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Transforming Health Care One Team at a Time: Ten Observations and the Trail Ahead

Eduardo Salas[1], Stephanie Zajac[1,2], and Shannon L. Marlow[1]

Abstract

The present review synthesizes existing evidence and theory on the science of health care teams and health care team training. Ten observations are presented that capture the current state of the science, with applications to both researchers and practitioners. The observations are drawn from a variety of salient sources, including meta-analytic evidence, reviews of health care team training, primary investigations, and the authors' collective expertise in developing and implementing medical team training. These observations provide insight into the team (e.g., psychological safety) and organizational-level (e.g., culture for teamwork) factors that drive effective health care teamwork, as well as advancements and best practices for designing and implementing team training initiatives (e.g., multilevel measurement). We highlight areas where new knowledge has emerged, and offer directions for future research that will continue to improve our understanding of health care teams in the future.

Keywords

teams or teamwork, training, health care, education

[1]Rice University, Houston, TX, USA
[2]The Houston Methodist Institute for Technology, Innovation, and Education (MITIESM) and Department of Surgery, Houston, TX, USA

Corresponding Author:
Eduardo Salas, Department of Psychology-MS 25, Rice University, Sewall Hall 429C, 6100 Main Street, Houston, TX 77005-1827, USA.
Email: Eduardo.Salas@rice.edu

The science behind teams and training in health care has seen incredible advancements. The competencies necessary for effective teamwork have been identified (e.g., Salas, Sims, & Burke, 2005), and their importance validated in the health care setting (e.g., Suter et al., 2009; Westli, Johnsen, Eid, Rasten, & Brattebø, 2010). Recent evidence now indicates that these teamwork attitudes, behaviors, and cognitions can be trained, and that team training leads to not only learning but also behavior change on-the-job and improved patient and organizational outcomes (Hughes et al., 2016). Furthermore, evidence-based training methods (e.g., simulation-based training [SBT]; Salas, Paige, & Rosen, 2013), open-source tools (e.g., Team Strategies and Tools to Enhance Performance and Patient Safety [TeamSTEPPS], Agency for Healthcare Research and Quality [AHRQ]), and a number of psychometrically sound measures have been identified (e.g., Marlow et al., 2017).

However, there is a limit to what we currently know. Medical error and the associated serious and potentially lethal threats to patient safety persist, and teamwork failures continue to be targeted as a root cause of these errors (James, 2013; Rabøl et al., 2011). A better understanding of the frontier of health care, including innovative training methods that target current limitations (e.g., virtual simulation; Sweigart et al., 2016), best practices for long-term sustainment of training, and early integration of teamwork into existing education, may be valuable in further reducing error. Moreover, limitations in the design and reporting of primary studies limit our ability to draw strong conclusions about patient and organizational outcomes. In the 146 independent health care team training evaluations meta-analyzed by Hughes and colleagues (2016), only 19, or 13% of, studies used the most robust design (i.e., independent groups and repeated-measures design). Marlow and colleagues (2017) found that, of the evaluations analyzed within their review, only 3% of measures assessed patient outcomes and 14.4% evaluated organizational outcomes. This illustrates the need to prioritize the assessment of patient and organizational outcomes and use more robust research designs.

Therefore, the aim of this review is threefold. First, the authors evaluate and take stock of the current state of the health care team and team training literatures, and provide observations that summarize the state of the science and practice. In doing so, we increase the accessibility of this vast body of information to both scientists and practitioners overseeing and researching health care teams. A secondary aim is to outline and document recent advances in health care team training research, such as the use of patient-specific in situ simulation (Yamada, Fuerch, & Halamek, 2017). Finally, we provide some thoughts about the road ahead to spur future research.

The Transformation: A Multidisciplinary Approach

We suggest that addressing the complex issue of medical error requires resources in the form of interdisciplinary expertise, access to hospitals and the people they serve, and an evidence-based approach to solving critical problems (e.g., human error, threats to patient safety, and barriers to a psychologically safe culture). In other words, we argue that the medical expertise held by clinicians (e.g., knowledge of potential causes of medical error), as well as their support and access to the health care system, is invaluable to advancing the science of health care teams. Equally important, scientists in the fields of teams and team training contribute unique knowledge on the individual-, team-, and organizational-level factors that influence critical outcomes as well as the research methods needed to evaluate these outcomes. We make this claim based in part on evidence from the aviation industry. Sexton, Thomas, and Helmreich (2000) commented on reduced error in the aviation industry, explaining that "the involvement of the research community, National Aeronautics and Space Administration, regulatory agencies, and the use of data driven initiatives to raise awareness of the limitations of human performance and the importance of effective teamwork" (p. 748) all played a role in this shift. They argue that the health care industry and medical errors parallel this domain, as human errors and organizational culture represent driving causes of error; we echo their argument in emphasizing the need for collaboration among scientists and practitioners to reduce medical errors. We therefore suggest that clinical and nonclinical professionals (e.g., organizational health, public health, cognitive engineering) are capable of transforming health care by working together. However, this is a slow process achieved by increasing effectiveness in one health care team at a time.

