BRIEF REPORT

OPEN

Relationship Between Resuscitation Team Members' Self-Efficacy and Team Competence During In-Hospital Cardiac Arrest

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OBJECTIVES: Inadequate self-efficacy of resuscitation team members may impair team performance, but high self-efficacy does not guarantee competence. We evaluated the relationship between individual self-efficacy and resuscitation team competence.

DESIGN: Secondary analysis of a randomized controlled trial.

SETTING: High-fidelity in situ in-hospital cardiac arrest simulations at seven hospitals in Utah.

SUBJECTS: Multidisciplinary cardiac arrest resuscitation team members.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: Resuscitation team members completed surveys evaluating resuscitation self-efficacy (confidence in resuscitation role, difficulty thinking clearly, and concerns about committing errors) after each simulation. The primary outcome was event-level chest compression hands-on fraction greater than 75%. Secondary outcomes included other measures of resuscitation quality, advanced cardiac life support protocol adherence, and nontechnical team performance. Analyses employed the Datta-Satten rank-sum method to account for response clustering within simulation events. Of 923 participants in 76 analyzable simulations, 612 (66%) submitted complete surveys and 33 (43%) resuscitation teams achieved hands-on fraction greater than 75%. Event-level chest compression hands-on fraction greater than 75% versus less than or equal to 75% was not associated with the percentage of resuscitation team members reporting confidence in their team role ($n = 213$ [74%] vs. $n = 251$ [77%], respectively, $p = 0.18$), lack of difficulty thinking clearly ($n = 186$ [65%] vs. $n = 214$ [66%], $p = 0.92$), or lack of worry about making errors ($n = 155$ [54%] vs. $n = 180$ [55%], $p = 0.41$). Team members' confidence was also not associated with secondary outcomes, except that teams with confident members had better values for composite (3.55 [interquartile range, IQR 3.00–3.82] vs. 3.18 [IQR 2.57–3.64], $p = 0.024$) and global (8 [7–9] vs. 8 [6–8], $p = 0.029$) scales measuring nontechnical team performance.

CONCLUSIONS: Team members' self-efficacy was not associated with most team-level competence metrics during simulated cardiac arrest resuscitation. These data suggest that self-efficacy should have a limited role for evaluation of resuscitation training programs and for initial certification and monitoring of individual resuscitation team members' competence.

KEYWORDS: cardiopulmonary resuscitation; code team; in-hospital cardiac arrest; quality of care; self-efficacy

Competent, guideline-adherent resuscitation is essential for optimal patient outcomes after in-hospital cardiac arrest (IHCA). Self-efficacy—"situation-specific self-confidence" (1)—refers to the belief of an individual in their ability to successfully fulfil the responsibilities of a specific task

DOI: 10.1097/CCE.0000000000001029

KEY POINTS

Question: Is individual self-efficacy associated with improved resuscitation team competence?

Findings: In this simulation-based multicenter study of multidisciplinary resuscitation teams, individual self-efficacy was not associated with increased chest compression hands-on fraction or other concrete resuscitation competence outcomes but was associated with improved nontechnical team performance.

Meaning: Self-efficacy should have a limited role for evaluation of resuscitation training programs and for initial certification and monitoring of individual resuscitation team members' competence.

(2). Self-efficacy is important to develop in resuscitation team members but is not synonymous with competence. Associations between self-efficacy and competence in cardiac resuscitations have been inconsistent, indicating a need for further study in this topic (2–6).

Previous studies have often been small (2, 4, 5) or were conducted in a single center (4–6); analyzed only one type of resuscitation team member (2–6) or trainees (4, 5) rather than multidisciplinary clinical teams; assessed participants outside of clinical settings (4, 5); or did not assess nontechnical aspects of resuscitation (2, 4, 6). This large, multicenter study analyzed interdisciplinary teams during high-fidelity, in situ simulations of IHCA resuscitation to investigate the impact of resuscitation team members' self-efficacy on resuscitation team competence.

MATERIALS AND METHODS

Study Setting

We performed a secondary analysis of a randomized controlled trial (ClinicalTrials.gov NCT03000829) that investigated the impact of telemedicine consultation on resuscitation quality (7). The trial conducted high-fidelity in situ cardiac resuscitation simulations at seven Utah hospitals (one level 1 trauma hospital, two regional referral hospitals, three community hospitals, and a surgical specialty hospital) in 2017–2018. This study was conducted in accordance with the ethical standards of the Intermountain Health Institutional Review Board (IRB) and the Helsinki Declaration of 1975 after approval by the IRB on November 11, 2016 (IRB number 1050317, "Code Blue Outcomes and Process Improvement through Leadership Optimization using Teleintensivists-Simulation") with a waiver of informed consent.

