The introduction of simulation-based training in the internal medicine residency program: An assessment of residents’ efficacy and performance

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1. Research questions
2. Methods
3. Results
4. Strengths and limitations
5. Future directions
6. Summary
Research Questions

1. Does participation by internal medicine residents in high-fidelity simulations of emergency scenarios lead to an improved sense of crisis resource management (CRM) self- and collective efficacy?

2. Is perceived CRM self-efficacy correlated with collective efficacy?
3. Is perceived CRM efficacy maintained over time after participation in high fidelity simulations of emergency scenarios?

4. Are perceptions of CRM self- and collective efficacy correlated with the appropriate performance of CRM principles in a simulated context?
Methods

- SE and CE questionnaire
  Summer 2010

- 1st simulation session
  Pre/post Q
  November 2010

- 2nd simulation session
  Pre/post Q
  January 2011

- 3rd simulation session
  Pre/post Q
  March 2011

- 4th simulation session
  Pre/post Q
  May 2011
Simulation session
# Results 1:
Self- and collective efficacy before and after simulation training

<table>
<thead>
<tr>
<th>CRM Questionnaire</th>
<th>Before session (mean of total scores)</th>
<th>After session (mean of total scores)</th>
<th>Two-tailed t-test (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>35.85</td>
<td>39.04</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Collective efficacy</td>
<td>37.23</td>
<td>38.94</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Results 2:
Correlation between CRM self- and collective efficacy

- Spearman correlation coefficient: 0.38
Results 3:
Self-efficacy as a function of time
Results 4:
Correlations between self- or collective efficacy and performance

- **Self-Efficacy and CRM performance**

  Spearman correlation coefficient = 0.011
Results 4:
Correlations between self- or collective efficacy and performance

- Collective efficacy and CRM performance
  - Spearman correlation coefficient = -0.031
Strengths and limitations of study

- Robust self- and collective efficacy questionnaires based on validated New General Self-Efficacy questionnaire
- Validated Ottawa CRM Global Rating Scale
- Small sample sizes
- Missing data points at the beginning of the academic year
- Many different evaluators with varying levels of experience (despite training)
- Different levels of experience between resident groups
Future directions

- Compare CRM self-efficacy scores with CRM performance in actual in-hospital codes

- Crisis Resource Management simulation-based training in McGill Internal Medicine curriculum
CRM simulation-based training has a valuable place in residency education but its impact on performance has yet to be shown.
The introduction of simulation-based training in the internal medicine residency program: An assessment of residents’ efficacy and performance
Crisis Resource Management Principles

- leadership skills
- communication
- resource utilization
- situational awareness
- problem-solving skills
# Self-efficacy questionnaire

Consider the following statements and please respond using the following scale:

1. Strongly disagree  
2. Disagree  
3. Somewhat disagree  
4. Undecided  
5. Somewhat agree  
6. Agree  
7. Strongly agree

Questions 1 to 7 refer to your **individual abilities** in a hospital code blue situation.

<table>
<thead>
<tr>
<th>Question</th>
<th>RESPONSE (1-7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am confident that I can effectively lead a multi-disciplinary team in a code blue situation.</td>
<td></td>
</tr>
<tr>
<td>2. I am confident that I can deal with life threatening problems while concurrently seeking to obtain a diagnosis in a code blue situation.</td>
<td></td>
</tr>
<tr>
<td>3. During a code blue situation, I believe that I can consistently re-assess and re-evaluate the situation.</td>
<td></td>
</tr>
<tr>
<td>4. During a code blue situation, I can anticipate likely events.</td>
<td></td>
</tr>
<tr>
<td>5. When I am participating in a code blue situation, I can call for help appropriately.</td>
<td></td>
</tr>
<tr>
<td>6. During a code blue situation, I can use resources appropriately (e.g. hospital staff and medical equipment).</td>
<td></td>
</tr>
<tr>
<td>7. I believe that I can communicate effectively when I participate in a code blue situation.</td>
<td></td>
</tr>
</tbody>
</table>
Consider the following statements and please respond using the following scale:
(1) Strongly disagree (2) Disagree (3) Somewhat disagree (4) Undecided (5) Somewhat agree (6) Agree (7) Strongly agree

Questions 8 to 14 refer to the abilities of your team in a hospital code blue situation.  

8. My hospital’s code blue teams are led effectively.  

8. ________

9. My hospital’s code blue teams can deal with life threatening problems while concurrently seeking to obtain a diagnosis.  

