descriptive design. Focus groups were selected as the data collection method because they facilitate the exploration of shared experiences, collective meanings, and interpersonal dynamics that may be difficult to capture through quantitative approaches alone.

Recruitment and Data Collection

Participants were recruited through direct invitations distributed via email and telephone contact. Individuals who expressed interest in participating received an information sheet and informed consent form. Following consent, focus group sessions were scheduled and conducted either face-to-face or remotely using Microsoft Teams.

Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda
Ospedaliera Universitaria di Bologna, via Giuseppe
Massarenti 11, 40138, Bologna (BO) ITALY



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Data were generated through focus group discussions guided by a semi-structured interview guide. The duration of each session varied according to the depth and richness of participants' contributions. All discussions were audio-recorded and transcribed verbatim prior to analysis.

Participants

The qualitative sample consisted of healthcare professionals working in surgical settings who voluntarily agreed to participate in the study. Eligibility criteria mirrored those adopted for the quantitative component and included continuous employment in a surgical department for at least six months and adequate proficiency in Italian. Professionals temporarily assigned to surgical units or absent from work for more than six months were excluded.

Data collection continued until thematic saturation was achieved. Although saturation had initially been estimated to occur after approximately 8–10 participants, recruitment continued to ensure adequate representation of professional experiences, resulting in a final sample of 20 participants.

Interview Guide

A semi-structured interview guide was specifically developed to explore healthcare professionals' experiences and perceptions of patient safety within surgical settings. The guide included broad, open-ended questions addressing motivations for working in surgical environments, factors influencing everyday practice, emotional experiences related to patient safety, organizational challenges, and potential strategies for strengthening safety culture within operating rooms.

The semi-structured format ensured consistency across focus groups while allowing participants to introduce and elaborate on issues they considered particularly relevant. Additional probing questions were used to clarify emerging concepts and encourage deeper reflection when appropriate.

Reflexivity

Data collection was conducted by two nurse managers who were also members of the research team and possessed complementary expertise. One researcher had extensive clinical experience in surgical care and advanced academic training in nursing and midwifery sciences, while the second researcher had specific expertise in evidence-based healthcare and research methodology.

During the focus groups, the researchers adopted complementary roles, with one facilitating the discussion and the other observing group interactions and documenting contextual observations. This approach supported the creation of a non-judgemental environment that encouraged participants to openly share their experiences and perspectives.

Data analysis was conducted by the researcher with expertise in evidence-based healthcare together with a nurse researcher holding a PhD and extensive experience in qualitative research. Throughout the study, the researchers engaged in ongoing reflexive discussions concerning their professional backgrounds, assumptions, emerging interpretations, and potential sources of bias. By balancing contextual familiarity with analytical distance, the research team sought to enhance the credibility, transparency, and trustworthiness of the findings.





Data Analysis

Quantitative Analysis

Quantitative data obtained from the SAQ and the sociodemographic variables were analysed using descriptive statistics to summarize participant characteristics and safety attitude scores across the eight SAQ dimensions.

Associations between safety attitudes and participants' sociodemographic and professional characteristics were examined using inferential statistics. Independent-samples t-tests were used for two-group comparisons, whereas one-way analyses of variance (ANOVA) were performed for comparisons involving multiple groups. Statistically significant ANOVA results were further explored using Bonferroni-adjusted post-hoc tests.

Prior to conducting inferential analyses, the assumptions of parametric testing were assessed. Normality was evaluated through inspection of score distributions and descriptive indices, while homogeneity of variance was assessed using Levene's test. Effect sizes were calculated to complement significance testing and are reported as Cohen's d for t-tests and eta-squared (η^2) for ANOVA analyses.

Qualitative Analysis

Qualitative data were analysed using an inductive qualitative descriptive approach. Analysis proceeded iteratively through repeated reading of the transcripts, coding of meaningful segments of text, comparison of codes across participants, and development of themes that captured shared patterns within the data.

The analysis focused on participants' experiences of patient safety, perceived organizational challenges within surgical settings, and recommendations for improving safety culture and practice. Credibility was enhanced through researcher triangulation and continuous evaluation of thematic saturation throughout the analytical process.

Integration of Quantitative and Qualitative Findings

In accordance with the convergent parallel mixed-methods design, quantitative and qualitative findings were integrated during the interpretation stage. A joint analytical matrix was developed to compare and relate findings from the two datasets, facilitating the identification of areas of convergence, divergence, and complementarity.

This integrative process enabled quantitative findings to be interpreted alongside participants' narratives, generating meta-inferences that provided a richer and more contextualized understanding of patient safety culture within surgical settings. The integrated findings also informed the identification of organizational priorities and potential strategies for strengthening safety-oriented practices.

Ethical Considerations

The study was approved by the Bioethics Committee of the University of Bologna on 26 June 2024 (Protocol No. 0183160; approval issued on 1 July 2024). All participants provided informed consent prior to participation, and participation was voluntary.



Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda
Ospedaliera Universitaria di Bologna, via Giuseppe
Massarenti 11, 40138, Bologna (BO) ITALY



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RESULTS

QUANTITATIVE PHASE

Participant Characteristics

A total of 295 healthcare professionals working in surgical settings were included in the study. The mean age was 40.4 years, and 60.7% of participants were female. Most participants belonged to the Millennial generation, and nurses represented 80% of the sample. Mean hospital work experience was 13 years, while most participants reported between 1 and 10 years of experience in operating rooms. The majority were employed in the Emilia-Romagna region. Further sociodemographic and professional characteristics are reported in *Table 1*.

Safety Attitudes Questionnaire

Mean scores across the eight SAQ dimensions revealed variability in participants' perceptions of patient safety culture. The highest scores were observed for Safety Climate (23.9 ± 5.2) and Other Conditions (17.2 ± 3.5), whereas the lowest scores were reported for Perception of Hospital Management (12.5 ± 3.8) and Working Conditions (12.7 ± 3.8). Mean scores and corresponding ranges for all SAQ dimensions are presented in *Table 2*. The distribution of responses across individual SAQ items showed variability across the dimensions assessed. Detailed item-level results are provided in *Appendices, Supplementary Table S1*.

Associations between SAQ dimension scores and participants' sociodemographic and professional characteristics revealed significant differences across several domains. Detailed findings are presented in *Appendices, Supplementary Table S2*. With respect to gender, men reported significantly higher scores than women in

Table 1. Participant Characteristics

Characteristics	mean $\pm$ sd
Age (years)	40.4 $\pm$ 9.9
n (%)	
Age (generations)	
Baby Boomers	6 (2.0)
Generation X	98 (33.2)
Millennials	156 (52.9)
Generation Z	35 (11.9)
Gender	
Male	97 (32.9)
Female	179 (60.7)
Prefer not to say	19 (6.4)
Marital Status	
Single	129 (44.0)
Married/Cohabiting	140 (47.0)
Divorced/Separated	22 (7.0)
Widowed	4 (1.4)
Region of Residence	
Abruzzo	10 (3.4)
Campania	2 (0.7)
Emilia-Romagna	270 (91.5)
Friuli-Venezia-Giulia	1 (0.3)
Lazio	3 (1.0)
Lombardia	5 (1.7)
Puglia	3 (1.0)
Sicily	1 (0.3)
mean $\pm$ sd	
Years of Hospital Experience	13.1 $\pm$ 9.9
n (%)	
Years of Operating Room Experience	
<1 year	20 (7.0%)
1–5 years	111 (38.0%)
6–10 years	76 (26.0%)
11–15 years	35 (12.0%)
16–20 years	22 (7.0%)
>20 years	31 (11.0%)
Professional Role	
Registered Nurse	236 (80.0)
Healthcare Assistant	28 (9.5)
Surgical	31 (10.5)





Technologist

Table 2. Mean scores and internal consistency of the eight SAQ dimensions

Dimensions	Mean $\pm$ sd	Range	Cronbach's α
Teamwork Climate	20.04 $\pm$ 4.55	6 - 30	0.818
Safety Climate	23.97 $\pm$ 5.23	7 - 35	0.836
Job Satisfaction	18.89 $\pm$ 4.70	5 - 25	0.859
Stress Recognition	15.80 $\pm$ 3.77	4 - 20	0.851
Perception of Hospital Management	12.52 $\pm$ 3.78	5 - 25	0.652
Perception of Unit Management	14.76 $\pm$ 4.40	5 - 25	0.634
Working Conditions	12.73 $\pm$ 3.75	4 - 20	0.601
Other Conditions	17.21 $\pm$ 3.51	5 - 25	0.745

Teamwork Climate (20.7 $\pm$ 4.4 vs. 20.0 $\pm$ 4.5; $p = 0.013$), Safety Climate (24.5 $\pm$ 5.5 vs. 24.0 $\pm$ 5.0; $p = 0.027$), Perception of Unit Management (15.3 $\pm$ 4.1 vs. 14.8 $\pm$ 4.5; $p = 0.022$), and Other Conditions (17.7 $\pm$ 3.4 vs. 17.2 $\pm$ 3.5; $p = 0.009$). Age was significantly associated with several SAQ dimensions. Baby Boomers achieved the highest scores for Teamwork Climate (20.5 $\pm$ 3.6; $p = 0.008$), Safety Climate (26.7 $\pm$ 6.6; $p = 0.007$), Job Satisfaction (20.2 $\pm$ 4.5; $p = 0.011$), and Perception of Hospital Management (14.8 $\pm$ 3.1; $p = 0.048$), followed by Generation X (Teamwork Climate: 21.0 $\pm$ 4.3; Safety Climate: 25.1 $\pm$ 5.2; Job Satisfaction: 20.1 $\pm$ 4.1). By contrast, Generation Z reported the lowest scores across these domains (Teamwork Climate: 18.0 $\pm$ 4.5; Safety Climate: 22.0 $\pm$ 4.3; Job Satisfaction: 17.6 $\pm$ 4.7). Bonferroni-adjusted post-hoc comparisons indicated that these differences were primarily driven by the lower scores observed among Generation Z participants relative to the older generations.