IHCA Simulations

IHCA simulation and data collection details have been previously described (7). In brief, simulations occurred in inpatient rooms on inpatient wards employing a SimMan 3G (Laerdaal, Stavanger, Norway) simulation mannequin and 11 unique clinical scenarios superimposed on an underlying three-phase simulation structure. Simulations lasted approximately 10–14 minutes and started with a nonshockable pulseless cardiac rhythm (pulseless electrical activity or asystole) and converted to a shockable rhythm (ventricular fibrillation or tachycardia) approximately 4–6 minutes after the resuscitation team leader's arrival. Return of spontaneous circulation occurred upon defibrillation (if performed), with the simulation terminated at the next pulse check. Resuscitation team members were unaware of the simulation scenario or the underlying simulation structure. Simulations were recorded (audio and video) for adjudication.

Participants

Hospitals' standard methods were used to activate IHCA resuscitation teams at simulation initiation. As previously described (7), team membership varied by hospital, and could include attending and resident physicians, advanced practice clinicians, nurses, respiratory therapists, pharmacists, and laboratory technicians (**eTable 1**, http://links.lww.com/CCX/B291). We included all participants who completed a survey after an analyzable simulation. Simulations (and associated survey responses) were excluded from analyses of an outcome if data for that outcome were unavailable or unevaluable (e.g., if equipment malfunction precluded chest compression measurement).

Survey Instrument and Exposures

After simulation completion, each participant was invited to complete a survey (7–9) evaluating contributors to resuscitation self-efficacy

(**Appendix 1**, http://links.lww.com/CCX/B291). Respondents provided demographic data and ranked their agreement with each of three statements on a 5-point Likert-style scale: 1) "I felt confident in my role on the Code Blue team," 2) "I had difficulty thinking clearly," and 3) "I worry that I made errors." The primary exposure was participant confidence in their resuscitation team role ("agree" or "strongly agree" response to the corresponding survey question). Secondary exposures were lack of difficulty thinking clearly and lack of worry about error commission ("disagree" or "strongly disagree" response to the corresponding survey questions).

Outcomes

The primary outcome was whether the resuscitation team achieved a chest compression hands-on fraction greater than 75%. Secondary outcomes included hands-on fraction as a continuous variable, epinephrine administration within 5 minutes of simulation initiation, defibrillation within 2 minutes of a shockable rhythm, and advanced cardiac life support (ACLS) protocol adherence and errors. Outcomes were measured from simulation activation to termination. Trained research coordinators assessed ACLS adherence using a modified version (7) of a previously validated assessment tool (**Appendix 2**, http://links.lww.com/CCX/B291). Resuscitation teams' nontechnical skills were evaluated using the validated Team Emergency Assessment Measure (TEAM) global rating scale (1–10, maximum 10) and a composite score averaging ratings (0–4, maximum 4) from 10 items evaluating teamwork, task management, and leadership (10).

Statistical Analysis

Evaluation of the association of participants' self-efficacy measures with primary and secondary team-level IHCA competence outcomes employed Datta-Satten rank sum testing to account for clustering of survey responses within simulation events. Sensitivity analyses tested the association of IHCA self-efficacy with alternative hands-on fraction thresholds (>70% or >80% [a priori] or >60% [post hoc]), restricted analysis to resuscitation leaders (post hoc), and used an alternative method for statistical hypothesis testing (generalized linear mixed model incorporating a logit link and a random effect for simulation event). A two-tailed p value of less than or equal to 0.05 was considered statistically significant. Analyses were performed using Stata, version 16.1 (StataCorp, College Station, TX) or R, version 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Of 82 high-fidelity resuscitation simulations, 76 simulations with 923 participants were included in the primary analysis (**eFig. 1**, http://links.lww.com/CCX/B291). Of the 923 participants, 612 (66%) provided complete postsimulation survey responses (**eTables 2** and **3**, http://links.lww.com/CCX/B291). Resuscitation teams achieved hands-on fraction greater than 75% during 33 (43%) IHCA simulations (287 team members), with 43 (57%) simulations (325 team members) having hands-on fraction less than or equal to 75% (**eTable 4**, http://links.lww.com/CCX/B291).

