Circulating nurse´s non-technical skills: a literature review

CURRENT STATUS: UNDER REVIEW

Reza Kalantari
Shiraz University of Medical Sciences

Zahra Zamanian
Shiraz University of Medical Sciences

zamanianz@sums.ac.ir Corresponding Author

Mehdi Hasanshahi
Shiraz University of Medical Sciences

Aliakbar Faghihi
Shiraz University of Medical Sciences

Hadi Niakan
Shiraz University of Medical Sciences

Jamshid Jamali
Mashhad University of Medical Sciences

Somayeh Gheysari
Shiraz University of Medical Sciences

DOI: 10.21203/rs.3.rs-23634/v1

SUBJECT AREAS
General Surgery Surgery

KEYWORDS
Circulating nurse, non-technical skills, behaviors, surgery, operating room.
Abstract

**Background:** Circulating nurses are key members of the surgical team and play an essential role in ensuring patient safety in the operating room. They need to use non-technical skills to provide safe and efficient patient care. This study was conducted to identify the behaviors related to the circulating nurse’s nontechnical skills from the existing literature.

**Methods:** A search of the literature between 1990 and 2020 was conducted using online sources, including Web of Science, MEDLINE, CINHAL, Scopus, OVID, and Cochran library. Furthermore, the publications of the Association of peri-operative registered nurses (AORN) and the National Association of Theater Nurses (NATH) were consulted. Then the skills were grouped into known categories of non-technical skills.

**Results:** Behaviors related to circulating nurse’s non-technical skills were extracted from the existing literature. Then they were grouped into seven domains, including communication, leadership, coping, teamwork, situational awareness, task management, and decision-making and problem-solving. Furthermore, several improper behaviors were extracted.

**Conclusion:** Circulating nurses need to use non-technical skills from the beginning until the end of surgery to perform efficiently. There is still a need for future work to identifying circulating nurses’ non-technical skills using other types of studies to develop an assessment tool.

**Background**

For more than one century, surgery has been a significant element of public health (1). More than 234 million major surgeries are undertaken every year worldwide. Regarding high rates of death and complications in major surgical procedures, surgical safety should be considered as a public health concern (2). In the operating room, interdisciplinary teams of healthcare professionals with different skills work together to deliver quality patient care (3). The operating room is high risk (4) and a very complex environment (5), in which occur approximately 50% of adverse events within a hospital (6). The analysis of the adverse events has shown that the causes of these events are defects in non-technical aspects of performance, rather than failures in technical expertise (7). In other words, these cognitive and social skills are being increasingly known as the leading cause of surgical errors (8).
Non-technical skills help to reduce surgical errors, effective response to face problems during surgery (9), contribute to safe task performance, and complement technical skills (10).

Circulating nurses are key members of the surgical team and play an important role in ensuring patient safety in the operating room (11). They control the events that happen outside the sterile area and provide team members (12). Circulating nurses remain outside the sterile field and keep the contacts with out of the operating room (13). They are responsible for the patient’s final check before surgery (14), and they support the activities of other team members and the patient (15). Circulating nurses control the traffic of the operating room and observe aseptic principles to prevent infections (16). Circulating nurse’s work relies on deployment of non-technical skills (11). They should follow the process of surgery and anticipate the needs of scrub nurses (17). The circulating nurses must remain focused, confident, calm, and in control during operation (18). They should observe the surrounding area to identify possible problems (19) and maintain patient safety (20). Therefore, their non-technical skills are crucial in safe and successful surgery.

The number of studies on operating room nurse’s nontechnical skills is lower than other surgical team members (11). Yet, the scrub nurse’s non-technical skills have been studied in past years, and a behavioral marker system was developed (3, 21, 22). The circulating nurse’s non-technical skills were not considered widely before. Only in one ethnographic study, Redaelli listed the main categories of circulating nurse’s non-technical skills, without reporting key behaviors (11). The survey on circulating nurse’s non-technical skills is under-developed, while their skills are very important. In a former study, Circulating nurses were the team members with most numbers concerning communication patterns (12). In a previous research, it was revealed that 77% of the errors during the surgery were intercepted by circulating nurses (19). Identifying the circulating nurse’s non-technical skills can be helpful in the development of a behavioral marker system, the assessment of their behaviors, and educating them to improve their skills. In this study, we aim to identify the behaviors related to circulating nurse’s non-technical skills from the existing literature.

