Elements of Teamwork in Resuscitation: An Integrative Review

Mohammad Hosseini1, Abbas Heydari2*, Hamidreza Reihani3, Hossein Kareshki4

1Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran
2Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
3Department of Emergency Medicine, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
4Department of Educational Sciences and Psychology, Ferdowsi University of Mashhad, Mashhad, Iran

*Corresponding author: Abbas Heydari
Address: Professor of Nursing, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
e-mail: heidarya@mums.ac.ir

Received: July 13, 2021
Revised: September 19, 2021
Accepted: November 20, 2021

ABSTRACT

Objective: To identify the elements of teamwork in resuscitation, an integrative review and synthesize current primary studies conducted.

Methods: PubMed, Scopus, Web of Science, and Embase, as well as Google Scholar search engine were searched from November 2015 to March 2020 to review previously published peer-reviewed studies. Out of the 5495 articles, 16 were finally included in the study. Search strategy implemented with these keywords (in the title/abstract) were (team* AND CPR) or (team* AND resuscitation). Six descriptive criteria was performed by using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline to analyze the articles and a modified version of Cooper’s five-stage method.

Results: Sixteen studies were included in this research. Twenty elements related to teamwork in resuscitation were identified by using data synthesis, then classified into four categories includes team interaction elements, leadership skills, individual elements and environmental elements. Communication, leadership, situation awareness and scene organization had the highest frequency of reviewed articles 10, 5, 4, 4, respectively.

Conclusion: The interactions between resuscitation team members and the skills of the leader and team members along with environmental elements had attracted the most attention of researchers by focusing on teamwork in resuscitation. Due to the limited number of articles related to this subject, more research is needed to reveal all the key elements of teamwork in resuscitation.

Keywords: Teamwork; Resuscitation; Elements; Skills.

Please cite this paper as:
Hosseini M, Heydari A, Reihani HR, Kareshki H. Elements of Teamwork in Resuscitation: An Integrative Review. Bull Emerg Trauma. 2022;10(3):95-102. doi: 10.30476/BAT.2021.91963.1291.
**Introduction**

Teamwork is a dynamic, and complex concept in healthcare systems. The range of interactive and dependent behavioral processes involved in teamwork depends on the number of team members, type of activity, workload, sensitivity, accuracy and urgency of action. To improve the performance of health care systems, the teamwork approach is superior to the leader-centered approach [1]. Currently, programs such as team strategies and tools are used to improve teamwork skills for enhancing performance and patient safety (TeamSTEPPS) and Crew Resource Management (CRM) [2]. Poor teamwork in resuscitation will jeopardize patient safety and will result in poor team performance and outcomes [3-6]. For example in a study, it has been concluded that higher scores on teamwork were associated with faster patient defibrillation [4], and in another study, 50% of errors in trauma resuscitation were directly related to teamwork and leadership failures [5]. Another study examined barriers to teamwork in pediatric resuscitation points out and showed leadership and communication within the resuscitation team need to be improved for increasing the quality of resuscitation [7]. Therefore, the crucial role of teamwork in managing emergency situations is generally accepted.

Not only Emergency Medical Services (EMS) providers, emergency nurses, and emergency physicians, but also nurses of all clinical departments and the team leader are the target audiences of teamwork in resuscitation. One of the main issues in our knowledge of teamwork in resuscitation is a lack of clear identification of its main categories. Due to the lack of the gold standard for measuring teamwork in resuscitation and uncertainty of teamwork competencies in resuscitation, determining the elements of teamwork in resuscitation will be useful for both the related tools development, education and training purposes in the hospital and pre-hospital settings. Focus on teams and teamwork as the contributors to the outcome quality in critical care settings especially in resuscitation is relatively new and emerged with the movement to improve patient safety. Therefore, this integrative review conducted to identify the elements of teamwork in resuscitation mentioned in published studies in peer-reviewed journals.

**Methods**

This review was conducted as an integrative review. Integrated review is a comprehensive methodological approach which allow experimental and non-experimental studies to fully understand the analyzed phenomenon. In this type of review, the results of independent studies on the same subject will identify, analyze, and synthesize [8]. In fact, it is a general review of the existing literature as a systematic process and usually involves both quantitative and qualitative studies. Cooper’s five-stage integrative review method which was modified by Whittemore and Knaf (2005) was used [9]. This method consist of five steps includes problem identification, data collection, quality appraisal, data abstraction and presentation of the results [10].