Marital status was associated with Job Satisfaction and Perception of Unit Management. Married or cohabiting

participants reported higher Job Satisfaction than single participants (19.5 $\pm$ 4.5 vs. 18.0 $\pm$ 4.8; $p = 0.007$) and higher Perception of Unit Management scores (15.3 $\pm$ 4.4 vs. 14.0 $\pm$ 4.2; $p = 0.026$). Although widowed participants exhibited the highest mean scores for Teamwork Climate (24.3 $\pm$ 2.9), Safety Climate (28.8 $\pm$ 2.6), and Job Satisfaction (24.0 $\pm$ 2.0), these findings should be interpreted cautiously because of the very small number of participants in this subgroup. Professional role was significantly associated with multiple SAQ dimensions. Compared with healthcare assistants and surgical technologists, nurses scored lower in Teamwork Climate (19.5 $\pm$ 4.6 vs. 22.3 $\pm$ 4.0 and 22.5 $\pm$ 3.0; $p < 0.001$), Safety Climate (23.3 $\pm$ 5.2 vs. 26.0 $\pm$ 4.7 and 27.1 $\pm$ 4.4; $p < 0.001$), Job Satisfaction (18.4 $\pm$ 4.7 vs. 21.1 $\pm$ 4.4 and 20.8 $\pm$ 3.8; $p = 0.001$), Perception of Unit Management (14.2 $\pm$ 4.4 vs. 17.0 $\pm$ 4.2 and 17.3 $\pm$ 3.1; $p < 0.001$), and Working Conditions (12.2 $\pm$ 3.7 vs. 14.5 $\pm$ 4.0 and 15.1 $\pm$ 2.2; $p < 0.001$).

No significant between-group differences were found for Other Conditions ($p = 0.704$). Post-hoc analyses

Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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confirmed that nurses consistently scored lower than both healthcare assistants and surgical technologists, whereas the latter two professional groups did not differ significantly from each other.

Operating room experience was also associated with safety attitudes. Professionals with less than one year of experience reported the lowest scores for Teamwork Climate (17.7 ± 4.7 ; $p < 0.001$), Safety Climate (21.9 ± 5.6 ; $p < 0.001$), Job Satisfaction (16.6 ± 5.4 ; $p < 0.001$), Perception of Unit Management (13.5 ± 4.2 ; $p = 0.001$), Working Conditions (11.3 ± 4.2 ; $p = 0.004$), and Other Conditions (14.9 ± 3.8 ; $p < 0.001$). Conversely, the highest scores were generally observed among professionals with 11–15 years of operating room experience (Teamwork Climate: 22.8 ± 3.7 ; Safety Climate: 26.9 ± 4.3 ; Job Satisfaction: 21.2 ± 4.0 ; Other Conditions: 18.9 ± 4.0). Bonferroni-adjusted comparisons showed that professionals with less than one year of experience consistently scored lower than their more experienced colleagues across the dimensions for which significant differences were identified.

QUALITATIVE PHASE

Participant Characteristics

The qualitative sample comprised 20 healthcare professionals working permanently in surgical settings. Participants were predominantly registered nurses, together with healthcare assistants and surgical technologists. Their ages ranged from early-career professionals to highly experienced staff, while operating room experience varied from fewer than 5 years to more than 20 years.

Qualitative Findings

The thematic analysis identified five main themes that provide an in-depth understanding of healthcare professionals' perceptions of patient safety within the operating room. These themes emerged from the focus group discussions and reflect participants' experiences, perceived challenges, and resources within the surgical setting.

Theme 1. Patient Safety as a Relational Climate and Professional Support

Patient safety was primarily described as being fostered by a supportive working environment characterized by collaboration, open communication, and mutual trust. Having colleagues and key professional figures to rely on—particularly the nurse manager and the anaesthesiologist—was consistently perceived as essential for ensuring both patient and staff safety.

The availability of a reliable professional support network was described as reducing uncertainty and helping professionals manage unexpected situations more effectively:

“Safety means knowing that there are people you can rely on to work together and overcome difficulties.”

“Even when I am working alone during the afternoon shift, I know there is always someone I can turn to for support.”

Overall, patient safety was perceived as a shared process emerging from collaboration among healthcare professionals rather than from individual actions alone.

Theme 2. The Role of Experience, Education, and Professional Competence





Participants consistently associated patient safety with professional experience in the operating room and access to adequate, ongoing education and training. Experience was considered fundamental for managing complex situations and emergencies with greater confidence and autonomy, whereas newly appointed staff frequently described an initial sense of uncertainty.

"We have all the competencies needed to work safely... we also know how to manage emergencies."

"For a new colleague, this environment can be intimidating; more simulation training and continuing education would be beneficial."

The reduction in regular educational opportunities was perceived as a limitation to patient safety, particularly for rare or highly complex procedures. Participants repeatedly emphasized the need to reintroduce simulation-based training and practical workshops, highlighting the importance of complementing experience with structured educational programmes.

Theme 3. Interprofessional Communication and Organizational Challenges

Communication emerged as one of the main areas of vulnerability, particularly between nurses and surgeons and among different clinical teams. Communication pathways mediated through the nurse manager were often perceived as limiting direct dialogue and, at times, reducing communication effectiveness.

"I would improve communication with surgeons outside the operating room... direct discussion is often missing."

"Communication regarding endovascular procedures is often incomplete, and this creates uncertainty."