Methods
This review was conducted based on the instruction of the Cochran handbook (23). The search terms
were selected based on non-technical skills previous researches. Communication, teamwork, leadership, situational awareness, monitoring, coping strategies, problem-solving, decision making, and task management are the non-technical skills that are indicated in previous researches on healthcare staff. The circulating nurses may be called as scout nurse, circulating practitioner, circulating technician, and operating room nurses; so all the terms were put in keywords.

A search of the literature between 1990 and 2020 was conducted using online sources including Web of Science, MEDLINE, CINHAL, Scopus, OVID, and Cochran library. Furthermore, the publications of the association of peri-operative registered nurses (AORN) and the National Association of Theater Nurses (NATH) were consulted. The searched terms were a combination of MeSH terms and keywords.

"Non-technical skills", "Task management", "Teamwork", "Communication", "Situational awareness", "Leadership", "Decision making", "coping", "monitoring", "problem-solving", "circulating nurse/practitioner/technician", "scout nurse", "intra-operative nurse" and "Operating room/Operating theatre" were included. Various combinations of the keywords were used.

Original articles, clinical trials, case reports, reviews, systematic reviews, and meta-analysis were included. The list of references for each review article was crosschecked for additional studies. The articles which were published in a language other than English and those that were not published in peer-reviewed journals were excluded from this study. Two authors screened the studies by title and abstract independently to consider potential eligibility. Then, they reviewed full texts to extract relevant studies. Disagreements between the authors were discussed, and after rechecking, they achieved complete agreement. The included studies were deeply analyzed to extract behaviors that are linked to circulating nurse’s non-technical skills. The behaviors were grouped based on the definition of known non-technical skills. Figure one shows the PRISMA diagram of the search results.

**Results**

The formerly developed behavioral marker systems to assess surgical team’s non-technical skills include some exemplar behaviors that are related to nursing sub-team and circulating nurse’s non-technical skills (24-30). Only one ethnographic study (11) has been conducted to extract the circulating nurse’s non-technical skills; however, the study not reported exemplar behaviors, so we
studied the references that are related to nursing and operating room to extract more behaviors. After reviewing the related studies and textbooks, we extracted the circulating nurse’s non-technical skills’ behaviors. We used the definition “social, cognitive, and personal recourse skills that contribute to safe task performance and complement technical expertise (10)” and known non-technical skills to categorize these skills.

**Communication**

Communication is the exchange of information among surgical team members (22). This category is a very important element in nursing jobs. The circulating nurse should communicate appropriately with the patient, surgical team members, and others in the surgical ward. They can talk to the patient to decrease his/her fear and stress before the start of surgery (31-33). Circulating nurses should use a proper tone of voice as they stand feet away from the surgical bed (34) and talk about only relevant issues to the surgery (12). They give necessary information to the team members during the surgery and hand-offs (35). Table one shows the circulating nurse’s communicational skills.

**Leadership**

Regarding circulating nurse’s duties, his/her leadership is not defined as “the capability to lead the surgical team”; instead, it’s better to describe it as “heading the surgical team members occasionally by guiding them toward corrective actions when they have deviated” (11). Circulating nurses have a crucial leadership role (36), as they are known as “in charge of the operating room” (37). They control the operating room traffic (31, 38) and do not let unnecessary entrances. They lead the time out process (39, 40) and orchestrate the surgery process within the operating room (31). Table 2 shows the circulating nurse’s leadership behaviors.