The inclusion criteria were includes full-text English language research articles, research related to teamwork or team performance, related to cardiopulmonary resuscitation (resuscitation settings), publication in peer-reviewed journals and primary study (not secondary references like a purely systematic review or editorial). Exclusion criteria were studies that was not relevant to the subject of resuscitation and animal studies.

This integrative review included available peer-reviewed articles published between November 2015 to March 2020 because the American Heart Association (AHA) for Cardiopulmonary Resuscitation (CPR) were substantially revised in 2015. Given the potential impact of changes to the resuscitation protocols and the Guideline on the performance of the Team, the release date of 2015 AHA Guideline was considered the starting point to review the literature. The search strategy was completed according to the PRISMA statement [11].

The assessed databases were PubMed, Scopus, Web of Science, and Embase as well as Google Scholar search engine using the following combination of search terms: (team* AND CPR) OR (team* AND resuscitation) in the title and abstract. For example, by searching the database for Pabmed, with strategy of “(team*[Title/Abstract] AND CPR) OR (team*[Title/Abstract] AND resuscitation) [Title/Abstract]” between November 3, 2015 and March 3, 2020, 1491 articles were obtained. The lists of included articles references were manually searched to identify possible additional studies. The Google Scholar search engine was also used to assess gray literature. First, the title and abstract of the identified articles were read by two independent reviewers to determine the eligibility of articles, then the full text of included articles were examined to exclude unrelated articles.

A broad literature was searched from the four databases and a search engine produced 2289 articles for the title and abstract review. A total of 219 of these articles were identified for a full-text review of which 16 articles met the inclusion criteria (Figure 1).

**Data Analysis**

Due to the heterogeneity of design and methodology between selected studies, using detailed quality appraisal criteria was not appropriate for an integrative review method [9]. However, for illustration the quality of selected articles, we used the six descriptive criteria to consider the methodological structure of studies that included as follow: aims and...
objectives clearly described, study design adequately described; research methods appropriate; explicit theoretical framework; limitations presented and implications discussed (modified based on Gazarian (2013)) [12]. All 16 included articles were evaluated in these six quality domains on a 3 point scale as “yes”, “poor” or “not reported” (Table 1).

**Data Synthesis**

By following the principles of inductive content analysis, Graneheim and Lundman [13], was analyzed and interpreted the content about elements of teamwork in resuscitation. Eight studies used a quantitative method and eight qualitative methods. Therefore, a narrative synthesis was used to present results [9]. The analysis was conducted by two researchers until reaching the categorizing stage [13]. After re-reading the articles several times and categorizing the content by two independent researchers, the next drafts were developed through shared discussions in two meeting, and the final analysis was completed with the consensus of all authors.

**Results**

By removing duplicates, 2289 out of 5495 primary records identified through database searching. Finally, 16 articles were selected for analysis. These studies included a diverse range of 8 quantitative and 8 qualitative studies conducted in different environments (simulated, real). The studies were mostly carried out in the emergency department (Table 1). Due to the multiplicity of elements related to teamwork as well as team leadership, the classification of elements was done according to the semantic similarity. As a result, four categories were formed which includes team interaction elements, leadership skills, individual elements, and environmental elements.

The team interaction elements category consisted of shared mental models, communication, co-operation, coordination, prioritization, and cognitive aids. In this category, the highest frequency was related to communication. Clear information needs, leadership, role allocation, and clear goals were related to the leadership skills category and leadership was the most frequent element in this class. Of the individual element category, situational awareness was the most common, and the other elements were followership, adaptability, mental practice, and provider’s expertise. Family presence, team climate, clinical standards, scene organization, and training, scene organization was the most repeated element in the studies (Table 2).