We identified 10 observations by emphasizing the most up-to-date evidence in both science and practice about the factors that facilitate effective health care teamwork and team training. We present these observations by first focusing on team dynamics and behaviors that can promote more effective teamwork in health care teams (i.e., team leadership, psychological safety, and resilience). We then discuss team training, beginning with what is known about the effectiveness of team training, who it benefits, and how it works, and then progress to factors that can facilitate more effective team training (i.e., debriefing and simulations). We end by emphasizing the steps evidence and theory indicate should follow training, including appropriate measurement and a focus on organizational sustainment. We have analyzed the current state of the literature in health care, summarizing and commenting on findings from a recent meta-analysis (Hughes et al., 2016; see Table 1), reviews of health care teams and training (e.g., Dietz et al., 2014; Weaver, Dy, & Rosen, 2014), and the most recent empirical evidence. The results were

Table 1. Key Findings From Meta-Analysis on Medical Team Training Conducted by Hughes et al. (2016).

Finding

• Health care team training significantly improved the following outcomes:
  • Reactions increased by 18%
  • Learning increased by 29% (affective learning by 26%, cognitive learning by 27%, and skill-based learning by 31%)
  • Transfer increased by 23% (teamwork performance by 17%, clinical task performance by 32%, medical errors reduced by 18%, and skill-based transfer by 26%)
  • Results increased by 13% (safety climate by 11% and non-Intensive Care Unit [ICU] length of stay by 6%)
  • Patient outcomes increased by 14% (patient satisfaction by 13% and patient mortality reduced by 13%)

Note. Cohen's *d* values reported in Hughes et al. (2016) converted to percentages from Cohen's U3 (Cohen, 1977).

combined with our 30 years of collective practical experience in developing, implementing, and evaluating medical team training in the field. In addition, we discuss critical needs that remain to be addressed (e.g., sustainability, creating supportive conditions, robust program evaluation) and provide the impetus for future research in areas where clarity is still needed.

Method

Literature Search

We conducted a search of published studies related to health care team training with an emphasis on research published in the last 5 years (i.e., the most up-to-date evidence available) to provide an update to reviews published approximately 5 years earlier (Cumin, Boyd, Webster, & Weller, 2013; Gordon, Darbyshire, & Baker, 2012; Rosen, Hunt, Pronovost, Federowicz, & Weaver, 2012; Weaver et al., 2013). A Boolean operator keyword search of the electronic database PubMed was conducted using combinations of relevant keywords (i.e., "teamwork," "team training," "team intervention," "teamwork training," "teamwork intervention," "TeamSTEPPS," "crew resource management"). Relevant review articles were identified, and backward and forward snowball techniques (i.e., the reference lists of these articles were searched; Greenhalgh & Peacock, 2005) were used to obtain an overview of existing evidence as well as the most up-to-date primary studies. Finally, a secondary search of PubMed was completed to identify additional primary studies conducted from 2013 to 2017.

From these articles, each author independently extracted themes based on the following focal questions: (a) What do we know about teamwork in health care? (b) What evidence do we have for the importance of teamwork? (c) What training methods are currently being used? (d) What evidence do we have that team training improves *results* (i.e., patient and organizational outcomes)? (e) What do we still need to know? and (f) How can we learn more? The three authors then met for consensus on the interpretation of the literature and the most salient themes; combining the results with our collective experience in developing and implementing health care across a variety of domains, we identified the 10 critical topics outlined below.

The Transformation: Observations

Observation 1: Teamwork Is the Foundation for Resilience and Reducing Medical Error

The health care domain is a high hazard sector; teams continuously face complex, uncertain, and fast-paced environments. Unlike other high reliability organizations (HROs) where crises are uncommon (e.g., aviation), Nemeth, Wears, Patel, Rosen, and Cook (2011) pointed out that health care teams are routinely faced with life-threatening situations. Accordingly, the authors asserted that a state of control is rarely achieved, and strict rules and procedures for how teams should perform do not apply. What is needed is resilience, or the ability to positively adjust and even thrive under conditions of adversity (Jackson, Firtko, & Edenborough, 2007). At the team level, resilience is defined as "the ability of teams to respond to sudden, unanticipated demands for performance quickly and with minimum decrement of performance" (van der Kleij, Molenaar, & Schraagen, 2011, p. 2158). In health care, this includes delivering safe and reliable care in dynamic, stressful environments (Robertson et al., 2015).