**Coping skills**

Operating room nurses are subject to stress, as there are several stressors in the operating room (41). Circulating nurses should be able to cope with stressful situations (11), as they are the most stressed team member in the peri-operative phase of surgery (42). They should adopt quickly to changes (23) because their reaction against stressful situations can affect other team members and the process of surgery. In such cases, they might reposition instruments smoothly (11). Staying calm
and dominant facing emergency situations and complications, being able to adapt with unpredicted and new conditions, Concentrating on the task that should be done at that moment, and a problem-solving based approach in stressful circumstances are the behaviors that were mentioned in the literature.

**Teamwork**

Circulating nurses should be able to work within the surgical team, cooperate with others, and stay coordinated with them. They function as an extra pair of hands and legs for surgical team, (43) and they help to prepare the operating room before start the surgery (44). Circulating nurses help other team members; for example, they help anesthesiology technicians during changes in patient status (15), induction, and intubation(45) and supporting sterile team members by providing their needs (45, 46). They could do it actively by walking around the operating room and helping team members (47).

Circulating nurses also play an important role in coordinating activities in the operating room. They coordinate sterile team members with anesthesiologists (46), coordinate whole team activities (23) and needs (48) with out of the operating room. Table 3 shows the circulating nurse´s extracted teamwork skills.

**Situational awareness**

Situational awareness refers to the perception of elements in an environment within the volume of space and time, understanding and comprehension of their meaning, and projecting their status in the near future (49). People, tools, patient, and instruments are considered as the elements of the operating room. A circulating nurse attends to the patient and reminds behind him/her during the induction of anesthesia. During the surgery, they watch and seek surgical procedure and monitor the sterile team´s needs (45). They should be able to anticipate the process of surgery and adjust his/her roles to meet the needs (17). Circulating nurses should ensure the patient´s safety and comfort (31) and should gather information about the patient-related issues (16). They should check the presence (50) and the correct function of the devices (16, 45) in the operating room before the start of surgery. Table 4 shows the behaviors related to the circulating nurse´s situational awareness.

**Task management**
Task management refers to the capacity of organizing resources to achieve the surgical team’s goals (22) and also maintain operating room standards. Circulating nurses should remain in the operating room until the end of surgery, like other team members (51, 52). They need to manage and prioritize their tasks to do efficiently (53) and do housekeeping of the operating room (54). Circulating nurses should do their duties with precision, for example, in opening the sterile packs (55). They should manage the specimens properly and pay attention to counting protocols such as recording count results immediately and correctly (45). Circulating nurses review and prepare patient’s documents (56) and know their roles and act toward them (57). Table 5 shows the circulating nurses´ skills in managing their tasks.

**Decision-making and problem-solving**

Circulating nurses can help in decision-making and problem-solving when the team faces problems. Behaviors like “participating in decisions by raising their opinion”, “offering alternatives when necessary, using analytical decision making regarding the events”, and “trying to identify and solve problems” were indicated in the literature.

**Improper behaviors**

Through reviewing the literature, we found some inappropriate behaviors that are against the circulating nurse’s non-technical skills and could endanger patient safety by deviating the surgery process. Table 6 shows these behaviors.

**Discussion**

This review was conducted to extract the circulating nurse’s non-technical skills from the existing literature. The skills categorized into seven domains, including communication, leadership, coping, teamwork, situational awareness, task management, and decision-making and problem-solving. They use these skills from the beginning until the end of surgery. Furthermore, we founded some improper behaviors regarding these skills from the literature.

