Clinical question.

"For healthcare professionals (P), do simulation based learning methodologies (I), when compared to traditional (lectures) training (C), improve the acquisition of content knowledge, technical skills, and behavioral skills required for effective and safe resuscitation (O)"

Is this question addressing an intervention/therapy, prognosis or diagnosis? Intervention

State if this is a proposed new topic or revision of existing worksheet: New topic

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No

Search strategy (including electronic databases searched).

PubMed: “Simulation” “teamwork” or “communication” or “retention” or “performance”) or (“training” or “education”); related articles linked to specific relevant references identified by initial search
“Resuscitation” (MeSH) and simulat* 899; 13 selected for further review
“Resuscitation” (MeSH) and “Patient Care Team” (MeSH) 847, none unique
“Simulation” and “neonatal resuscitation” (text words) 20 refs, 2 unique ref identified
Advanced Cardiac Life Support and simulation 29 refs, 3 unique

Web of Science: “Simulat*” AND “Resuscitation” AND “Medicine” 63 articles; 8 selected for further review
AHA EndNote Master library 3 additional references identified
Cochrane Database for Systematic Reviews, Central Register of Controlled Trials, CINAHL, using simulation as initial term
Review of references from key articles 2 additional articles for review

Initial search 1/10/2009; most recent update 10/10/2009

State inclusion and exclusion criteria

Inclusion criteria: All studies of effect of simulation on acquisition of any information or skills related to successful performance of resuscitation; any subjects including adults, children, infants, and mannequins; any level of provider also included studies of simulation of critical/emergency care in related areas (eg, trauma management)

Exclusion criteria: Simulation of individual skills or scenarios not directly related to resuscitation, e.g. intravenous line placement, laparoscopy; review articles; studies of simulation that did not compare to other educational methods.

Number of articles/sources meeting criteria for further review: 24
# Summary of evidence

## Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Good</th>
<th>Donoghue E2</th>
<th>Nadel E2, 3</th>
<th>Wayne 2008 E1</th>
<th>Cooke E4</th>
<th>Steadman E2</th>
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<tbody>
<tr>
<td>Fair</td>
<td>Owen E2</td>
<td>Kory E2</td>
<td>Barsuk E2</td>
<td>Wayne 2006 E2</td>
<td>Gettman E2</td>
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<td>Schmid 1999 E3</td>
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<td>Wayne 2005 E2</td>
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<td>Poor</td>
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<td>Gilfoyle E3, 4</td>
<td>Smith E1</td>
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### Level of evidence

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Other endpoint  
Italics = Animal studies  
E1 = Clinical performance  
E2 = Performance in simulation  
E3 = Knowledge assessment  
E4 = Self-assessment

## Evidence Neutral to Clinical Question

<table>
<thead>
<tr>
<th>Good</th>
<th>Cherry E2</th>
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<tr>
<td>Fair</td>
<td>Curran E2, 3, 4</td>
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<td>Shapiro E1</td>
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<td>Campbell E2</td>
<td>Hoadley E3</td>
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<td>Nunnink E3, 4</td>
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## Evidence Opposing Clinical Question

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<td>Fair</td>
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<td>Poor</td>
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REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

More than half of the studies reviewed found that simulation-based training improved performance in healthcare providers. However, only two of the studies were true randomized, controlled trials. One of the supporting RCTs (Knudson 2008, 255, LOE 1) as well as an additional study with historic controls (Wayne 2008, 56, LOE 3) found that previous simulation based training improved performance in the clinical arena. In contrast, 4 RCTS, including one that used a clinical endpoint (Shapiro 2004 417, LOE 1) found no difference in performance between the study group exposed to simulation and the group(s) trained using other methods. Most of the studies suffered from relatively small numbers of participants and fairly high drop-out rates. Most studies reported that participants’ perception of the simulation training was that it was beneficial and preferable to standard methods, but these reports were not quantified or scored in any systematic way. Because of the differences among the training methods used, the populations studied, and the endpoints evaluated, it is difficult to draw strong conclusions from the available literature. Most likely some aspects of performance during resuscitation, including teamwork and communication behaviors, improve more after “practice” that includes simulations than pure cognitive skills such as remembering specific drug doses, etc. However, additional large, well-designed RCTS are needed to demonstrate that this is the case.