Participants also identified the management of equipment and clinical information during complex care pathways—particularly vascular and endovascular procedures—as a critical issue. Inadequate communication was perceived as contributing to delays, operational difficulties, and potential risks to patient safety.

Hospital management was frequently perceived as being distant from everyday clinical practice:

"We do not feel that we have a direct relationship with hospital management."

"To make our voices heard, we had to take strong action."

The lack of structured feedback and regular audit activities was identified as a missed opportunity to strengthen an organizational culture more strongly oriented towards patient safety.

Theme 4. The Operating Room as a Place of Perceived Safety and Professional Identity

Despite the challenges described, the operating room was consistently perceived as an environment that provides a high level of personal and professional safety. Many participants described it as a familiar workplace that offers a sense of protection and professional fulfilment.

"For me, this is my professional family."

"In the operating room, you feel safer because you can focus on one patient and do your job well."

The opportunity to care for one patient at a time, together with well-organized workflows and strong team integration, contributed to a sense of both physical and psychological security. Participants also described the operating room as a setting in which they had developed a





strong professional identity, advanced technical expertise, and meaningful collaborative relationships.

"From the first day I discovered the operating room, I never wanted to work anywhere else."

This theme highlights an interesting paradox: the operating room was perceived as a highly safe environment by the most experienced professionals, whereas feelings of insecurity mainly emerged when participants were required to work outside their usual role or in the absence of effective interprofessional communication.

Theme 5. Proposals for Improvement: Education, Communication, and Organizational Participation

The improvement strategies discussed during the focus groups reflected a strong commitment to continuously strengthening patient safety within the operating room. Participants first emphasized the need to reinforce education through simulation-based training, structured continuing professional development, and formal mentoring programmes for newly appointed staff. Education was viewed as an essential resource for maintaining safe practice, particularly during complex or infrequently performed procedures.

Communication represented a second key area for improvement. Participants described communication as, at times, fragmented or filtered, particularly in interactions with other clinical teams and along complex care pathways. They advocated for dedicated opportunities for discussion, such as non-punitive clinical audits and structured reviews of challenging cases, to promote information sharing and collective reflection on errors.

Finally, participants highlighted the importance of greater involvement in organizational decision-making. Although

some internally proposed initiatives had been implemented, the overall perception was that organizational decision-making processes were not always transparent or fully shared. According to participants, greater involvement of healthcare professionals in decision-making and the review of clinical procedures would further strengthen patient safety culture within surgical settings.

Mixed-Methods Integration of Findings

The integration of the quantitative and qualitative findings provided a more comprehensive and nuanced understanding of patient safety culture in surgical settings. The mixed-methods approach showed that the quantitative and qualitative findings not only converged across several key aspects but also complemented one another, offering a coherent and enriched understanding of the phenomenon under investigation.

Overall, the quantitative findings from the SAQ indicated a generally positive perception of patient safety culture, particularly with regard to Safety Climate and interprofessional collaboration. At the same time, Perception of Hospital Management and Working Conditions received the lowest mean scores, highlighting organizational aspects that were perceived less positively. Inferential analyses further revealed significant differences in safety attitudes according to gender, age, professional role, and years of operating room experience.

The qualitative findings confirmed and further contextualized these results. Participants described a working environment in which patient safety was grounded in the quality of interpersonal relationships, mutual support, and the key role played by reference professionals, particularly nurse managers and





anaesthesiologists. Professional experience emerged as a crucial factor influencing perceptions of safety, especially when dealing with complex or unexpected situations, whereas newly appointed staff frequently described feelings of uncertainty and disorientation during their initial period of practice. At the same time, participants highlighted challenges related to interprofessional communication and a perceived distance from hospital management. These findings closely reflected the lower scores observed for the corresponding SAQ dimensions.

Taken together, the quantitative and qualitative findings demonstrated substantial convergence across several key areas, particularly regarding the importance of professional relationships, experience, and organizational challenges. At the same time, the qualitative findings provided a more nuanced understanding of communication processes and the management of professional responsibilities within surgical pathways. They also brought to light aspects that were not captured by the questionnaire, including the need for non-punitive opportunities for discussion, greater involvement in organizational decision-making, and stronger support for continuing professional education.

The relationship between the quantitative and qualitative findings is summarized in the Joint Display Table (Table 3), which aligns the SAQ dimensions with the themes identified through the thematic analysis, highlighting areas of convergence, complementarity, and divergence.

DISCUSSION

Using a convergent mixed-methods design, this study explored the safety attitudes of healthcare professionals working in surgical settings by integrating quantitative assessment through the SAQ with a qualitative exploration of participants' experiences, perceived challenges, and

organizational resources encountered in everyday clinical practice. This integrated approach provides a comprehensive understanding of patient safety culture within the operating room, confirming several findings reported in the literature while offering additional insights relevant to organizational management and professional development.

Overall Perceptions of Patient Safety

Overall, the quantitative findings suggest a moderately positive perception of patient safety culture, with the highest scores observed for Safety Climate and Other Conditions. These findings are consistent with those reported by Sacks et al. [24], who found that healthcare professionals working in surgical settings generally perceive a favourable safety culture, particularly in environments characterized by strong interprofessional collaboration.