The characteristics and processes that contribute to capacity for resilience in successful health care teams have been identified (Mallak, 1998; Shaw, 2015; Wilson, Burke, Priest, & Salas, 2005; see Table 2 for example factors). The underlying theme of these factors is that teamwork is the foundation for resilience to errors; teams can be thought of as adaptive systems that provide backup and monitoring when necessary (Burke, Salas, Wilson-Donnelly, & Priest, 2004). Furthermore, recent evidence suggests that many of these factors can be trained, efforts to create and assess multilevel resilience interventions have been made (e.g., Anderson, Ross, & Jaye, 2013), and innovative methods for measuring resilience are being developed (Stevens, Galloway, Gorman, Willemsen-Dunlap, & Halpin, 2016).

Table 2. Resilience Factors.

Factor	Example
• Goal-directed solution seeking	• Team goals guide individual action
• Role dependence	• Team members understand and can perform each other's roles
• Back-up behavior/mutual support	• Taking an active role in assisting others when overloaded
• Performance monitoring	• Monitoring team members for errors or decreases in performance
• Huddles and debriefs	• Taking time to discuss the situation, the team's response, and positive and negative examples of behavior
• Guidance seeking	• Seeking out high-quality information or advice from internal or external members
• Advocacy/assertive communication	• Firm but respectful communication of differing viewpoint, speaking up with need for corrective action

Observation 2: Leadership Matters—Team Leadership Is Necessary

Wacker and Kolbe (2014) noted that leadership serves several critical functions in the context of health care and shaping patient safety outcomes. The authors asserted that effective leadership may be especially important when teams are contending with unexpected and/or stressful situations. In fact, leadership is a cornerstone of well-validated training programs (e.g., TeamSTEPPS, AHRQ), and evidence-based approaches to measuring this construct across health care professions have emerged (e.g., Calhoun et al., 2008). Importantly, health care teams may be most effective when leadership is shared across members (e.g., residents and nurses; Künzle et al., 2010; Muller-Juge et al., 2014).

In the health care domain, a number of factors may help explain why team leadership is effective, including the prevalence of (a) interdisciplinary team members, (b) complex and dynamic tasks, and (c) membership fluidity. Team members with different functional and educational backgrounds can step up into the leadership role when the task requires a specific set of expertise (Künzle et al., 2010; Wacker & Kolbe, 2014). For example, interprofessional teams must often engage in shared decision making when developing patient care plans, and valuing other's expertise and input is of utmost importance (Schaik, O'Brien, Almeida, & Adler, 2014). Furthermore, health care teams often face

complex situations, which require a high level of interdependence and creativity to tackle. Under these conditions, it is unlikely any one individual will hold the required expertise, and a greater pool of knowledge and synergistic team processes are required (Baker, Day, & Salas, 2006). Finally, some forms of medical teams (e.g., surgical teams) experience frequent membership change and must reconfigure quickly after the loss or exchange of a member; therefore, in health care teams, it is ideal if task leadership is based on expertise and rotated as necessary (Bedwell, Ramsay, & Salas, 2012).

Observation 3: Psychological Safety Matters

Psychological safety plays an integral role in promoting learning and team performance in health care (e.g., Edmondson, Higgins, Singer, & Weiner, 2016; Frazier, Fainshmidt, Klinger, Pezeshkan, & Vracheva, 2016). Defined as "the shared belief that the team is safe for interpersonal risk taking" (Edmondson, 1999, p. 354), psychological safety is fostered in health care teams through showing others respect, active listening, and by encouraging others to speak up (O'Leary, 2016). A lack of this important psychosocial factor may act as a barrier to identifying and mitigating the consequences of medical error; conversely, a high degree of psychological safety should facilitate conditions that enable learning and reduce mistakes. For example, Appelbaum, Dow, Mazmanian, Jundt, and Appelbaum (2016) found that individuals reporting higher levels of psychological safety were more likely to report adverse events, argued to be critical for mitigating the possibility of their reoccurrence. Furthermore, O'Leary (2016) found that, in multidisciplinary health care teams, psychological safety promotes knowledge cogeneration and power sharing.