The result of the review showed that circulating nurses need to have more communication, teamwork, situational awareness, and task management skills than leadership and decision making. This result can be due to the roles in the operating room; surgeons, as the surgical team’s formal leader, have
more authority to make decisions and lead the team. On the other way, circulating nurses do the majority of their work with coordinating and management of the operating room. They could only be asked to give their opinion based on their expertise in problem-solving and decision-making, or they help indirectly with acting promptly and providing team members what they need. They manage and control the operating room to provide a comfortable environment for the patient and team members. Circulating nurses play a vital role in the operating rooms, and their efficient performance extremely is related to deploying non-technical skills. Circulating nurses perceive the operating room as a complex environment that needs high activity and teamwork (58), as technological advances increase their workload and stress (59). They may be impacted by technological and technical factors more than any other member of the surgical team (60). The use of non-technical skills in the operating room can help circulating nurses to do their tasks better in such situations and ensure patient safety. They play a vital role in error recovery and ensuring patient safety (19) by maintain high vigilance and observing other team members from a better point of view; this way, they can protect the sterile field. If a circulating nurse is absent during the surgery process, the communicative bridge between the operating room and hospital will be disconnected, and it could cause delays in the process of surgery and failures.

Individual assessment of circulating nurse´s non-technical skills has not be conducted before. Only in studies using behavioral marker systems such as the observational teamwork assessment for surgery (OTAS) (24) and Oxford non-technical skills system (NOTCHES II) (27) the nursing sub-team, including scrub and the circulating nurse is assessed. As being the team member who has the most interactions with materials, equipment, and technologies (61), and regarding the importance of circulating nurse´s non-technical skills in safe surgery and patient safety (20), the study of their behaviors is important. This study can be a starting point to develop a tool for the assessment of circulating nurse´s non-technical skills and find their strengths and weaknesses in applying these skills. Maybe an interview study could complement our results to develop a tool for assessment of circulating nurse´
non-technical skills.

Conclusion
The circulating nurse’s non-technical skills have not been studied widely. Circulating nurses need to use non-technical skills to work efficiently and ensuring safe surgery. They have more skills in managing tasks, communication, teamwork, and situational awareness than other leadership and decision-making. There is still a need for investigation on the circulating nurse’s non-technical skills.

Abbreviations
AORN: Association of peri-Operative Registered Nurses
NATH: National Association of Theater Nurses
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
OTAS: Observational Teamwork Assessment for Surgery
NOTCHES II: Oxford non-technical skills system II

Declarations

Ethics approval and consent to participate
This study was approved by the ethics committee of Shiraz University of Medical Sciences.

Consent for publication
Not applicable.

Availability of data and materials
All data generated or analyzed during this study are included in this published article.

Competing interests
The authors declare that they have no competing interests.

Funding
This study was financially supported by Shiraz University of Medical Sciences as a part of a Ph.D. thesis.

Author Contribution
RK, MH, and ZZ designed and conceived the study. JJ and AF analyzed the data. MH, RK, and SG performed the literature search. HN prepared data analyzation. All authors edited, reviewed, and approved the manuscript.

Acknowledgment
Not applicable.

References

1. Organization WH. WHO guidelines for safe surgery: safe surgery saves lives: Sưu tầm; 2009.

2. Weiser TG, Regenbogen SE, Thompson KD, Haynes AB, Lipsitz SR, Berry WR, et al. An estimation of the global volume of surgery: a modelling strategy based on available data. The Lancet. 2008;372(9633):139-44.

3. Mitchell L, Flin R. Non-technical skills of the operating theatre scrub nurse: literature review. Journal of advanced nursing. 2008;63(1):15-24.

4. Yule S, Flin R, Maran N. Safer surgery Analysing behaviour in the operating theatre. 2009.

5. Christian CK, Gustafson ML, Roth EM, Sheridan TB, Gandhi TK, Dwyer K, et al. A prospective study of patient safety in the operating room. Surgery. 2006;139(2):159-73.

6. Kohn LT, Corrigan J, Donaldson MS. To err is human: building a safer health system: National academy press Washington, DC; 2000.

7. Bogner MS. Misadventures in health care: inside stories: Psychology Press; 2003.

8. Brunckhorst O, Khan MS, Dasgupta P, Ahmed K. Nontechnical skill training and the use of scenarios in modern surgical education. Current opinion in urology. 2017;27(4):330-6.

