Design, Realization, and Initial Evaluation of a Software-Based Virtual Patient Simulator for Prehospital Care Training of Stroke and Myocardial Infarction

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1 BACKGROUND AND OBJECTIVE
2 METHODS
3 RESULTS
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BACKGROUND AND OBJECTIVE
BACKGROUND

The morbidity and mortality

- The number of people diagnosed with stroke and myocardial infarction is increasing as well as the mortality.
The variation tendency of cerebrovascular mortality among Chinese residents from 2003 to 2013
The variation tendency of AMI mortality among Chinese residents from 2002 to 2013.
Effective prehospital emergency care

• Shorten the prehospital delays and the time to be seen for initial evaluation by an emergency physician

• Increase the use of the intravenous recombinant tissue-type plasminogen activator (rtPA) or percutaneous coronary intervention (PCI).
Providing emergency staff with prehospital care training in stroke and myocardial infarction is extremely essential.

There is recognition that Chinese emergency staff lack training opportunities in a number of areas.
Software-based virtual patient simulator

- To develop a software-based virtual patient simulator for training the care for stroke and myocardial infarction and enhancing prehospital clinical performance of emergency staff.

- The initial evaluation of the prototype has been conducted.
METHODS
1. Cases Design
2. Simulator Realization
3. Initial Evaluation
Cases Design

1. International guidelines
2. Domestic guidelines
3. Prehospital medical condition in China

- Determine the content of pre-hospital care of stroke and myocardial infarction

literature study
Cases Design

1. Brainstorming (Assessment/diagnosis/Intervention/transport)
2. linear string and branching
3. Decision about media (texts and pictures)

- Choose a design model
- Build the case development framework
Cases Design

Develop virtual patient cases

The content of cases + Case development framework

Two cases ( initial ) + focus group interview

Two cases ( final edition )
Cases Design

Include assessment

- Formative assessment
- Summative assessment

- Operation evaluation sheet
  (crucial/helpful/useless/harmful)
Include assessment

- Formative assessment
- Summative assessment

- The number of concrete steps (crucial/helpful/useless/harmful)
The software-based virtual patient simulator was developed by using Adobe Flash Builder 4.7.
Initial Evaluation

- A self-designed questionnaire about their evaluation on the training effects and using complexity
- Nineteen paramedics (convenience sampling)
RESULTS
1. Cases and Software Platform Development
2. Initial Evaluation
The software platform has been developed and contained two virtual patients who suffer from stroke and myocardial infarction respectively.
Mr. Zhang, a 70-year-old yellow male, described substernal chest pain with radiation to his left arm at 12 o’clock. He was sweating and frightened. The pain is not relieved by rest. His family called “120” and 15 minutes later, the emergency workers get to patient’s home.

If you are the worker to help the patient, what will you do before reaching the hospital?
• **ABCD:** normal

• **Monitor:** Blood pressure, 140/95mmHg; heart rate, 95 beats/mins; respiratory rate, 22 breaths/min; oxygen saturations, 93%

• **History:** elevated cholesterol levels, hypertension, smoking. He has no known drug allergies and no gastrointestinal bleeding.

• **Physical examination:** cardiac examination revealed weaken S1 and normal S2.
Critical Intervention

- IV/O₂/monitor
- 12-lead ECG that showed 3~10mm ST-segment elevation in leads V1 through V6, I and aVL.
- Aspirin/Nitroglycerin/Morphine
- Contacting the nearest hospital having cardiovascular reperfusion qualification
Initial Evaluation

- The simulator was evaluated with 19 paramedics from a primary hospital in China. Among them, 13 were female and 6 were male. Mean age of the students was 29 (25-36 years).

- Students’ opinion about experience, effectivity, and applicability was determined by using a 5-point Likert scale.
### Initial Evaluation

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having enough time to exercise</td>
<td>3.94</td>
<td>Good</td>
</tr>
<tr>
<td>No need for more help</td>
<td>3.33</td>
<td>Neutral</td>
</tr>
<tr>
<td>Easy to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willing to use new knowledge while working</td>
<td>4.33</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Improving clinical reasoning skill</td>
<td>4.33</td>
<td>Strongly agree</td>
</tr>
<tr>
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<td>4.33</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Improving clinical reasoning skill</td>
<td>4.39</td>
<td>Agree</td>
</tr>
<tr>
<td>Emphasizing the importance of the rescue</td>
<td>3</td>
<td>Neutral</td>
</tr>
<tr>
<td>Increasing self-confidence</td>
<td>4.33</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Getting related knowledge</td>
<td>4.33</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Good tool for self-assessment</td>
<td>4.33</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Easy to learn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good learning experience</td>
<td></td>
<td></td>
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</tbody>
</table>

The self-designed questionnaire:

- 5—Strongly agree;
- 4—Agree;
- 3—Neutral;
- 2—Disagree;
- 1—Strongly disagree
<table>
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</table>
Discussion

• A useful training tool
  • The software-based virtual patient simulator revealed a positive effect on knowledge gain and showed a high rate of student acceptance.
• Need more help for operating
  • The software was easy to use in the technology level, but students lack knowledge about the role of every module. The help text is not enough.
  • To develop an easier case and recording the case operating method using as the help text.
The qualitative comments on strong and weak aspects of the simulator

**Strong aspects** were identified as convenience, ease of use, without the restriction of time and space, effect on practice:

“It is easy to use and learn. It can inspire our learning interest and improve the knowledge.”

“Much more fun than using traditional learning methods. The simulator offers me the chance to thinking actively.”
**Weak aspects** included interface appearance, the feeling of first aid, learning issues and condition changes.

“Adding explanation about the critical intervention in the end. And then students will understand that why the specific step is critical or not.”
Discussion

- Adding background music and operation sound to create the emergency atmosphere and adding explanation of crucial measures into the summative assessment.
CONCLUSIONS
CONCLUSIONS

Improvement of the virtual patient simulator will be based on the feedback of the paramedics in this study.
The software-based virtual patient simulator can offer good learning experience and provide an opportunity to increase knowledge and self-confidence in pre-hospital care for stroke and myocardial infarction. However, self-assessment forms are not a sufficient instrument for validation.
The training effects will be validated by randomized controlled trial (face-to-face simulating VS simulator) in the further study.
Thank you very much!