Overall, 464 participants (76%) reported confidence in their role on the Code Blue team, 400 (65%) denied difficulty thinking clearly, and 335 (55%) denied worrying about making errors (**Fig. 1**). Event-level chest compression hands-on fraction greater than 75% versus less than or equal to 75% was not associated with resuscitation team members confidence in their team role (n = 213 [74%] vs. n = 251 [77%], respectively, p = 0.18), lack of difficulty thinking clearly (n = 186 [65%] vs. n = 214 [66%], p = 0.92), or lack of worry about making errors (n = 155 [54%] vs. n = 180 [55%], p = 0.41; **eTable 5**, http://links.lww.com/CCX/B291). Results were similar from sensitivity analyses employing mixed effects logistic regression models (eTable 5, http://links.lww.com/CCX/B291), restricted to survey responses from resuscitation leaders (**eTables 6** and **7** http://links.lww.com/CCX/B291), and redefining a competent hands-on fraction as greater than 60%, greater than 70%, or greater than 80% (data not shown). Resuscitation role confidence was also not associated with better resuscitation performance when hands-on fraction was measured as a continuous variable (median 0.74 [IQR 0.67–0.80] vs. 0.75 [IQR 0.67–0.80], p = 0.39; **Table 1**).

Participants' confidence in their resuscitation team role was not associated with timely epinephrine administration or defibrillation or ACLS protocol adherence (Table 1). In contrast, confidence in resuscitation role was associated with better nontechnical team performance as measured by both the TEAM composite score (median 3.55 [IQR 3.00–3.82] vs. median 3.18

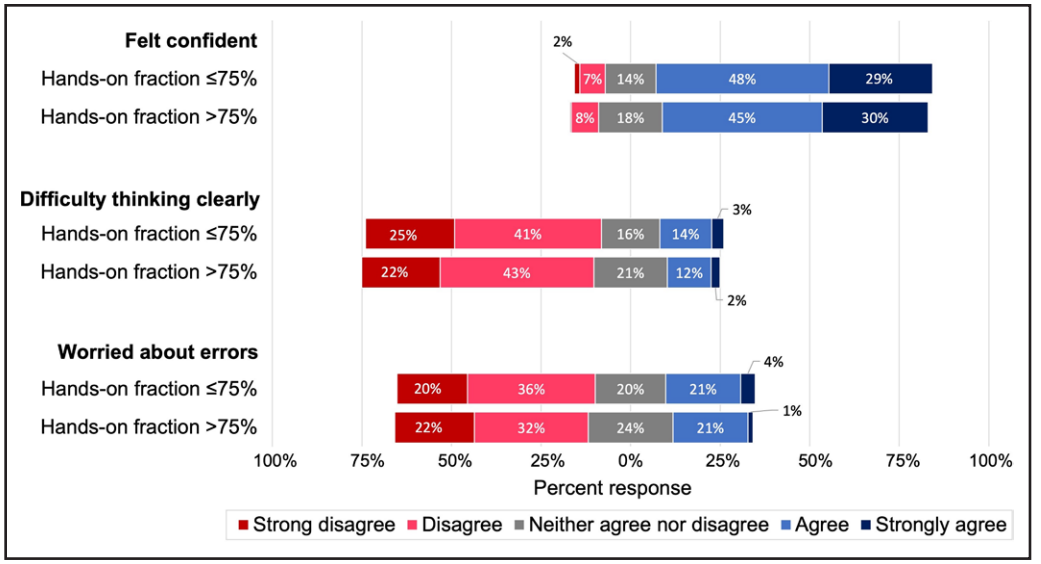

Figure 1. Diverging stacked bar graph depicting competence of chest compressions provided (e.g., hands-on fraction) and individual team members' self-efficacy. There was no difference in confidence (agreement with the statement "I felt confident in my role on the Code Blue team," $p = 0.53$), lack of difficulty thinking clearly (disagreed or strongly disagreed with the statement "I had difficulty thinking clearly," $p = 0.97$), or lack of worry about making errors (disagreed or strongly disagreed with the statement "I worry that I made errors," $p = 0.98$) when comparing participants on teams with hands-on fraction > 75% and participants on teams with hands-on fraction ≤ 75%.

[IQR 2.57–3.64], $p = 0.024$) and the TEAM global rating scale (median 8 [IQR 7–9] vs. median 8 [IQR 6–8], $p = 0.029$; **eFig. 2**, http://links.lww.com/CCX/B291).