The qualitative findings reinforce this interpretation by describing a collaborative working environment in which mutual support, trust, and the presence of key professional figures are regarded as fundamental to patient safety. This observation is consistent with the work of Prati et al. [15], who identified the quality of interprofessional relationships as a key determinant of safety attitudes.

The Role of Experience and Education

A significant association was observed between years of professional experience and higher scores across several SAQ dimensions. The qualitative findings mirrored this pattern, with participants consistently describing experience as a source of technical competence, emotional confidence, and the ability to manage unexpected situations effectively.



Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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Table 3. *Integration of quantitative and qualitative findings (Joint Display)*

Domain	Quantitative Findings	Qualitative Findings	Type of Integration
Safety Climate and Collaboration	Safety Climate achieved one of the highest mean scores (23.9 ± 5.2). Teamwork Climate was moderately positive.	Theme 1: Patient safety as a relational climate based on trust, professional support, and interprofessional collaboration.	Strong convergence
Role of Experience	Greater operating room experience was associated with higher scores across most SAQ dimensions. Generation Z reported the lowest scores for Teamwork Climate, Safety Climate, and Job Satisfaction.	Themes 2 and 4: Professional experience enhances both technical confidence and emotional security, whereas newly appointed staff initially experience uncertainty and disorientation.	Explanatory complementarity
Leadership and Management	Perception of Hospital Management (12.5) and Perception of Unit Management (14.7) received the lowest mean scores.	Theme 3: Perceived distance from hospital management, limited feedback, the need for regular audits, and the pivotal role of the nurse manager.	Strong convergence
Working Conditions	Working Conditions received one of the lowest mean scores (12.7).	Theme 3: Organizational challenges in complex clinical pathways and inadequate communication in highly variable surgical settings.	Convergence
Suggestions for Improvement	Not directly explored by the SAQ because of its standardized structure.	Theme 5: Strong emphasis on education and training, simulation-based learning, non-punitive discussion, and greater organizational participation.	Qualitative expansion (new insights)
Differences Across Professional Roles	Nurses scored significantly lower than healthcare assistants and surgical technologists across several SAQ dimensions.	Themes 1–5: Differences between professional groups were discussed mainly in relation to roles and responsibilities, although they were less explicitly reflected in participants' narratives.	Limited divergence

These findings support the observations of Blegen et al. [16], who suggested that well-established competencies and an appropriate skill mix contribute to reducing the risk of adverse events.

Importantly, participants did not equate experience solely with years of service. Instead, they emphasized the importance of continuous, structured education, particularly simulation-based training for complex or infrequently performed procedures. This perspective aligns with the work of Huddleston et al. [12] and Hemingway et al. [13], who highlighted the need for robust educational systems to support the introduction of new professional

roles and maintain safe, coordinated practice within the operating room.

Communication, Coordination, and Organizational Challenges

Among the SAQ dimensions, Perception of Hospital Management and Working Conditions received the lowest scores, identifying organizational management as one of the principal areas requiring improvement. The qualitative findings provided important context for these results, describing a perceived distance between healthcare professionals and hospital management, fragmented communication, and the absence of structured feedback mechanisms. Similar observations have been reported by

Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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Bogdanovic et al. [14], who emphasized the importance of adaptive coordination within surgical teams.

Participants also described communication challenges associated with complex surgical pathways, particularly vascular and endovascular procedures. These findings reflect those reported by Catchpole et al. [17], who demonstrated that increasing procedural complexity and the involvement of multiple professionals heighten the risk of communication failures and operational errors.

Another important area of convergence between the quantitative and qualitative findings concerns the role of the nurse manager. Participants consistently described this figure as central to maintaining team coordination and promoting patient safety. This finding is in line with the work of Wurstner et al. [7] and Micheli et al. [8], which showed that dedicated coordination and support roles can improve both operational efficiency and perceptions of safety.

The Operating Room as a Place of Professional Identity

One of the most distinctive findings of this study emerged almost exclusively from the qualitative component. Participants described the operating room not only as a highly specialized clinical environment but also as a place of professional identity, familiarity, and belonging. This perception extended beyond technical competence, encompassing feelings of safety, protection, and professional fulfilment.

Although this dimension cannot be captured through the SAQ, it provides an additional perspective on patient safety in surgical settings by suggesting that stable teams and strong professional cohesion may themselves function as protective factors, complementing the organizational

and interpersonal dimensions traditionally explored in the patient safety literature.

Strategies to Strengthen Patient Safety Culture

The improvement strategies proposed by participants, including enhanced education and training, non-punitive audit processes, improved interprofessional communication, and greater involvement in organizational decision-making, closely reflect current international recommendations for strengthening patient safety culture. They are also consistent with the recommendations emerging from the validation of the Italian version of the SAQ by Bernalt-Martí [22].

Although these aspects are not directly assessed by the questionnaire, they represent one of the main added values of the present study. By complementing the quantitative findings with professionals' experiences and recommendations, the qualitative component provides practical indications for healthcare organizations seeking to further strengthen patient safety culture within surgical settings.

