



## Elements of Teamwork in Resuscitation: An Integrative Review

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### 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.

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## 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 (TeamSTEPS) 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 Whitemore and Knafl (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) [Title/Abstract] 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

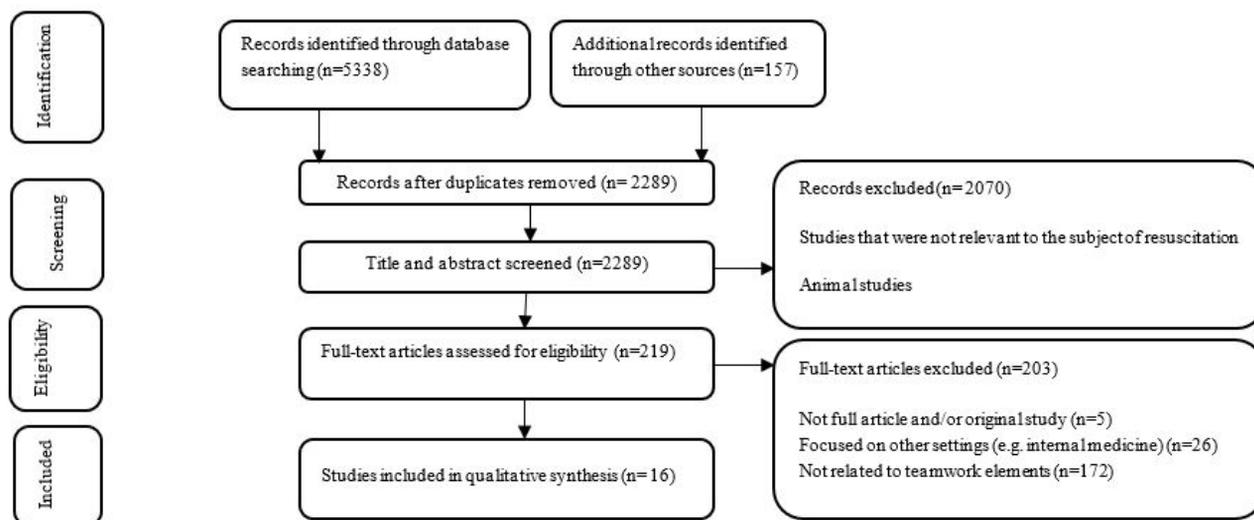


Fig. 1. Flow diagram of literature searches and selection.

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

**Table 1.** Elements of teamwork in resuscitation.

Authors	Study aim	Method	Setting	teamwork elements	Quality appraisal criteria (scale: y = yes, p = poor, nr = not reported)
Beck <i>et al.</i> , [14]	To investigate if training on shared mental models, improves team performance in cardiac arrest.	A randomized controlled trial	Simulation	Shared mental models	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : p 5 <sup>e</sup> : y 6 <sup>f</sup> :p
Bolandparvaz <i>et al.</i> , [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 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : p 5 <sup>e</sup> :nr 6 <sup>f</sup> :p
Calder <i>et al.</i> , [16]	To understand how teams communicate during resuscitation	A mixed-methods qualitative analysis	The emergency department	A shared mental model, clear information needs, situational awareness, consistent communication patterns, cognitive aids	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> :nr 5 <sup>e</sup> : y 6 <sup>f</sup> :p
Cooper <i>et al.</i> , [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 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :y
Gundrosen <i>et al.</i> , [18]	To explore the function of three specific modes of talk (discourse types) in decision-making processes.	A qualitative discourse analytical method	Emergency department	Mutual understanding, distributing tasks and responsibilities, communication skills	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> :nr 5 <sup>e</sup> : y 6 <sup>f</sup> :p
Lorello <i>et al.</i> , [19]	To investigate the role of mental practice to promote nontechnical, team-based skills for trauma	A randomized controlled trial	Simulation	Mental practice	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :p
McLanders <i>et al.</i> , [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 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> :nr 6 <sup>f</sup> :y
Moore <i>et al.</i> , [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 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :y

Sherman <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :p
Sweberg <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :p
Balki <i>et al.</i> , [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.	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> :nr 5 <sup>e</sup> : y 6 <sup>f</sup> :y
Su <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> :nr 5 <sup>e</sup> : y 6 <sup>f</sup> :y
Yamada <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> :nr 5 <sup>e</sup> :nr 6 <sup>f</sup> :y
Faiz <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : p 5 <sup>e</sup> :nr 6 <sup>f</sup> :y
Rosenman <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :y
Krage <i>et al.</i> , [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	1 <sup>a</sup> : y 2 <sup>b</sup> : y 3 <sup>c</sup> : y 4 <sup>d</sup> : y 5 <sup>e</sup> : y 6 <sup>f</sup> :y

<sup>a</sup>Aims and objectives; <sup>b</sup>Study design; <sup>c</sup>Research methods; <sup>d</sup>Explicit theoretical framework; <sup>e</sup>Limitations; <sup>f</sup>Implications.

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

Authors	Team interactions elements			Leadership skills			Individual elements				Environmental elements								
	Shared mental models	Communication	Co-operation co-ordination	Prioritization	Cognitive aids	Clear information needs	Leadership	Role allocation	Clear goals	Followership	Situational awareness	Adaptability	Mental practice	Provider's expertise	family presence	Team climate	Clinical standards	Scene organization	Training
Beck <i>et al.</i> , [14]	*																		
Gundrosen <i>et al.</i> , [18]	*	*					*												
Sweberg <i>et al.</i> , [23]		*	*	*													*	*	
Su <i>et al.</i> , [25]		*																	
Balki <i>et al.</i> , [24]	*	*					*		*	*						*			
Sherman <i>et al.</i> , [7]		*					*	*		*				*	*		*	*	
Calder <i>et al.</i> , [16]	*	*			*	*				*									
Mclanders <i>et al.</i> , [20]		*					*	*										*	
Yamada <i>et al.</i> , [26]		*																	
Cooper <i>et al.</i> , [17]		*	*	*	*		*			*	*				*	*			
Lorello <i>et al.</i> , [19]												*							
Moore <i>et al.</i> , [21]		*							*				*					*	
Bolandparvaz <i>et al.</i> , [15]													*						

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 2<sup>nd</sup> 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 3<sup>rd</sup> most important element of teamwork in resuscitation. Awareness of "what is going on around you" in resuscitation is integral to successful teamwork. This should be a priority, and proper communication will facilitate it [16]. 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

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.

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**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.

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