Psychological safety has also been identified as an important agent in process and quality improvement efforts in health care. Ortega, Van den Bossche, Sánchez-Manzanares, Rico, and Gil (2014) found that psychological safety mediated the relationship between change-oriented leadership and team learning, indicating that psychological safety serves yet another critical role as a mechanism promoting innovative improvements. In a similar vein, Nembhard and Edmondson (2006) found psychological safety was related to engagement in quality improvement work (e.g., reporting participating in improvement efforts) within health care teams.

Observation 4: Medical Team Training Works

HROs (e.g., hospitals) have several characteristics that require effective teamwork, including hypercomplexity, high task interdependence, steep

hierarchies, multiple decision makers, and time pressure (Baker et al., 2006). This environment gives rise to factors such as stress and fatigue; while many members of HROs (e.g., aviation, medical) deny the effect of these factors on team outcomes (Sexton et al., 2000), empirical evidence suggests a strong negative influence on processes and performance. For example, in a review of surgical malpractice claims involving harm to the patient, Greenberg and colleagues (2007) found that nearly 15% of claims involved communication breakdowns (e.g., failure to notify attending surgeon) across the life cycle of patient care. Unstandardized communication, information exchange via telephone (e.g., transfer, consults) or between different levels of staff, patient handovers, and hesitance speaking up are just a few of the many opportunities for communication breakdowns to occur (Rabøl et al., 2011).

Fortunately, strong evidence suggests that health care team training works (Riley et al., 2016; Salas, Burke, Bowers, & Wilson, 2001; Salas et al., 2008), and science and practice offer specific strategies, delivery methods, and tools proven to enhance team processes and attitudes toward teamwork (e.g., TeamSTEPPS; Brock et al., 2013). A meta-analytic review of crew resource management (CRM) conducted by O'Dea, O'connor, and Keogh (2014) showed a strong positive impact on learning and behavior. In a qualitative review, Weaver et al. (2014) found that both simulation and didactic-based team training methods improve critical team processes (e.g., communication) and emergent states (e.g., trust), as well as patient safety outcomes (e.g., morbidity, mortality). Finally, Hughes and colleagues (2016) were able to demonstrate the relationship between training and team and multilevel outcomes through meta-analysis of more than 100 primary studies (see Table 2). The authors found health care team training positively influenced all four levels of Kirkpatrick's (1994) evaluation criteria: (a) trainee (i.e., individuals receiving formal training) reactions; (b) affective, cognitive, and skill-based learning; (c) transfer to the workplace; and (d) organizational and patient-related results. Perhaps most importantly, there was compelling evidence to suggest that training can reduce patient mortality, and therefore the link between training and patient safety outcomes has been more firmly established.

Observation 5: Team Training Benefits Health Care Clinicians and Students

A high degree of attention has been given to assessing the impact of team training on practicing health care clinicians, as demonstrated by the large amount of primary studies assessing this population (Marlow et al., 2017). Comparatively fewer studies have been completed to determine how health care team training improves student outcomes, despite the fact that these

students are frequently receiving team training (Beach, 2013; Marlow et al., 2017). Yet, Hughes et al. (2016) found that health care team training benefits both health care clinicians and students equally. There were no significant differences in terms of learning or transfer, which were both significant outcomes for each sample type. However, because these analyses were based on fewer studies, Hughes et al. suggested caution in interpreting findings as meta-analytic effect sizes based on fewer studies may be less stable. We further note that transfer within an undergraduate medical student sample would most likely consist of something related to the academic environment as opposed to actual on-the-job performance in a hospital or other health care organization.

Observation 6: The Pathway to Improved Organizational Results Begins With Learning

Recent meta-analytic evidence indicates that, within the health care team training context, an improvement in organizational outcomes (e.g., safety climate) is initiated by trainee learning (Hughes et al., 2016). Specifically, Hughes and colleagues (2016) found partial support for a sequential model of health care team training, wherein positive trainee reactions lead to learning which facilitates transfer which, in turn, fosters enhanced organizational outcomes. The authors tested the causal model implied in Kirkpatrick's (1959/1994); seminal evaluation framework, which argues that the following outcomes should be measured after training: reactions (i.e., the degree to which trainees like training and perceive it as useful), learning (i.e., increases in the trainee's knowledge, skills, and abilities [KSAs]), transfer (i.e., whether trainees exhibit trained KSAs on-the-job), and outcomes (i.e., organizational results). Other researchers have criticized this model on the basis that, although there is little evidence to support the claim, it inherently implies that there is a causal relationship among these criteria that begins with trainee reactions (Alliger & Janak, 1989).