9. Flin R. Non-technical skills for anaesthetists, surgeons and scrub practitioners (ANTS, NOTSS and SPLINTS). The Healthcare Foundation. 2013:1-9.

10. Flin RH, O'Connor P, Crichton M. Safety at the sharp end: a guide to non-technical skills: Ashgate Publishing, Ltd.; 2008.

11. Redaelli I. Nontechnical skills of the operating theatre circulating nurse: An
ethnographic study. Journal of advanced nursing. 2018;74(12):2851-9.

12. Garosi E, Kalantari R, Zanjirani Farahani A, Zuaktafi M, Hosseinzadeh Roknabadi E, Bakhshi E. Concerns About Verbal Communication in the Operating Room: A Field Study. Human factors. 2019:0018720819858274.

13. Groah LK. Operating room nursing: the perioperative role: Reston Pub. Co.; 1983.

14. Leveson N, Samost A, Dekker S, Finkelstein S, Raman J. A systems approach to analyzing and preventing hospital adverse events. 2016.

15. Roth E, Christian C, Gustafson M, Sheridan TB, Dwyer K, Gandhi T, et al. Using field observations as a tool for discovery: analyzing cognitive and collaborative demands in the operating room. Cognition, Technology & Work. 2004;6(3):148-57.

16. Nymberg SM, Crawford AH. Video-assisted thoracoscopic releases of scoliotic anterior spines. AORN journal. 1996;63(3):559-75.

17. Sergeeva A, Aij K, Van den Hooff B, Huysman M. Mobile devices in the operating room: Intended and unintended consequences for nurses’ work. Health informatics journal. 2016;22(4):1101-10.

18. Murdock DB. Trauma: when there's no time to count. AORN journal. 2008;87(2):322-8.

19. Yang YT, Henry L, Dellinger M, Yonish K, Emerson B, Seifert PC. The circulating nurse's role in error recovery in the cardiovascular OR. AORN journal. 2012;95(6):755-62.

20. Alfredsdottir H, Bjornsdottir K. Nursing and patient safety in the operating room. Journal of advanced nursing. 2008;61(1):29-37.

21. Mitchell L, Flin R, Yule S, Mitchell J, Coutts K, Youngson G. Thinking ahead of the surgeon. An interview study to identify scrub nurses’ non-technical skills. International journal of nursing studies. 2011;48(7):818-28.
22. Mitchell L, Flin R, Yule S, Mitchell J, Coutts K, Youngson G. Development of a behavioural marker system for scrub practitioners' non-technical skills (SPLINTS system). Journal of evaluation in clinical practice. 2013;19(2):317-23.

23. Higgins J, Green S. Highly sensitive search strategies for identifying reports of randomized controlled trials in MEDLINE. Cochrane Handbook for Systematic Reviews of Interventions 4.2. 5 [updated May 2005]; Appendix 5b. The Cochrane Library. 2005;3.

24. Healey A, Undre S, Vincent C. Developing observational measures of performance in surgical teams. BMJ Quality & Safety. 2004;13(suppl 1):i33-i40.

25. Hull L, Bicknell C, Patel K, Vyas R, Van Herzeele I, Sevdalis N, et al. Content validation and evaluation of an endovascular teamwork assessment tool. European Journal of Vascular and Endovascular Surgery. 2016;52(1):11-20.

26. Sevdalis N, Davis R, Koutantji M, Undre S, Darzi A, Vincent CA. Reliability of a revised NOTECHS scale for use in surgical teams. The American Journal of Surgery. 2008;196(2):184-90.

27. Robertson ER, Hadi M, Morgan LJ, Pickering SP, Collins G, New S, et al. Oxford NOTECHS II: a modified theatre team non-technical skills scoring system. PLoS One. 2014;9(3).

28. Devcich DA, Weller J, Mitchell SJ, McLaughlin S, Barker L, Rudolph JW, et al. A behaviourally anchored rating scale for evaluating the use of the WHO surgical safety checklist: development and initial evaluation of the WHOBARS. BMJ Qual Saf. 2016;25(10):778-86.