As shown in Table 2, the communication, Leadership, situational awareness, and scene organization with frequencies 10, 5, 4, and 4 out of 13 had the highest repetition in the reviewed articles. The highest frequency of leadership-related elements in resuscitation was also related to leadership, communication, and decision-making (2 out of 3 for all three) (Table 2). Therefore, leadership and communication were the common elements of teamwork and leadership in resuscitation and the most frequently discussed subject in the reviewed articles.

**Discussion**

Team interaction elements, leadership skills, individual elements, and environmental elements were four main categories (dimensions) for teamwork in resuscitation that emerged from the data. These results are very consistent with the results of the study of Salas et al. that identified seven principal components relevant to teamwork includes cooperation, coordination, communication, cognition, coaching, conflict, conditions [29]. Despite the obvious importance of teamwork in improving health care systems, the number of studies that explicitly outline the dimensions
| Authors                  | Study aim                                                                 | Method                        | Setting                  | Teamwork elements                                                                 | Quality appraisal criteria (scale: y = yes, p = poor, nr = not reported) |
|-------------------------|---------------------------------------------------------------------------|-------------------------------|--------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Beck et al., [14]       | To investigate if training on shared mental models, improves team performance in cardiac arrest. | A randomized controlled trial | Simulation               | Shared mental models                                                              | 1*: y 2*: y 3*: y 4*: p 5*: y 6*: p                                      |
| Bolandparvaz et al., [15]| To determine the correlation between the success rates of the CPR and the team’s leader education and skill level | A cross-sectional study       | Emergency department     | Higher medical degrees                                                            | 1*: y 2*: y 3*: y 4*: p 5*: nr 6*: p                                       |
| Calder et al., [16]     | To understand how teams communicate during resuscitation                  | A mixed-method qualitative analysis | The emergency department | A shared mental model, clear information needs, situational awareness, consistent communication patterns, cognitive aids | 1*: y 2*: y 3*: y 4*: nr 5*: y 6*: p                                    |
| Cooper et al., [17]     | To test the resuscitation non-technical Team Emergency Assessment Measure (TEAM) for feasibility, validity, and reliability | A quasi-experimental design   | Emergency Departments    | Leadership control, Communication, Co-operation and co-ordination, Team climate, Adaptability, Situation awareness (perception), Situation awareness (projection), Prioritization, Clinical standards | 1*: y 2*: y 3*: y 4*: y 5*: y 6*: y                                    |
| Gundrosen et al., [18]  | To explore the function of three specific modes of talk (discourse types) in decision-making processes. | A qualitative discourse analytical method | The emergency department | Mutual understanding, distributing tasks and responsibilities, communication skills | 1*: y 2*: y 3*: y 4*: nr 5*: y 6*: p                                    |
| Lorello et al., [19]    | To investigate the role of mental practice to promote nontechnical, team-based skills for trauma | A randomized controlled trial | Simulation               | Mental practice                                                                    | 1*: y 2*: y 3*: y 4*: y 5*: y 6*: p                                    |
| McLanders et al., [20]  | To investigate factors that affect teamwork during neonatal resuscitation | Semi-structured interviews, Critical Incident Technique | Neonatal resuscitation teams | Role allocation, leadership, communication, and scene organization                 | 1*: y 2*: y 3*: y 4*: y 5*: nr 6*: y                                    |
| Moore et al., [21]      | To determine elements contributed to the successful outcome of an unusual prolonged resuscitation case | Case report                   | Emergency department     | Clear goals, stronger and effective communication, provider’s expertise, resources readily available | 1*: y 2*: y 3*: y 4*: y 5*: y 6*: y                                    |
| Authors | Title | Research Design | Methods | Key Findings |
|---------|-------|-----------------|---------|--------------|
| Sherman et al., [22] | Barriers to Effective Teamwork Relating to Pediatric Resuscitations | A mixed-methods study | Pediatric emergency department | Closed-loop communication, team leader attributes, physical environment, resources, declaration of roles, the culture of teamwork, situational awareness, family presence, and training |
| Sweberg et al., [23] | Description of hot debriefings after in-hospital cardiac arrests | Qualitative content analysis | The Pediatric Resuscitation Quality Collaborative (pediRes-Q) database | Cooperation/coordination, communication, clinical standards, equipment |
| Balki et al., [24] | To develop a new interdisciplinary teamwork scale for the management of obstetric emergencies | Delphi method | Obstetric setting | Shared mental model, communication, situational awareness, leadership, followership, workload management, and positive/effective behaviors and attitudes. |
| Su et al., [25] | To determine if patterns of human behavior in the prearrival period of a simulated trauma resuscitation is predictive of resuscitation performance | A randomized controlled trial | Simulation | Balanced communication |
| Yamada et al., [26] (USA) | To assess the impact of Standardized Communication Techniques on Errors during Simulated Neonatal Resuscitation | A prospective, single-blinded, matched pairs design with block randomization | Two simulated complex neonatal resuscitations | Standardized communication techniques |
| Faiz et al., [27] | To develop and validate an evaluation tool for trauma team leader performance | A literature review and expert panel | Pediatric trauma department | Critical Assessment, Communication and Leadership, Decision Making, Clinical Performance, Teaching |
| Rosenman et al., [5] | To develop and pilot a novel team leadership assessment measure for emergency medicine resuscitation teams. | A systematic literature review and expert consensus. | Simulated and actual resuscitation | Gathering information, Setting goals, Facilitating decision making, Contingency planning, Role delegation (frequency), Role delegation (quality), Maintaining a global perspective, Resources utilization, Monitoring progress, Managing team workload, Explicit communication, Asserting control, Promoting team collaboration, and Conflict management |
| Krage et al., [28] | To investigate the relationship between non-technical and technical skills during cardiopulmonary resuscitation | Simulator-based randomized cross-over study | Simulation | The non-technical skills (task management, leadership, situational awareness, communication, and decision-making) of the team leader |