To address this gap, Hughes and colleagues (2016) meta-analytically tested the implied causal link in Kirkpatrick's (1959) model. They found support for the model; however, they also found that the chain does not appear to start with trainee reactions. Rather, trainee learning appears to initiate this causal chain. In other words, all paths within the tested model were significant, except the path from reactions to learning. These findings indicate the significance of prioritizing learning within the training process, particularly through measurement. Reactions may play other roles in furthering training effectiveness (e.g., increasing motivation to attend future training), but in the context of facilitating organizational outcomes such as improved safety climate or patient outcomes, learning appears to be the most important criterion.

Observation 7: Debriefing Works—It Improves Teamwork

Research has emphasized the importance of feedback and debriefing in facilitating enhanced performance after training (e.g., Tannenbaum & Cerasoli, 2013). In fact, in a review of SBT, McGaghie, Issenberg, Petrusa, and Scalese (2010) found feedback to be the most important and frequently cited feature for improving SBT outcomes. Hamstra, Cook, Zendejas, Hamstra, and Brydges (2014) asserted that feedback provides guidance as well as objective information about their performance, allowing trainees to be aware of their strengths and weaknesses. However, as the authors noted, the efficacy of feedback depends on how it is delivered, and effective feedback methods can vary depending on the type and difficulty of the task as well as characteristics of the trainees (e.g., regulatory focus and experience level).

Although specific task and trainee factors should be considered, evidence has suggested critical elements that must be addressed in *every* debrief. These elements include the following: (a) a review of goals and learning objectives, (b) reflection on strengths as well as areas that require additional practice, and (c) an action plan to improve future performance (Ahmed et al., 2013). Discussing errors and poor performance, although necessary, can be threatening to trainees if not approached correctly. Therefore, at the beginning of a debrief, the facilitator should frame errors as opportunities for improvement, set rules for interaction (e.g., do not interrupt team members), and stress the developmental purpose of the exercise (Lyons et al., 2015). In recognizing that discussing poor performance is an inherently judgmental process, Rudolph, Simon, Dufresne, and Raemer (2006) provided an approach to debriefing that allows critical evaluation while maintaining trust and psychological safety. Debriefing with Good Judgment, as termed by the authors, involves an in-depth self-evaluation guided by the facilitator and a conversational style that is characterized by both advocacy and genuine curiosity. The voluminous literature on debriefing provides many additional recommendations (see Tannenbaum & Goldhaber-Fiebert, 2013).

Observation 8: Simulation Is a Powerful Tool to Enhance Teamwork

Research continues to support the utility of SBT methods in health care contexts (e.g., Paige et al., 2014). SBT provides trainees with the opportunity to engage in deliberate practice, which has been found to be a critical component for enabling trainee learning (Hughes et al., 2016; McGaghie, Issenberg, Cohen, Barsuk, & Wayne, 2011). Specifically, deliberate practice allows trainees the opportunity to refine the skills that will later be

required to perform effectively on-the-job and learn from mistakes in a safe environment. However, SBT should be guided by empirically derived principles to maximize its effectiveness (Salas et al., 2013).

Toward this end, one aspect of simulator design that has received considerable attention is psychological fidelity, or the degree to which the underlying psychological factors elicited in training (e.g., self-efficacy, resource allocation, required knowledge) are matched with learning and performance on-the-job (Kozlowski & DeShon, 2004). Researchers have suggested that this component of fidelity is more important than other often-considered aspects of fidelity, such as how closely the simulated environment matches the actual task environment (Bowers & Jentsch, 2001; Rehmann, Mitman, & Reynolds, 1995). Recent empirical evidence supports this claim in the context of health care teamwork skills; Hughes and colleagues (2016) examined physical fidelity, defined as the degree to which the simulation physically and behaviorally matches that of real life (Miller, Crandall, & McLaughlin, 2012), as a moderator of team training effectiveness within their meta-analysis. The authors found no significant differences between programs with high and low physical fidelity, which is an important finding given the potentially prohibitive costs of high fidelity simulators.

Recent work has called for new considerations in the design and implementation of simulation-based team training. For example, although there are often significant barriers (e.g., logistical constraints), the importance of inclusion of all members of a multidisciplinary patient care team (e.g., nurse, anesthetists, lab tech, surgeon) has been acknowledged (Arora, Hull, Fitzpatrick, Sevdalis, & Birnbach, 2015). In addition, Schoenherr and Hamstra (2017) asserted that focusing on fidelity as it has been traditionally defined overlooks a crucial simulation feature, namely, the social aspects of the simulation environment. The authors argued for more attention to be paid to the interactions between the educator and learner in constructing the learning experience.