Practical Implications

The findings of this study identify several priorities for strengthening patient safety culture within surgical settings. Foremost among these is the need to enhance continuing professional education through simulation-based training and structured orientation programmes for newly appointed staff. Such initiatives may strengthen both technical competence and professionals' confidence when managing complex or infrequently performed procedures.

A second priority concerns interprofessional communication. Providing dedicated opportunities for discussion, such as non-punitive clinical audits and brief





debriefing sessions, may facilitate more effective information sharing and contribute to safer management of complex clinical pathways.

Participants also highlighted the importance of establishing a more direct and transparent relationship with hospital management, which may strengthen organizational trust and foster greater engagement in decision-making processes. Finally, recognizing and supporting the role of the nurse manager, identified as a key source of operational and emotional support for the team, appears essential for promoting a working environment perceived as safe, cohesive, and collaborative.

Study Limitations

The findings of this study should be interpreted in light of several limitations. First, the quantitative component relied on a non-probability sample of voluntary participants, the majority of whom were recruited from a single Italian region. Consequently, the generalizability of the findings to other surgical settings may be limited.

Second, although the SAQ is a validated instrument, its self-report nature may have introduced social desirability bias and reflects participants' subjective perceptions, which may not fully correspond to actual organizational conditions.

In addition, SAQ scores were reported using the original subscale scores rather than the standardized 0–100 transformation commonly adopted in the international literature. Although this choice does not affect the statistical comparisons performed, it may limit direct comparisons with published benchmarks and international studies.

Regarding the qualitative component, the relatively small number of participants may not have captured the full diversity of professional experiences. Although thematic saturation was achieved, additional focus groups might have further enriched the interpretation of the findings. Moreover, the group dynamics inherent to focus groups may have influenced participants' willingness to express dissenting opinions, potentially favouring consensus over less commonly expressed perspectives.

Finally, although the convergent mixed-methods design provided a richer and more contextualized understanding of patient safety culture, the observational nature of the study precludes any inference of causal relationships between the variables examined.

CONCLUSION

This convergent mixed-methods study explored how healthcare professionals working in surgical settings perceive patient safety and the factors that shape their experiences. The quantitative findings showed that perceptions of patient safety varied across the SAQ dimensions, with Teamwork Climate and Safety Climate emerging as strengths, whereas perceptions of management and working conditions represented the principal areas of concern. Significant differences in safety attitudes were also observed according to gender, professional role, and years of operating room experience.

The qualitative findings complemented and enriched these results by showing that patient safety is experienced primarily as a relational process grounded in trust, collaboration, and the presence of trusted professional figures. The communication and organizational challenges described during the focus groups were consistent with the lower SAQ scores, while the operating room was





perceived by the most experienced professionals as a highly safe environment that also fosters a strong sense of professional identity.

Taken together, the quantitative and qualitative findings indicate that patient safety in surgical settings is shaped by the interplay of technical competence, interprofessional relationships, and organizational practices. Strengthening continuing professional education, promoting effective communication, and increasing healthcare professionals' involvement in organizational decision-making may represent key strategies for fostering a stronger and more widely shared patient safety culture.

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Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 11, 40138, Bologna (BO) ITALY



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APPENDICES:

Supplementary Table S1. *Distribution of responses to individual questionnaire items*