*Aims and objectives; Study design; Research methods; Explicit theoretical framework; Limitations; Implications.
of teamwork in resuscitation is very limited. We know before, during, and after resuscitation, time is very important. The team’s actions and interactions should be efficient, multidisciplinary, and coordinated for implementation numerous and interrelated tasks simultaneously under significant time pressure [25, 30, 31]. Although high technical skills are important in resuscitation, teamwork skills and interactions between team members are also paramount importance, and sometimes these interactions are more important than one’s clinical knowledge [32-34].

According to the results of the present review, communications from the team interaction elements category have gained the most importance and emphasis, which is consistent with the study by Mancheva and Dugdale. They concluded that poor communication wasted valuable time in emergencies that would lead to life-threatening mistakes [35]. In another study, it was reported that poor communication was responsible for nearly 60% of all medical errors [36]. In a particular situation, some factors such as failure to hear the voice of the team leader, prescribing norepinephrine 1mg or increasing the infusion rate of a positive inotropic drug can put patients at high risks. Today, the importance of an effective communication in resuscitation is widely accepted [6, 16, 37]. Because of the importance of wastage preventing time in resuscitation, various studies have examined effective communication patterns in resuscitation, such as standard communications and closed-loop communication [38].

Effective team leadership in resuscitation is linked to better teamwork. In terms of frequency, leadership from the leadership skills category was the 2nd element related to teamwork in resuscitation. In line with this result, different studies have shown that leadership training skills in emergency teams leads to improved outcomes like Return of spontaneous circulation (ROSC) and survival rates [6, 39, 40]. Leadership is especially important when the team performs its activities under complex, dynamic, and time-pressured conditions [5].

Situational awareness from individual elements category and scene organization from environmental elements together with the same frequency was the 3rd most important element of teamwork in resuscitation. Awareness of “what is going on around you” in resuscitation is integral to successful teamwork. Understanding the situation awareness is one of the essential components for improving patient safety and quality of care. In emergencies, situation awareness tends to be suboptimal, therefore, we need training techniques to enhance situation awareness and improve decision-making during emergencies [41].

Scene organization was the most common element repeated in the environmental elements category. In Mclanders et al., study, all interviewees emphasized scene organization as a critical component that can either facilitate the workflow and teamwork or be an obstacle in their way [20]. Another study found that the availability of resources and equipment during resuscitation helps to achieve successful outcomes and team cohesiveness [21].