Observation 9: Relevant, Diagnostic, and Robust Measurement Is Critical

Numerous initiatives have focused on uncovering what drives effective measurement, and researchers have now demonstrated how to accurately and reliably assess team processes and outcomes. For example, Rosen and colleagues (2008) delineated several best practices for measuring teamwork. Among these recommendations, they suggested that measures should be linked to specific competencies, or the KSAs that are targeted with training. Moreover, the authors asserted that capturing both team processes and outcomes is

critical in evaluating the success of a training intervention, as factors outside of the team's control can influence observed levels of performance. Utilizing multiple sources (e.g., self-report, observer) also enables researchers to avoid biases associated with any one source (Rosen et al., 2008). These principles, among others (e.g., Salas, Rosen, Held, & Weissmuller, 2009), have informed how to effectively measure teamwork.

One recent advancement in this area is the inclusion of the patient perspective in measurement tools. As the primary goal of team training is often to improve patient care and patient-centered outcomes (e.g., Clancy & Tornberg, 2007), it is critical that measurement mirrors this goal. Fortunately, the definition of team membership has expanded to include the patient, and the importance of the contribution and perspective of the patient in team process (e.g., shared decision making; Oshima Lee & Emanuel, 2013) and patient-centered outcomes (e.g., time to diagnosis; Taplin et al., 2015) have been considered. For example, Truijens and colleagues (2015) examined the impact of multiprofessional simulation-based team training on patient-reported quality of care during pregnancy and childbirth. Training was evidenced to significantly improve patient involvement in planning and provision of information.

Observation 10: Team Training Is Not a Panacea

Although it is clear that team training improves team performance outcomes, it is not a panacea. As illustrated in Table 1, outcomes stemming from health care team training can be improved by as much as 32%. Although this is a substantial change, this finding indicates that there is a room for a variety of additional factors to further influence teamwork processes and training outcomes. Therefore, practitioners and researchers should take a systems-level approach (i.e., accounting for the importance of influences at the individual, team, and organizational levels, as well as factors before, during, and after formal training events) to both delivering training interventions and enhancing teamwork. In particular, we emphasize the importance of organizational support for sustaining trained teamwork behaviors. For example, Escher et al. (2017) found that the intrinsic motivation of medical students to participate in training and improve skills was positively increased by a training program targeting patient safety climate. Jacobs and colleagues (2013) similarly demonstrated a relationship between organizational culture, as set by senior management, and performance in acute hospitals.

Important organizational conditions include aspects such as safety culture, leadership, and organizational incentives. Safety culture (i.e., shared beliefs, attitudes, norms, values, and behavioral characteristics as related to the organization's patient safety performance; Guldenmund, 2000) has been argued

to be integral to patient safety and patient care (Morello et al., 2013). Teamwork has been considered a dimension of this construct (Singla, Kitch, Weissman, & Campbell, 2006), highlighting the interconnected nature of teamwork and safety culture and the need to foster an effective safety culture to facilitate teamwork and patient care. Salas, DiazGranados, Weaver, and King (2008) further argued that implementing rewards that are directly linked to trained teamwork behaviors is critical for promoting transfer. In accordance with this argument, Blumenthal, Song, Jena, and Ferris (2013) noted the importance of implementing incentives at the team level to foster increased team performance, providing guidance on how to effectively implement such rewards. In sum, each of these elements and other organizational factors should be considered in addition to team training to support effective training transfer and team performance in health care teams.

The Next Frontier: Future Directions for Understanding Health Care Teams

The observations discussed throughout this review emphasize how far the science of teams and training in health care has advanced. For example, evidence has illuminated the conditions before, during, and after team training that enhance or mitigate its effectiveness (e.g., Salas, Tannenbaum, Kraiger, & Smith-Jentsch, 2012). We also now know that the pathway to improved organizational results, as a function of medical team training, begins with trainee learning (Hughes et al., 2016). However, significant gaps in our understanding persist in many of the highlighted areas, and challenges remain in translating what is known from the science to practice. Consequently, we conclude by putting forth eight fruitful areas for future investigation with the overarching goal of improving team performance, the quality of patient care, and other critical system-level outcomes (e.g., safety climate).

Future Direction 1: Focus on Training Sustainment

Future applications of health care team training should be designed and implemented with an underlying focus on long-term sustainment of trained behaviors. Training is not a one-time event; ensuring that targeted behaviors are maintained in the long-term requires consideration of the conditions in place before and after training. In part, evidence suggests sustainment can be accomplished by fostering a culture of teamwork through organizational policies and procedures (e.g., inclusion of teamwork training in new employee orientation and mandatory annual training; Thomas & Galla, 2013). However, future research should aim to develop a theoretical framework that includes not only transfer but the multilevel factors important to long-term

sustainment of trained behaviors. We know little about the rate of decay for teamwork skills, and critical questions related to sustainment remain unanswered (e.g., required frequency of refresher training; Weaver et al., 2014).