	Strongly disagree	Slightly disagree	Disagree	Slightly agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)	n (%)
Item 1	23 (7.8)	72 (24.4)	61 (20.7)	91 (31.2)	47 (15.9)
Item 2	59 (20.0)	72 (24.4)	60 (20.3)	77 (26.1)	27 (9.2)
Item 3	22 (7.5)	67 (22.7)	50 (16.9)	83 (28.1)	73 (24.7)
Item 4	11 (3.7)	33 (11.2)	49 (16.6)	113 (38.3)	89 (30.2)
Item 5	8 (2.7)	48 (16.3)	67 (22.7)	95 (32.2)	77 (26.1)
Item 6	38 (12.9)	59 (20.0)	61 (20.7)	84 (28.5)	53 (18.0)
Item 7	21 (7.1)	44 (14.9)	65 (22.0)	99 (33.6)	66 (22.4)
Item 8	15 (5.1)	53 (18.0)	59 (20.0)	92 (31.2)	76 (25.8)
Item 9	13 (4.4)	46 (15.6)	65 (22.0)	103 (34.9)	68 (23.1)
Item 10	25 (8.5)	66 (22.4)	77 (26.1)	68 (23.1)	59 (20.0)
Item 11	57 (19.3)	68 (23.1)	56 (19.0)	78 (26.4)	36 (12.2)
Item 12	14 (4.7)	52 (17.6)	62 (21.0)	87 (29.5)	80 (27.1)
Item 13	17 (5.8)	33 (11.2)	65 (22.0)	96 (32.5)	84 (28.5)
Item 14	68 (23.1)	74 (25.1)	76 (25.6)	48 (16.3)	29 (9.8)
Item 15	7 (2.4)	18 (6.1)	30 (10.2)	70 (23.7)	170 (57.6)
Item 16	38 (12.9)	37 (12.5)	62 (21.0)	82 (27.8)	76 (25.8)
Item 17	16 (5.4)	40 (13.6)	54 (18.3)	88 (29.8)	97 (32.9)
Item 18	6 (2.0)	12 (4.1)	43 (14.6)	75 (25.4)	159 (53.9)
Item 19	32 (10.8)	60 (20.3)	69 (23.4)	75 (25.4)	59 (20.0)
Item 20	13 (4.4)	25 (8.5)	42 (14.2)	100 (33.9)	115 (39.0)
Item 21	9 (3.1)	25 (8.5)	38 (12.9)	92 (31.2)	131 (44.4)
Item 22	13 (4.4)	22 (7.5)	48 (16.3)	72 (24.4)	140 (47.5)
Item 23	13 (4.4)	39 (13.2)	46 (15.6)	100 (33.9)	97 (32.9)
Item 24	76 (25.8)	67 (22.7)	55 (18.6)	44 (14.9)	53 (18.0)
Item 24 b	119 (40.3)	83 (28.1)	54 (18.3)	30 (10.2)	9 (3.1)
Item 25	77 (26.1)	38 (12.9)	68 (23.1)	70 (23.7)	42 (14.2)
Item 25 b	30 (10.2)	41 (13.9)	81 (27.5)	70 (23.7)	73 (24.7)
Item 26	49 (16.6)	61 (20.7)	73 (24.7)	52 (17.6)	60 (20.3)
Item 26 b	89 (30.2)	76 (25.6)	87 (29.5)	34 (11.5)	9 (3.1)
Item 27	66 (22.4)	71 (24.1)	68 (23.1)	38 (12.9)	52 (17.6)
Item 27 b	107 (36.3)	82 (27.8)	73 (24.7)	26 (8.8)	7 (2.4)
Item 28	35 (11.9)	51 (17.3)	67 (22.7)	78 (26.4)	64 (21.7)
Item 28 b	74 (25.1)	67 (22.7)	74 (25.1)	60 (20.3)	20 (6.8)
Item 29	43 (14.6)	59 (20.0)	56 (19.0)	90 (30.5)	47 (15.9)
Item 30	50 (15.9)	65 (22.0)	76 (25.8)	68 (23.1)	36 (12.2)

Corresponding author:

Lea Godino: lea.godino2@unibo.it, IRCCS Azienda
Ospedaliera Universitaria di Bologna, via Giuseppe
Massarenti 11, 40138, Bologna (BO) ITALY



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Item 31	20 (6.8)	70 (23.7)	86 (29.2)	89 (30.2)	30 (10.2)
Item 32	22 (7.5)	47 (15.9)	55 (18.6)	86 (29.2)	85 (28.8)
Item 33	6 (2.0)	15 (5.1)	44 (14.9)	116 (39.3)	114 (38.9)
Item 34	15 (5.1)	47 (15.9)	74 (25.1)	89 (30.2)	70 (23.7)
Item 35	13 (4.4)	26 (8.8)	60 (20.3)	107 (36.3)	89 (30.2)
Item 36	40 (13.6)	55 (18.6)	68 (23.1)	74 (25.1)	58 (19.7)

Corresponding author:

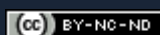
Lea Godino: lea.godino2@unibo.it, IRCCS Azienda
Ospedaliera Universitaria di Bologna, via Giuseppe
Massarenti 11, 40138, Bologna (BO) ITALY



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Supplementary Table S2. Differences in SAQ dimension scores across sociodemographic and professional characteristics