DISCUSSION

In our study of over 600 healthcare professionals, we found that self-efficacy was not associated with objective measures of overall team competence during high-fidelity IHCA resuscitations but did find a positive association with nontechnical team performance. These findings suggest healthcare personnel and administrators should avoid judging resuscitation competence by their own or their staff's self-efficacy and that educators should avoid evaluating resuscitation training programs' effectiveness based solely on an increase in participants' self-efficacy. However, the association of confidence in resuscitation role with nontechnical team performance suggests that self-efficacy remains an important quality to develop in healthcare team members to support effective team leadership and collaborative team functioning. Interestingly, nontechnical skills have previously been found to impact resuscitation competence outcomes such as chest compression hands-on fraction (11).

Our study's strengths include the large number of resuscitation events and resuscitation team members and an excellent survey response rate from an interdisciplinary group of healthcare personnel across a variety of hospital types. However, this study had several limitations. First, self-efficacy was measured at an individual level, and competence was assessed through team-level outcomes. Although we adjusted for clustering, a link between individual self-efficacy and individual competence was not directly assessed. However, we believe measuring team-based competence instead of individual competence more accurately reflects the real-world nature of resuscitations. We chose chest compression hands-on fraction as the primary outcome due to its association with patient-centered resuscitation outcomes (12), but this outcome may be relatively insensitive to self-efficacy. The diverse resuscitation team members completing surveys had many different team roles; some roles' influence on the primary outcome may have been small or varied across the studied outcomes. This simulation-based study was not able to directly assess the association of self-efficacy with patient-centered outcomes such as return of spontaneous circulation. Although our survey response rate was high, differential survey completion associated with self-efficacy or competence could have biased our results. Finally, it remains possible that self-efficacy and/or competence might have differed if measured with actual IHCA resuscitations rather than simulations.

CONCLUSIONS

During IHCA resuscitation by interdisciplinary teams, team members' self-efficacy was associated with better nontechnical team performance but was not associated

TABLE 1.
Association Between Self-Reported Confidence in Resuscitation Role and Primary and Secondary Competence Outcomes After Accounting for Clustering

Outcome	Participants Reporting Confidence in Resuscitation Team Role	Participants Not Reporting Confidence in Resuscitation Team Role	p^a
Chest compression quality			
Included survey respondents (*n*)	464	148	
Hands-on fraction > 75% (*n*, %)	213 (46%)	74 (50%)	0.18
Hands-on fraction (median, IQR)	0.74 (0.67–0.80)	0.75 (0.67–0.80)	0.39
Resuscitation protocol adherence			
Included survey respondents (*n*)	439	131	
Epinephrine given within 5 min of code activation (*n*, %)	213 (49%)	56 (43%)	0.35
Shock given within 2 min of shockable rhythm identification (*n*, %)	397 (90%)	117 (89%)	0.67
ACLS protocol errors (median, IQR)	3 (2–4)	3 (2–4)	0.97
ACLS protocol adherence (median, IQR)	0.82 (0.76–0.90)	0.80 (0.70–0.87)	0.20
Nontechnical resuscitation team performance			
Included survey respondents (*n*)	447	142	
TEAM scale composite score (median, IQR)	3.55 (3.00–3.82)	3.18 (2.57–3.64)	0.024
TEAM scale global rating (median, IQR)	8 (7–9)	8 (6–8)	0.029

ACLS = advanced cardiovascular life support, IQR = interquartile range, TEAM scale = Team Emergency Assessment Measure scale.
[a]*p* values calculated using the Datta-Satten rank-sum test to account for clustering.

with concrete resuscitation quality metrics. These data suggest self-efficacy should have a limited role for evaluation of resuscitation training programs and for initial certification and monitoring of individual resuscitation team members' competence. The practical impact of self-efficacy's association with nontechnical team performance requires further study.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website (http://journals.lww.com/ccejournal).

Supported by grants from the Intermountain Research and Medical Foundation and the National Institute of General Medical Sciences (K23GM129661 and R35GM151147) to Dr. Peltan and from the National Heart, Lung, and Blood Institute (T35HL007744) to Dr. Hooper. These funding sources had no role in study design; collection, analysis, or interpretation of data; writing of the report, or the decision to submit the article for publication.

Dr. Peltan reports grant funding unrelated to the present study from the National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), and Janssen and payments to his institution from Regeneron. Dr. Brown reports grant funding unrelated to the present study from the NIH, Department of Defense, CDC, and Janssen and serving as chairperson for a Data and Safety Monitoring Board for Hamilton Ventilators. . The remaining authors have disclosed that they do not have any potential conflict of interest.

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