Future Direction 2: Understanding Organizational Conditions

The role of senior and executive leadership in enforcing organizational conditions that promote sustainment of training and teamwork cannot be overstated (Thomas & Galla, 2013). For example, senior leadership is responsible for framing teamwork training in a way that elicits enthusiasm and participation, and for allocating the necessary resources (e.g., time, equipment) to ensure teamwork-centered programs are integrated into the health care system. Therefore, exploring the factors that promote buy-in from leaders and clearly showing the link between teamwork and organizational outcomes, including patient safety, is of utmost importance. Similarly, future research should investigate methods for overcoming the persistent barriers to training implementation (e.g., strong hierarchies, lack of organizational communication and central coordination point, insufficient time allocation, professional silos, inadequate access to training and feedback, and poor climate; Clay-Williams & Braithwaite, 2015) and provide practical recommendations to leadership. No transformation of health care will be complete without understanding the organizational conditions that lead to effective and sustainable transfer in health care systems. The challenge ahead is to uncover these conditions.

Future Direction 3: Creating a Climate for Teamwork

Leadership shared at the team level is both effective and often required; however, attitudes toward team leadership are not always positive (Leipzig et al., 2002). Efforts are needed to promote the value of team leadership, as well as to understand how to transfer leadership smoothly among members. Specifically, we need a better understanding of how to create positive affective team climates; although the importance of mutual trust and respect for team leadership is acknowledged, how to encourage this among members remains a challenge.

In a similar vein, positive team-level attitudes (e.g., mutual respect) act as a foundation for psychological safety. Unfortunately, a survey given to intensive care staff indicated that half of respondents found it difficult to discuss or acknowledge mistakes, suggesting that a climate of psychological safety may be difficult to establish (Sexton et al., 2000). Moreover, team training programs commonly implemented within the health care context (e.g.,

TeamSTEPPS) do not specifically include psychological safety in training content. We argue that future research should implement and evaluate health care team training programs that include psychological safety as a competency targeted with training.

Future Direction 4: Emerging Training Modalities

As another consideration, the influence of technology will play a large role in SBT and team process and performance measurement. Mathieu, Maynard, Rapp, and Gilson (2008) noted that an emerging trend in the area of general team training is the increased prevalence of novel approaches to delivery. Although training has traditionally been delivered face-to-face via a live instructor, they suggest that "alternative training delivery methods, such as self-administered CD, multimedia instruction, and Web-based training" (p. 448) are becoming increasingly common. We suggest that this trend is especially relevant to the context of health care teams. As technology is likely to continue expanding the availability and opportunity for training (e.g., allowing for web-based learning and training distributed teams virtually), a greater understanding of the efficacy of new methods is needed. Indeed, technology provides the ability to overcome present challenges (e.g., the need to be physically colocated; Sweigart et al., 2016), but primary studies comparing the outcomes of alternate modalities with traditional training are needed. Moreover, this area would benefit from theoretically driven investigation into the relationship between specific features of new training methods and training outcomes (e.g., the use of feedback and reflection in virtual patient models; Georg & Zary, 2014).

Future Direction 5: Robust Performance Measurement Systems

Although the measurement of teamwork has significantly advanced (e.g., Rosen et al., 2008), new sensor-based approaches (Rosen, Dietz, Yang, Priebe, & Pronovost, 2014) have emerged that hold great potential for assessing teamwork in an objective and unobtrusive way. For example, Kim, McFee, Olguin, Waber, and Pentland (2012) asserted that sociometric badges allow for accurate and real-time assessment of fine-grained speech and behavioral patterns, and can capture interaction among fluid health care team members. Importantly, these data may help us address underexplored areas of team research such as whether what a team experiences and reports is what actually occurs during performance (i.e., comparison of subjective and objective measures of teamwork), and why potential discrepancies or bias in different measurement methods may exist. Rosen and colleagues (2014)

provided initial support for the feasibility and potential value of sensor-based measurement, and put forth an initial theoretical framework. However, as the authors noted, additional theory linking specific applications of sensors (e.g., motion tracking, pressure sensors) to teamwork competencies is sorely needed. In addition, analyzing data gathered from simulations remains a challenge. A large volume of behavioral data is generated from simulations, and determining how to best focus measurement and analysis to diagnose teamwork is crucial.