29. Medvedev ON, Merry AF, Skilton C, Gargiulo DA, Mitchell SJ, Weller JM. Examining reliability of WHOBARS: a tool to measure the quality of administration of WHO surgical safety checklist using generalisability theory with surgical teams from three
New Zealand hospitals. BMJ open. 2019;9(1):e022625.

30. Frankel A, Gardner R, Maynard L, Kelly A. Using the communication and teamwork skills (CATS) assessment to measure health care team performance. The Joint Commission Journal on Quality and Patient Safety. 2007;33(9):549-58.

31. Gillette VA. Applying nursing theory to perioperative nursing practice. AORN journal. 1996;64(2):261-70.

32. Dunn D. Responsibilities of the preoperative holding area nurse. AORN journal. 1997;66(5):819-38.

33. Chanes C. The Circulating Nurse’s Role in Decreasing Fear to Patient and Designated Family Member Prior to a Surgery Under Anesthesia. 2018.

34. Stringer B, Haines TA, Oudyk JD. Noisiness in operating theatres: nurses’ perceptions and potential difficulty communicating. Journal of perioperative practice. 2008;18(9):384-91.

35. Groah L. Hand offs--A link to improving patient safety. AORN journal. 2006;83(1):227-30.

36. Wakeman D, Langham Jr MR, editors. Creating a safer operating room: Groups, team dynamics and crew resource management principles. Seminars in pediatric surgery; 2018: Elsevier.

37. Leach LS, Myrtle RC, Weaver FA. Surgical teams: role perspectives and role dynamics in the operating room. Health Services Management Research. 2011;24(2):81-90.

38. Parikh SN, Grice SS, Schnell BM, Salisbury SR. Operating room traffic: is there any role of monitoring it? Journal of pediatric orthopedics. 2010;30(6):617.

39. Rydenfält C. Teamwork in the operating room-The role of organizational design and implications for patient safety: Lund University; 2014.

40. Dillon KA. Time out: an analysis. AORN journal. 2008;88(3):437-42.
41. Soltanmoradi Y, Ansari A, Heidari S. Occupational stress among operating room nurses of hospitals affiliated to Kerman universities of medical sciences, Iran (2016): A cross-sectional study. Journal of Occupational Health and Epidemiology. 2017;6(4):225-33.

42. Flood V, Allen D. High-tech, high-stress environment: Coping strategies for the perioperative nurse. Perioperative Nursing Clinics. 2012;7(1):129-33.

43. Elprama SA, Kilpi K, Duysburgh P, Jacobs A, Vermeulen L, Van Looy J, editors. Identifying barriers in telesurgery by studying current team practices in robot-assisted surgery. 2013 7th International Conference on Pervasive Computing Technologies for Healthcare and Workshops; 2013: IEEE.

44. Bhatt AS, Carlson GW, Deckers PJ. Improving operating room turnover time: a systems based approach. Journal of medical systems. 2014;38(12):148.

45. NF P. Berry and Kohn’s operating room technique. St Louis, MO: Mosby; 2004.

46. Carpini JA, Parker SK, Griffin MA. Nurse Voice as a Catalyst in the Operating Theatre: How Voice Instigates Team Adaptation and Drives Team Efficiency. THESIS DECLARATION.117.

47. Palmer I. Predicting Surgical Flow Disruption Recovery in Cardiothoracic Operating Rooms. 2013.

48. Spry C. Essentials of perioperative nursing: Jones & Bartlett Publishers; 2016.

49. Endsley MR, editor Design and evaluation for situation awareness enhancement. Proceedings of the Human Factors Society annual meeting; 1988: SAGE Publications Sage CA: Los Angeles, CA.

50. Eufinger H, Saylor B. Computer-assisted prefabrication of individual craniofacial implants. AORN journal. 2001;74(5):648-54.