9. ________

10. My hospital’s code blue teams can consistently re-assess and re-evaluate the situation.  

10. ________

11. My hospital’s code blue teams can anticipate likely events.  

11. ________

12. My hospital’s code blue teams can call for help appropriately.  

12. ________

13. My hospital’s code blue teams can use medical equipment and manage hospital staff appropriately.  

13. ________

14. My hospital’s code blue teams can communicate effectively.  

14. ________
APPENDIX A – OTTAWA CRISIS RESOURCE MANAGEMENT (CRM) GLOBAL RATING SCALE (“Ottawa GRS”)

EVALUATION CRITERIA:
This evaluation scale is directed towards assessing competence in crisis management (CM) skills and care of critically ill patients. The standard of competence has been set at the senior resident level, i.e. the third-year resident who has had prior ICU experience, and through experience as a senior housestaff physician, has previous experience in managing crises. As there exists a general base of medical knowledge required to effectively manage crises, this will also be evaluated. However, the focus will be on evaluating the CRM skills. The skills listed below comprise essential aspects of crisis management. In the simulation case scenario sessions, performance in each of these areas will be assessed, in addition to the amount of promoting or guidance required during the case scenario sessions.

The following criteria will be evaluated:

LEADERSHIP SKILLS
Stays calm and in control during crisis
Prompt and firm decision making
Maintains global perspective (“big picture”)

PROBLEM SOLVING
Organized and efficient problem solving approach (ABC’s)
Quick in implementation (Concurrent management)
Considers alternatives during crisis

SITUATIONAL AWARENESS
Avoids fixation on error
Resources and re-evaluation situation constantly
Anticipates likely events

RESOURCE UTILIZATION
Calls for help appropriately
Utilizes resources at hand appropriately
Prioritizes tasks appropriately

COMMUNICATION SKILLS
Communicates clearly and actively
Uses directed verbal/non-verbal communication
Listens to team input

OVERALL

Resident #: ____________________________

Staff: ____________________________

Date: ____________________________

Time: ____________________________

OVERALL PERFORMANCE

1 2 3 4

Novice: all CM skills require significant improvement
Advanced novice: many CM skills require moderate improvement
Competent: most CM skills require minor improvement
Clearly superior: few, if any CM skills that only require minor improvement

I. LEADERSHIP SKILLS

1 2 3 4

Leader calm and in control for most of crisis; able to make firm decisions; maintains global perspective
Leader calm and in control for most of crisis; able to make firm decisions; maintains global perspective
Leader calm in control for most of crisis; makes firm decisions with little delay; usually maintains global perspective
Leader calm and in control for entire crisis; makes prompt and firm decisions with little delay, usually maintains global perspective

II. PROBLEM SOLVING SKILLS

1 2 3 4

Cannot implement ABC’s assessment without direct cues; sequential assessment approach until new; gives little consideration to alternatives
Incomplete or slow ABC’s assessment; rarely uses sequential assessment approach unless cued; gives little consideration to alternatives
Satisfactory ABC’s assessment; without cues; rarely uses concurrent management approach with only minimal caution; considers some alternatives in crisis
Thorough yet quick ABC’s assessment; without cues; always uses concurrent management approach; considers most likely alternatives in crisis

III. SITUATIONAL AWARENESS SKILLS

1 2 3 4

Cannot manage stress during crisis; unable to re-evaluate situation despite repeated cues; fails to anticipate likely events
Avoids fixation error; only with coaching; rarely re-evaluates situation without cues; rarely anticipates likely events
Normally avoids fixation error; with minimal coaching; resourcefully re-evaluates situation frequently; frequently anticipates likely events
Avoids fixation error; normally resists; resourcefully re-evaluates situation without cues; constantly anticipates likely events

IV. RESOURCE UTILIZATION SKILLS

1 2 3 4

Unable to use resources and staff effectively; does not prioritize tasks or ask for help when required
Unable to use resources with minimal effectiveness; only prioritizes tasks or asks for help when required
Can use resources with moderate effectiveness; able to prioritize tasks and ask for help with minimal cues
Can use resources with maximal effectiveness; sets clear task priority and asks for help early with no cues

V. COMMUNICATION SKILLS

1 2 3 4

Does not communicate with staff; does not acknowledge staff contributions; only uses directed verbal communication
Communicates occasionally with staff, but unclear and vague; occasionally listens to staff feedback
Communicates with staff clearly and consistently at all times, encourages input and listens to staff feedback
Communicates clearly and consistently at all times, encourages input and listens to staff feedback


Histograms: SE before and after

Histogram Total Self-Efficacy scores before intervention

Histogram of Self-Efficacy Scores after intervention
Histograms: CE before and after

Histogram of Total Group Efficacy Scores before intervention

Histogram of Total Group Efficacy Scores after intervention
Histograms: SE and performance

Histogram Total Self-Efficacy scores before intervention

Histogram of Total Ottawa CRM GRS Scores
Distribution of resident level by simulation training session

Simulation training session by month
### Efficacy questionnaire

<table>
<thead>
<tr>
<th></th>
<th>NGSE</th>
<th>Our NGSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total score</td>
<td>31.25 out of 40 (Likert 5-point scale)</td>
<td>45.83 out of 56 (Likert 7-point scale)</td>
</tr>
<tr>
<td>Percentage</td>
<td>78.2%</td>
<td>81.8%</td>
</tr>
</tbody>
</table>

Spearman correlation coefficient
NGSE and Self-efficacy scores – 0.4

Histograms: SE and NGSE

Histogram Total Self-Efficacy scores before intervention

Histogram of New General Self-Efficacy Scores