Future Direction 6: Understanding Multiteam Systems (MTSs)

As previously stated, we have a strong understanding of the competencies necessary for delivering high-quality patient care in teams. However, patient care increasingly requires collaboration across several departments within the health care system; put another way, it is necessary for MTSs to act interdependently for one patient (DiazGranados, Dow, Perry, & Palesis, 2014). According to Marks, DeChurch, Mathieu, Panzer, and Alonso (2005), MTSs are defined as a network of teams linked together by a goal hierarchy. Each component team is distinguishable and has its own unique goals, but individual team goals combine to achieve a larger overall objective (e.g., quality patient care). West and colleagues (2015) recognized several challenges for the understanding of multiteam health care systems that require further attention, including rapidly changing composition and membership in multiple teams. The broader literature also holds many important theoretical questions for patient care MTSs. For example, DeChurch and Zaccaro (2013) pointed out the possibility that some team competencies considered beneficial for individual team performance may actually undermine the performance of MTSs (e.g., cohesion within teams may limit between team information sharing).

Future Direction 7: Focus on Patient-Centered Outcomes

Synthesizing the literature on the relationships between teamwork and critical outcomes, Manser (2009) noted that "only a few studies could establish a direct link between specific teamwork behaviors and clinical performance or patient outcome" (p. 147). Although Manser concluded that, on the whole, teamwork was related to positive aspects of patient care, the author noted that there are many areas where research is needed for more robust conclusions. Specifically, more objective measures of patient quality and teamwork are necessary to ensure that a granular understanding of how teamwork improves patient safety is attained. Similarly, Marlow and colleagues (2017) found

that, across 195 empirical evaluations of health care team training programs and 1,757 measures implemented within these interventions, only 3% (k = 58) evaluated patient outcomes.

Future Direction 8: Multidisciplinary Collaboration to Improve Patient Care

Finally, there is a need to promote a continued partnership among clinicians and scientists in the fields of training, human factors, and learning. As the patient safety movement progresses and the importance of teamwork in patient care is increasingly recognized (e.g., Manser, 2009), expertise acquired from both science and practice should continue to inform its progress. Thus, scientists with expertise in teamwork and training should continue to partner with clinicians with experience in these domains to leverage their combined expertise to foster increased teamwork and enhanced training effectiveness. We stress that only with cooperation from both parties can substantial progress be attained. As an anonymous physician interviewed by one of the authors succinctly put, "solutions to patient safety are not in medicine, they are in psychology".

Conclusion

> Human error in medicine, and the adverse events that may follow, are problems of psychology and engineering, not medicine. (Senders, 1994, p. 159)

The science of health care teams and training has advanced significantly and, correspondingly, practice has benefited; evidence indicates training can reduce mortality and improve patient-related outcomes (Hughes et al., 2016). The themes identified in this review highlight both strong existing evidence and areas where research remains nascent. Specifically, the underpinnings of effective teamwork have been uncovered and we now know that certain team states, such as psychological safety, are critical in facilitating team success. Through a collaboration between science and practice, we have demonstrated that factors such as feedback and effective measurement drive training success and components such as organizational culture are critical in sustaining trhaining outcomes. However, there are still numerous areas where additional research is needed. For example, although scientific understanding has advanced, measurement remains a challenge and there will be numerous opportunities in the future to gather additional types of data to bolster our understanding of the effect of health care team training. The multilevel, multidisciplinary, longitudinal, and rigorous studies currently needed (O'Dea

et al., 2014) will undoubtedly require substantial resources (e.g., time, monetary investment, multidisciplinary knowledge); however, they will continue to advance and improve our understanding one team at a time.

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Author Biographies

Eduardo Salas is the Allyn R. & Gladys M. Cline Chair professor and Chair of the Department of Psychology at Rice University. Previously, he was a trustee chair and Pegasus professor of Psychology at the University of Central Florida where he also held an appointment as program director for the Human Systems Integration Research Department at the Institute for Simulation and Training (IST). Before joining IST, Eduardo was a senior research psychologist and Head of the Training Technology Development Branch of NAWC-TSD for 15 years.

Stephanie Zajac, PhD, is an Industrial/Organizational psychologist working to further simulation-based training at the Houston Methodist Institute for Technology, Innovation, and Education (MITIE). She specializes in the design, development, and evaluation of training programs for both individuals and teams. Her research interests include teams, training, procedural skill acquisition, and performance measurement.

Shannon Marlow is currently an Industrial and Organizational Psychology PhD student at Rice University. She specializes in research on teams, leadership, and training. She has a Bachelor's of Science degree in Psychology and a Master's of Science in Industrial and Organizational Psychology from the University of Central Florida