Citation List


LOE 3, E2, Fair; Supporting. Evaluated only basic airway management using score sheet.


LOE 1, E2, Neutral, Fair. Pediatric residents (n=15 total) randomized to standard mannequin or SimBaby for NRP Megacode performance. Behavior minimally better in SimBaby group, but no difference in performance on written test or intubation of mannequin between the 2 groups.


LOE 1, E3, Poor, Neutral. Technically an RCT but less than half of “invited” subjects were randomized. Knowledge evaluated only with multiple-choice test.


LOE 1, E2, Good, Neutral. No difference in performance on structured clinical exam; subjects preferred using the simulator to traditional teaching.


LOE 4, E4, Good, Supporting. Evaluated resident confidence via written test pre- and post- simulation-based training.


LOE 1, E2,3,4, Good, Neutral. No difference in knowledge or skills retention at 8 months in group with simulator“booster” at 4 months compared to training video “booster”.

LOE 1, E2, Good, Supporting. Pediatric residents from 3 tertiary children’s hospitals (n=51) randomized to basic mannequin or high-fidelity simulator during a PALS course that included mock codes. Excellent study design; standardized scoring criteria. Performance on standardized mock code compared; greater improvement in performance post-course vs pre-course in high-fidelity group.


LOE 5, E2, Fair, Supporting. Evaluated laparoscopy performance after teamwork training based on pre- and post-test scores; not strictly simulation.


LOE 3, E3&4, Poor, Supporting. Leadership skills improved after training; control group not well-described.


LOE 3, E3, Fair, Neutral. Compared low fidelity (i.e, standard mannequin) vs high fidelity simulation; no significant difference in cognitive or behavioral scores between groups.


LOE 1, E1, Good, Supporting. Well-designed RCT; simulation training improved clinical performance in trauma codes.


LOE 2, E2, Fair, Supporting. Not randomized; group assignments based on historical training. Evaluated airway management skills as demonstrated in simulated clinical scenario.


LOE 2, E2&3, Good, Supporting. Residents assigned to standard training with or without mock resuscitation exercises at intervals. Mock codes associated with better performance and increased confidence.


LOE 5, E3&4, Fair, Neutral. Pre and post-training multiple choice tests of knowledge and confidence. No significant difference after simulation training.


LOE 1, E2, Fair, Supporting. General medicine trainees randomized to one of 3 educational methods: computer-based teaching, computer plus basic mannequin, or computer plus mannequin and high-fidelity simulator. All groups (n=20 in each) had same teaching time; confidence questionnaire and performance on standard scenarios compared. High-fidelity group did better than other 2 on 2 of 3 scenarios.


LOE 1, E2, Fair, Supporting. Residents who used a simulator program with feedback performed better on hands-on simulation than traditional group.

LOE 1, E2, Fair., Supporting. Residents and attending physicians who prepared for ACLS mock codes with computer simulation program performed better than those who used textbooks to prepare.


LOE 1, E1, Good, Neutral. Emergency room staff (MDs, nurses, technicians) randomized to 8 hr in simulator or 8 hr as team in ER. No difference in team behavior during ER shifts after training.


LOE 4, E1, Poor, Supporting. Case report of providers who just completed simulation using knowledge in clinical situation.


LOE 5, E2, Good, Supporting. Medical students (n=31); randomized crossover design comparing problem-based instruction and simulation-based instruction to learn management of dyspnea and abdominal pain. Assessment was performance in dyspnea scenario; simulation group had better performance; individual incremental improvement also better in simulation group.


LOE 4, E4, Poor, Neutral. Residents’ self-evaluation of confidence correlated with number of mock codes.


LOE 3, E2, Fair, Supporting. “Wait-list” controls; use of simulator increased skills to a degree comparable to clinical experience.


LOE 3, E1, Good, Supports. Not randomized; simulator-trained residents performed better in clinical setting in adherence to AHA guidelines for ACLS.


Supports; LOE 4; Fair; E2. Performance of ACLS skills by internal medicine residents followed for 14 months after ACLS course and subsequent sessions with simulator; evaluated using ACLS scenarios and simulator; skills improved significantly with no decline over study period.