Most studies of teamwork in resuscitation have referred to elements that facilitate or hinder team performance. There is often a tendency to have more articles on the obvious aspects of a complex concept or concepts that are well developed. More articles on one aspect of teamwork do not necessarily mean that aspect is the most important factor. Even though leadership and communication seem to be

### Table 2. Classification of elements of teamwork in resuscitation.

| Authors                        | Team interactions elements | Leadership skills | Individual elements | Environmental elements |
|-------------------------------|----------------------------|-------------------|---------------------|------------------------|
| Beck et al., [14]             | *                          |                   |                     |                        |
| Gundrosem et al., [18]        | *                          |                   | *                   |                        |
| Sweberg et al., [23]          | * * *                      |                   |                     |                        |
| Su et al., [25]               | *                          |                   |                     |                        |
| Balki et al., [24]            | * *                        | *                 |                     | *                      |
| Sherman et al., [7]           | *                          | *                 | *                   | *                      |
| Calder et al., [16]           | * *                        | *                 |                     |                        |
| Mclanders et al., [20]        | *                          |                   |                     |                        |
| Yamada et al., [26]           | *                          | *                 |                     |                        |
| Cooper et al., [17]           | * * *                      | *                 | *                   | *                      |
| Lorello et al., [19]          | *                          | *                 |                     |                        |
| Moore et al., [21]            | *                          | *                 | *                   |                        |
| Bolandparvaz et al., [15]     | *                          |                   |                     |                        |
more important in resuscitation than in other aspects of teamwork, and they have been more popular with researchers. However, it should not be overlooked that problems in each aspect of teamwork in resuscitation can change the outcome from excellent to poor. The weaknesses and strengths of every team member includes the interactions between them, the quality of team leadership, and the characteristics of the resuscitation environment that they create their own training needs.

One of the limitations of this study was the small number of articles related to teamwork in resuscitation, which is due to the novelty of this topic and the concept of teamwork in resuscitation. To overcome this limitation, we tried to review the articles related to the resuscitation team more carefully, therefore, they could be included in the study whenever the meaning of teamwork was understood. More randomized controlled trials and qualitative studies in simulated and real environments are needed to develop the knowledge body in resuscitation teamwork.

The results of this study suggest that in order to improve the performance of resuscitation teams and teamwork, appropriate planning should be done to cultivate effective leaders for the resuscitation team, improve interactions between resuscitation team members, and individual skills. Also, the provision of the necessary infrastructure in terms of environment conditions, facilities and devices should be considered optimally.

**Conclusion**

Leadership skills, team interaction, individual and environmental factors were the main elements of teamwork in resuscitation that considered by the researchers. Further studies in simulated and real environments will help more clarifying the fundamental characteristics of teamwork in resuscitation.

**Declaration**

**Ethics approval and consent to participate:** This study was written as a part of the Ph.D. dissertation in nursing, which was registered at Mashhad University of Medical Sciences with code No. of 981118.

**Consent for publication:** None

**Conflict of interests:** The authors declared that there is no conflict of interest.

**Funding:** This study was financially supported by the Deputy of Research and Technology of Mashhad University of Medical Sciences.

**Authors’ contributions:** MH, AH, HH, HK: substantial contributions to conception and design, or data acquisition, or analysis and interpretation of data; MH, AH, HH, HK: drafting the manuscript or revising it critically for important intellectual content; MH, AH, HH, HK: Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; MH: Agreed to be accountable for all aspects of the work to ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Acknowledgements:** Special thanks to Dr. Hasan Khalili, a respected friend and colleague, for reading the article and providing valuable feedback.