51. Wiegmann DA, Eggman AA, ElBardissi AW, Parker SH, Sundt III TM. Improving cardiac
surgical care: a work systems approach. Applied ergonomics. 2010;41(5):701-12.

52. Matson K. The critical" nurse" in the circulating nurse role. AORN journal. 2001;73(5):971-.

53. Espin SL, Lingard LA. Time as a catalyst for tension in nurse-surgeon communication. AORN journal. 2001;74(5):672-82.

54. Strauss J. An OR nurse internship program that focuses on retention. AORN journal. 1997;66(3):455-63.

55. Hopper WR, Moss R. Common breaks in sterile technique: clinical perspectives and perioperative implications. AORN journal. 2010;91(3):350-67.

56. Cherry C. Anterior cervical discectomy and fusion for cervical disc disease. AORN journal. 2002;76(6):996-1008.

57. Gentry MB. Registered nurse peer evaluation in the perioperative setting. AORN journal. 2006;84(3):462-72.

58. Sheikhzadeh A, Gore C, Zuckerman JD, Nordin M. Perioperating nurses and technicians' perceptions of ergonomic risk factors in the surgical environment. Applied ergonomics. 2009;40(5):833-9.

59. Johnstone PL. Occupational stress in the operating theatre suite: Should employers be concerned? Australian Health Review. 1999;22(1):60-80.

60. Parker SH, Laviana A, Sundt T, Wiegmann D, editors. Developing a tool for reliably identifying distractions and interruptions during surgery. Proceedings of the Human Factors and Ergonomics Society Annual Meeting; 2009: SAGE Publications Sage CA: Los Angeles, CA.

61. Neyens DM, Bayramzadeh S, Catchpole K, Joseph A, Taaffe K, Jurewicz K, et al. Using a systems approach to evaluate a circulating nurse's work patterns and workflow disruptions. Applied ergonomics. 2019;78:293-300.
Table 1: Circulating nurse’s communicational skills

- Provides proper feedbacks and acknowledgment
- Informs other team members about his/her actions
- Does not distract other team members
- Gives and asks full information during hand-offs
- If he/she is worried about something, informs other team members
- Raises his/her requests clearly, is audible
- Talks kindly to the patient, informs him/her and calms him/her down
- Respects the patient and other team members
- Knows when should stay quiet and when to talk
- Reminds the forgotten issues to the team members
- Uses proper tone of voice when talking
- Does not talk about irrelevant topics in the OR
- Avoids struggles with other team members
- Participates in the team conversations
- Warns other team members when the sterility is threatened
- Shares necessary information with other team members
- Makes the team members aware of the problems with their performance and instruments
- Has a friendly relationship with other team members and uses sense of humor properly
- Asks for information and updates
- Talks about the plan and the next activities
- Uses the planned communication ways
- Uses keywords for getting the attention of others when faces a problem
- Uses the names when interacts with other team members
- Asks question if feels ambiguous
- Uses non-verbal communication and eye contact

Table 2: Circulating nurse’s leadership behaviors
Reacts when sees a defect in other team member’s performance
Controls the distractors and noises of the operating room environment and makes it quiet
Directs surgical team members and trainees
Manages the OR events under challenging situations
Shows enough assertiveness especially regarding aseptic technique (for example in correct gloving and gowns)
Observes the performance of other team members
Participate in planning for future acts
Encourages other team members to be involved and seek surgery process
Motivates others team members and tries to increase morale

Table 3: Circulating nurse’s teamwork behaviors

- Supports and helps surgical team members
- Offers help to the other team members
- Participates in patient transfer from and to the surgical bed
- Is coordinated with other team members in patients’ positioning
- Conducts shaving and prepping after coordination with the surgeon
- Sets the tourniquet after the coordination with surgeon
- Is coordinated with the scrub nurse in counting
- Coordinates his/her tasks with other team members
- Coordinates the patient’s particular needs with the surgeon
- Coordinates the presence of other team members before surgery
- Cooperates with every last minute request of the surgical team
- Checks important issues with other team members
- Helps the scrub nurse in cleaning the room
- Asks help from other personnel when necessary
- Does not compete with other team members

Table 4: Circulating nurse’s situational awareness behaviors
Predicts the needs of the sterile team

Always is ready to meet other team members’ requests

Listens actively to the warnings, orders, and conversations.