		Teamwork Climate		Safety Climate		Job Satisfaction		Stress Recognition		Perception of Hospital Management		Perception of Unit Management		Working Conditions		Other Conditions	
		mean $\pm$ sd	p-value	mean $\pm$ sd	p-value	mean $\pm$ sd	p-value	mean $\pm$ sd	p-value	mean $\pm$ sd	p-value	mean $\pm$ sd	p-value	mean $\pm$ sd	p-value	mean $\pm$ sd	p-value
Gender																	
	Male	20.7 $\pm$ 4.4	0.013	24.5 $\pm$ 5.5	0.027	18.9 $\pm$ 4.9	0.512	15.7 $\pm$ 4.1	0.244	12.87 $\pm$ 3.90	0.504	15.3 $\pm$ 4.1	0.022	13.0 $\pm$ 3.6	0.662	17.7 $\pm$ 3.4	0.009
	Female	20.0 $\pm$ 4.5		24.0 $\pm$ 5.0		19.0 $\pm$ 4.7		16.0 $\pm$ 3.6		12.39 $\pm$ 3.70		14.8 $\pm$ 4.5		12.7 $\pm$ 3.9		17.2 $\pm$ 3.5	
	Prefer not to say	17.3 $\pm$ 4.6		21.0 $\pm$ 5.1		17.7 $\pm$ 4.0		14.5 $\pm$ 3.8		12.00 $\pm$ 4.10		12.2 $\pm$ 4.4		12.2 $\pm$ 3.4		15.1 $\pm$ 3.2	
Age (generations)																	
	Baby Boomers	20.5 $\pm$ 3.6	0.006	26.7 $\pm$ 6.6	0.007	20.2 $\pm$ 4.5	0.011	16.3 $\pm$ 3.4	0.313	14.83 $\pm$ 3.12	0.048	15.3 $\pm$ 1.9	0.210	11.7 $\pm$ 3.8	0.298	18.2 $\pm$ 3.8	0.055
	Generation X	21.0 $\pm$ 4.3		25.1 $\pm$ 5.2		20.1 $\pm$ 4.1		15.5 $\pm$ 3.7		12.90 $\pm$ 3.93		15.4 $\pm$ 4.6		13.2 $\pm$ 3.5		17.9 $\pm$ 3.5	
	Millennials	19.9 $\pm$ 4.7		23.6 $\pm$ 5.2		18.4 $\pm$ 4.9		16.2 $\pm$ 3.8		12.01 $\pm$ 3.68		14.6 $\pm$ 4.5		12.7 $\pm$ 3.9		16.9 $\pm$ 3.5	
	Generation Z	18.0 $\pm$ 4.5		22.0 $\pm$ 4.3		17.6 $\pm$ 4.7		15.0 $\pm$ 4.0		13.37 $\pm$ 3.66		13.6 $\pm$ 3.3		12.0 $\pm$ 3.6		16.5 $\pm$ 3.1	
Marital Status																	
	Single	19.4 $\pm$ 4.9	0.050	23.2 $\pm$ 5.3	0.047	18.0 $\pm$ 4.8	0.007	16.0 $\pm$ 4.0	0.642	12.27 $\pm$ 3.64	0.535	14.0 $\pm$ 4.2	0.026	12.1 $\pm$ 3.8	0.010	16.9 $\pm$ 3.6	0.371
	Married/Cohabiting	20.4 $\pm$ 4.1		24.3 $\pm$ 5.0		19.5 $\pm$ 4.5		15.5 $\pm$ 3.6		12.61 $\pm$ 3.79		15.3 $\pm$ 4.4		13.1 $\pm$ 3.5		17.5 $\pm$ 3.3	
	Divorced/Separated	24.3 $\pm$ 2.9		28.8 $\pm$ 2.6		24.0 $\pm$ 2.0		16.3 $\pm$ 3.0		12.00 $\pm$ 3.83		18.8 $\pm$ 2.6		16.8 $\pm$ 0.5		18.8 $\pm$ 2.5	
	Widowed	21.0 $\pm$ 5.2		25.3 $\pm$ 6.1		19.5 $\pm$ 5.1		16.5 $\pm$ 3.9		13.50 $\pm$ 4.59		15.3 $\pm$ 5.1		13.8 $\pm$ 4.6		16.9 $\pm$ 4.2	
Professional Role																	
	Registered Nurse	19.5 $\pm$ 4.6	< 0.001	23.3 $\pm$ 5.2	< 0.001	18.4 $\pm$ 4.7	0.001	15.8 $\pm$ 3.8	0.928	12.44 $\pm$ 3.77	0.744	14.2 $\pm$ 4.4	< 0.001	12.2 $\pm$ 3.7	< 0.001	17.1 $\pm$ 3.5	0.704
	Healthcare Assistant	22.3 $\pm$ 4.0		26.0 $\pm$ 4.7		21.1 $\pm$ 4.4		16.0 $\pm$ 3.4		12.96 $\pm$ 4.07		17.0 $\pm$ 4.2		14.5 $\pm$ 4.0		17.4 $\pm$ 4.2	
	Surgical Technologist	22.5 $\pm$ 3.0		27.1 $\pm$ 4.4		20.8 $\pm$ 3.8		15.9 $\pm$ 4.0		12.74 $\pm$ 3.76		17.3 $\pm$ 3.1		15.1 $\pm$ 2.2		17.7 $\pm$ 2.9	

Corresponding author:

Lea Godino: lea.godino2@unibo.it Policlinico
S. Orsola Malpighi, via Giuseppe Massarenti 11,
40138, Bologna (BO) ITALY

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Years of Operating Room Experience																	
	<1 year	17.7±4.7	< 0.001	21.9±5.6	< 0.001	16.6±5.4	< 0.001	15.0±4.2	0.189	13.00 ± 4.32	0.510	13.5±4.2	0.001	11.3±4.2	0.004	14.9±3.8	< 0.001
	1–5 years	18.5±4.2		22.3±4.7		17.7±4.6		15.5±3.9		12.39 ± 3.68		13.6±4.0		12.0±3.5		16.7±3.0	
	6–10 years	20.7±4.7		24.7±5.1		19.4±4.6		16.2±3.7		11.96 ± 3.28		15.6±4.4		13.6±3.8		17.3±3.4	
	11–15 years	22.8±3.7		26.9±4.3		21.2±4.0		17.1±3.6		13.14 ± 4.31		16.8±4.2		14.3±4.0		18.9±4.0	
	16–20 years	20.7±4.9		24.5±6.8		19.3±4.8		15.4±3.2		13.36 ± 4.93		15.2±5.3		12.5±4.1		16.6±4.8	
	>20 years	21.9±3.3		25.7±4.5		20.3±3.9		15.4±4.0		12.77 ± 3.44		15.2±4.3		12.6±3.0		18.9±2.7	

Corresponding author:

Lea Godino: lea.godino2@unibo.it Policlinico
S. Orsola Malpighi, via Giuseppe Massarenti 11,
40138, Bologna (BO) ITALY

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