**References**

1. Lloyd A. From leader to leadership in emergency care. *Nursing Times*. 2016;112(41-42):10-2.
2. King HB, Battles J, Baker DP, Alonso A, Salas E, Webster J, et al. TeamSTEPPS™: Team Strategies and Tools to Enhance Performance and Patient Safety. In: Henriksen K, Battles JB, Keyes MA, Grady ML, editors. Advances in Patient Safety: New Directions and Alternative Approaches (Vol. 3: Performance and Tools). Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.
3. Freytag J, Strofen F, Hautz WE, Schauer SK, Kämmer JE. Rating the quality of teamwork—a comparison of novice and expert ratings using the Team Emergency Assessment Measure (TEAM) in simulated emergencies. *Scand J Trauma Resusc Emerg Med*. 2019;27(1):12.
4. Butler L, Whitfill T, Wong AH, Gawel M, Crispino L, Auerbach M. The Impact of Telemedicine on Teamwork and Workload in Pediatric Resuscitation: A Simulation-Based, Randomized Controlled Study. *Telemed J E Health*. 2019;25(3):205-212.
5. Rosenman ED, Bullard MJ, Jones KA, Welsh L, Brolliar SM, Levine BR, et al. Development and Empirical Testing of a Novel Team Leadership Assessment Measure: A Pilot Study Using Simulated and Live Patient Encounters. *AEM Educ Train*. 2019;3(2):163-171.
6. Hunziker S, Johansson AC, Tschau F, Semmer NK, Rock L, Howell MD, et al. Teamwork and leadership in cardiopulmonary resuscitation. *J Am Coll Cardiol*. 2011;57(24):2381-8.
7. Sherman JM, Chang TP, Ziv N, Nager AL. Barriers to Effective Teamwork Relating to Pediatric Resuscitations: Perceptions of Pediatric Emergency Medicine Staff. *Pediatr Emerg Care*. 2020;36(3):e146-e150.
8. Souza MT, Silva MD, Carvalho RD. Integrative review: what is it? How to do it? *Einstein (Sao Paulo)*. 2010;8(1):102-6. [English, Portuguese].
9. Whittemore R, Knaff K. The integrative review: updated methodology. *J Adv Nurs*. 2005;52(5):546-53.
10. Cooper HM. The integrative research review: a systematic approach. The integrative research review: A systematic approach. 1988:144-.
11. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group.
Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 2009;6(7):e1000097.

12. Gazarian PK. Use of the critical decision method in nursing research: an integrative review. *ANS Adv Nurs Sci.* 2013;36(2):106-17.

13. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ. Today.* 2004;24(2):105-12.

14. Beck S, Doehn C, Funk H, Kosan J, Issleib M, Daubmann A, et al. Basic life support training using shared mental models improves team performance of first responders on normal wards: A randomised controlled simulation trial. *Resuscitation.* 2019;144:33-39.

15. Bolandparvaz S, Mohajer H, Masjedi M, Mohammadhosseini E, Shayan L. Correlation between Success Rates of Cardiopulmonary Cerebral Resuscitation and the Educational Level of the Team Leader; A Cross-Sectional Study. *Bull Emerg Trauma.* 2015;3(4):138-43.

16. Calder LA, Mastoros G, Rahimpour M, Sohmer B, Weitzman B, Cwinn AA, et al. Team communication patterns in emergency resuscitation: a mixed methods qualitative analysis. *Int J Emerg Med.* 2017;10(1):24.

17. Cooper S, Cant R, Connell C, Sims L, Porter JE, Symmons M, et al. Measuring teamwork performance: Validity testing of the Team Emergency Assessment Measure (TEAM) with clinical resuscitation teams. *Resuscitation.* 2016;101:97-101.

18. Gundrosen S, Thammessen G, Wiborg T, Aadahl P. Team talk and team decision processes: a qualitative discourse analytical approach to 10 real-life medical emergency team encounters. *BMJ Open.* 2018;8(11):e023749.

19. Lorello GR, Hicks CM, Ahmed SA, Unger Z, Chandra D, Hayter MA. Mental practice: a simple tool to enhance team-based trauma resuscitation. *CJEM.* 2016;18(2):136-42.

20. Melanders M, Sanderson P, Liley H. Importance of 'scene organisation' for neonatal resuscitation teamwork. *Australian Critical Care.* 2017;30(2):118.

21. Moore NK, Squire KM, Blocker RC, editors. Examining the successful outcomes of multidisciplinary teamwork in a code situation using the shared mental model framework. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting; 2015: SAGE Publications Sage CA: Los Angeles, CA.*

22. Sherman JM, Chang TP, Ziv N, Nager AL. Barriers to Effective Teamwork Relating to Pediatric Resuscitations: Perceptions of Pediatric Emergency Medicine Staff. *Pediatr Emerg Care.* 2020;36(3):e146-e150.