Seeks the surgery process preciously

Looks at the monitor of vital signs to be aware of the patient status

Stays in a proper place to dominate all events

Observes the patient’s positioning on the bed

Observes the other team members’ acts

Monitors the safety of the patient

Pays attention and follows the other team members’ concerns

Checks the site of operation before the start of surgery

Reviews the patient’s documents before the start of surgery

Checks the availability of blood products

Makes sure about the availability of needed instruments before the start of surgery

Is aware of the resources and uses them properly

Checks the presence of things required before the start of surgery

Pays attention to patients conform

Makes sure that the patient’s documents are brought to recovery

Rechecks the requirements during surgery

Table 5: circulating nurse’s task management behaviors
- Observes labeling and transfer of the specimens
- Is aware of the roles and capabilities of other team members
- Helps in the fluent process of surgery.
- Reacts promptly against the events
- Disagrees with the orders that are against standards.
- Insists on correct action and maintaining operating room standards
- Conducts his/her tasks quickly
- Is punctual
- Is aware of the protocols and standards
- Records the events of surgery precious in a proper time
- Prepares the patient`s documents before the start of surgery
- Prevents the unnecessary entrances to the OR
- Prepares the operating room entirely before the start of surgery
- Keeps the trolley in a good order
- Stays at the operating room until the end of surgery
- Brings all necessary instruments and needed items before the start of surgery
- Priorities his/her tasks
- Understands his roles clearly
- Provides the required things in a proper time
- Does his/her duties accurately
- Does not open unnecessary surgical sets
- Bring more instruments and surgical sets before the start of surgery
- Manages his/her tasks so that could concentrate on counting perfectly
- Arranges the instruments properly in the OR
- Records the count results on the board
- Keeps the operating room ordered
- Does his/her tasks in a proper time
- When is under-loaded, does other necessary tasks
- Concentrates on his/her tasks
- Divides his/her workload during the surgery
- Does accurately while doing several tasks at a time

Table 6: Circulating nurse`s improper behaviors regarding non-technical skills
Talks unnecessarily when the surgeon is concentrated on the operation and distracts him/her
Causes delays in the surgery process
Uses mobile phone in the operating room
Fails in coordination with anesthesiologist technician (for example in drugs, positioning)
Could be distracted easily from surgery procedure
Exits from operating room
Counts carelessly
Opens unnecessary sets
Is careless in transferring instruments
Talks about issues unrelated to the surgical process
Ignores the distractors
Brings needed instruments mistakenly
Does not check necessary items before surgery (patient, operation site, instruments, etc.)
If there is a need for exiting, does not put another nurse in his/her place
Pays no attention to regularizing operating room
Does not inform others about conducting his/her tasks
Ignores sterility
Cannot be adapted with work pressure
Does not bring all necessary instruments before the start of surgery
Does not prepare required tools before the start of surgery
Does not listen to others and provides no feedback
Is not present to transfer required instruments to the surgical team
_responses and reacts late
Concentrates excessively on documenting and ignores the surgery process
Does not documenting in a proper time
Struggles with other team members
Ignores necessary activities in the work process
Pays no attention to fill necessary forms and checklists
Shows weakness and fatigue in his/her tasks
Does not know roles
Does not provide required tools in a proper time
Cannot find essential instrument when needed
Ignores team member’s requests
Uses improper tone of voice
- Does not respect to other team members
- Ignores the operating room protocols and standards
- Does not share important information with team members
- Is inattentive to patient safety
- Cannot predict patient’s and surgical process’ future status
- Does not support other team members
- Blames other team members

**Figures**

![Figure 1: PRISMA diagram](image-url)