23. Sweberg T, Sen AI, Mullan PC, Cheng A, Knight L, Del Castillo J, et al. Description of hot debriefings after in-hospital cardiac arrests in an international pediatric quality improvement collaborative. *Resuscitation.* 2018;128:181-187.

24. Baliki M, Hoppe D, Monks D, Cooke ME, Sharples L, Windrim R. Multidisciplinary Delphi Development of a Scale to Evaluate Team Function in Obstetric Emergencies: The PETRA Scale. *J Obstet Gynaecol Can.* 2017;39(6):434-442.e2.

25. Su L, Kaplan S, Burd R, Winslow C, Hargrove A, Waller M. Trauma resuscitation: can team behaviours in the prearrival period predict resuscitation performance? *BMJ Simulation and Technology Enhanced Learning.* 2017;3(3).

26. Yamada NK, Fuerch JH, Halamek LP. Impact of Standardized Communication Techniques on Errors during Simulated Neonatal Resuscitation. *Am J Perinatol.* 2016;33(4):385-92.

27. Tuma F, Nassar A, Elder T, Reid S. Establishing an evaluation tool for trauma team leader performance during trauma resuscitation. *The Southwest Respiratory and Critical Care Chronicles.* 2019;7(28):38-43.

28. Kragge R, Zwaan L, Tjon Soei Len L, Kolenbrander MW, van Groeningen D, Loer SA, et al. Relationship between non-technical skills and technical performance during cardiopulmonary resuscitation: does stress have an influence? *Emerg Med J.* 2017;34(11):728-733.

29. Salas E, Shuffler ML, Thayer AL., Bedwell WL, Lazzara EH. Understanding and improving teamwork in organizations: A scientifically based practical guide. *Human resource management.* 2015;54(4):599-622.

30. Chartier L, Hansen S, Lim D, Yi S, McGovern B, Davies D, et al. P023: Code Resus-using a quality improvement approach to improve health care provider response during resuscitations. *Canadian Journal of Emergency Medicine.* 2016;18(S1):S86-S.

31. Sas J. The effect of team leader stress on teams practicing cardiopulmonary resuscitation in a simulation room: an exploratory study into the effect of team leader stress on team leader behaviour, closed-loop communication, and team performance of a simulated medical emergency team: University of Twente; 2017.

32. Makary MA, Daniel M. Medical error-the third leading cause of death in the US. *BMJ.* 2016;353:i21239.

33. Donaldson MS, Corrigian JM, Kohn LT. To err is human: building a safer health system. 2000.

34. Mathieu JE, Helfner TS, Goodwin GF, Salas E, Cannon-Bowers JA. The influence of shared mental models on team process and performance. *J Appl Psychol.* 2000;85(2):273-83.

35. Mancheva L, Dugdale J, editors. Understanding communications in medical emergency situations. 2016; 49th Hawaii International Conference on System Sciences (HICSS); 2016: IEEE.

36. Gong Y, Zhu M, Li J, Turley JP, Zhang J, editors. Clinical communication ontology for medical errors. Medinfo 2007: Proceedings of the 12th World Congress on Health (Medical) Informatics; Building Sustainable Health Systems; 2007: IOS Press.

37. Lok F. The effect of team personality composition on the team performance of teams practicing cardiopulmonary resuscitation in a simulation room: University of Twente; 2018.

38. Lauridsen KG, Watanabe I, Løfgren B, Cheng A, Duval-Arnould J, Hunt EA, et al. Standardising communication to improve in-hospital cardiopulmonary resuscitation. *Resuscitation.* 2020;147:73-80.

39. Ornato JP, Peberdy MA, Reid RD, Feesser VR, Dhindsa HS; NRCPR Investigators. Impact of resuscitation system errors on survival from in-hospital cardiac arrest. *Resuscitation.* 2012;83(1):63-9.

40. Ford K, Menchine M, Burner E, Arora S, Inaba K, Demetriades D, et al. Leadership and Teamwork in Trauma and Resuscitation. *West J Emerg Med.* 2016;17(5):549-56.

41. Cooper S, Porter J, Peach L. Measuring situation awareness in emergency settings: a systematic review of tools and outcomes. *Open Access Emerg Med.* 2013;6:1-7.