Comparing learning outcomes for medium and high fidelity human patient simulation manikins in nursing education

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The journey begins ...

- 2 Laerdal SimMan 3G manikins (in a box)
- No simulation unit (but 10 clinical skills centres)
- Identified problems with clinical reasoning skills in final semester students
- $220,000 project grant
Project Aims ...

- **Quasi-experimental study**: To identify the conditions under which simulation (high and medium fidelity) impacts nursing students’ clinical reasoning, satisfaction and knowledge acquisition.

- **Systematic review**: To appraise the evidence related to the capacity of high fidelity manikins to improve students’ clinical reasoning skills.

- **Cross-sectional survey**: To explore the range and types of simulation used in Australian nursing programs and the pedagogical principles that underpin their use.

- **Delphi study**: To develop quality indicators for the use of simulation.

- To develop a range of teaching and learning resources to support nursing students and educators in the use of simulation.

Statistically significant differences were not apparent between 2\textsuperscript{nd} (n = 268) or 3\textsuperscript{rd} year (n = 76) students exposed to medium or high fidelity manikins during a quasi-experimental study:

Experimental group (HF): mean 4.472/5
Control group (MF): mean 4.415/5

2\textsuperscript{nd} year students - t (208) = -1.586, p > 0.05
3\textsuperscript{rd} year students - t (74) = -0.586, p > 0.05

*Measured using the *Satisfaction with Simulation Experience Scale (SSES)*
Student satisfaction

- **Need for more simulation experiences** - *We should have simulations much more often – at least once per week.*

- **Simulation should complement but not replace clinical placements** - *It should not replace the valuable clinical placement hours but should definitely be incorporated throughout the program in every clinical course.*

- **Application of knowledge and skills to the simulation** - *The simulation helped to bring everything together - knowledge, skills and clinical reasoning*

- **Clinical reasoning** - *The simulation helped me to think like a nurse*

- **Safe environment to learn** - *The simulation mirrored a ‘real-life’ situation where you knew your mistakes were learning opportunities that could not affect a real patient.*

- **Value of learning experience** - *I learnt more in the simulation than in hours of lectures.*
n = 76 (third year students)

No statistically significant differences in mean scores were found between the control (medium fidelity) and experimental (high fidelity) groups at either point in time (before simulation, following simulation, or 2 weeks later)

- Control group: 11.8 (Test 1) – 12.8 (Test 3)
- Experimental group: 12.5 (Test 1) – 13.2 (Test 3)

The improvement was not statistically significant, $F (2, 66) = 3.29, p > 0.05$

*Measured using a 21 item multiple choice test from TestGen® a validated item bank*
Describe or list facts, context, objects or people.

Review current information (e.g. handover reports, patient history, patient charts, results of investigations and nursing/medical assessments previously undertaken).
Gather new information (e.g. undertake patient assessment)
Recall knowledge (e.g. physiology, pathophysiology, pharmacology, epidemiology, therapeutics, context of care, ethics, law etc)

Interpret: analyse data to come to an understanding of signs or symptoms. Compare normal Vs abnormal.
Discriminate: distinguish relevant from irrelevant information; recognise inconsistencies, narrow down the information to what is most important and recognise gaps in cues collected.
Relate: discover new relationships or patterns; cluster cues together to identify relationships between them.
Infer: make deductions or form opinions that follow logically by interpreting subjective and objective cues; consider alternatives and consequences.
Match current situation to past situations or current patient to past patients (usually an expert thought process).
Predict an outcome (usually an expert thought process).

Synthesise facts and inferences to make a definitive diagnosis of the patient’s problem.

Describe what you want to happen, a desired outcome, a time frame.

Establish goal/s

Identify problems/issues

Collect cues/information

Gather new information (e.g. undertake patient assessment)

Recall knowledge (e.g. physiology, pathophysiology, pharmacology, epidemiology, therapeutics, context of care, ethics, law etc)

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Match current situation to past situations or current patient to past patients (usually an expert thought process).
Predict an outcome (usually an expert thought process).

Evaluate the effectiveness of actions and outcomes. Ask: “has the situation improved now?”

Evaluate outcomes

Take action

Select a course of action between different alternatives available.

Contemplate what you have learnt from this process and what you would do differently next time.

Reflect on process and new learning

Consider the patient situation
n = 38 (second year students)

Clinical reasoning scores ranged from 10 to 74

Control group (MF): mean 19.222 ($SD = 11.090$)

Experimental group (HF): mean 42.900 ($SD = 15.784$)

Statistically significant difference: $t (36) = -5.293$, $p < 0.05$.

*Measured via observation of simulation experience and using a validated clinical reasoning checklist (next page)*
CLINICAL REASONING CHECKLIST - HYPERVOLAEMIA

Students receive one point for every item on the checklist performed correctly and in the proper sequence. They receive a score of zero for any item not performed, performed out of sequence or performed incorrectly.

**Scenario:** An 76 year old man, day 2 post-op following a bowel resection, with hypervolaemia and early stage pulmonary oedema

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
<th>Behaviour</th>
<th>✓</th>
<th>Comments</th>
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</table>
| **Considers the patient situation** | **Observes** context and patient situation | **Verbalises key observations from handover and initial view of patient:**  
1. Patient’s age  
2. Recent surgery  
3. Previous fluid challenges  
4. IV 125 mL/hr  
5. PCA  
6. Patient’s restlessness  
7. Patient’s distress/confusion  
8. Other relevant observation/s | | |
| **Collect cues/information**   | **Reviews** current information (e.g. handover reports, patient history, patient charts, results of investigations and nursing/medical assessments previously undertaken) | **Reviews:**  
1. Temp  
2. HR  
3. RR  
4. BP  
5. O₂ sats  
6. Urine output | | |
<table>
<thead>
<tr>
<th>Gathered new information (e.g. undertake patient assessment)</th>
<th>Assesses:</th>
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</thead>
<tbody>
<tr>
<td>1. IV rate</td>
<td>1. Asks patient how they are feeling</td>
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<tr>
<td>2. FBC – cumulative balance</td>
<td>2. HR</td>
</tr>
<tr>
<td>3. Medical notes</td>
<td>3. BP</td>
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<tr>
<td>4. Nursing notes</td>
<td>4. RR</td>
</tr>
<tr>
<td>5. Temp</td>
<td>5. Temp</td>
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<tr>
<td>6. O₂ saturation</td>
<td>6. O₂ saturation</td>
</tr>
<tr>
<td>7. PCA</td>
<td>7. PCA</td>
</tr>
<tr>
<td>11. O₂ flow rate</td>
<td>11. O₂ flow rate</td>
</tr>
<tr>
<td>13. BGL</td>
<td>13. BGL</td>
</tr>
<tr>
<td>15. Peripheral oedema</td>
<td>15. Peripheral oedema</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Recalled knowledge (e.g. physiology, pathophysiology, pharmacology, epidemiology, therapeutics, culture, context of care, ethics, law etc)</th>
<th>Verbalises:</th>
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</thead>
<tbody>
<tr>
<td>1. BP is related to fluid status</td>
<td>1. BP is related to fluid status</td>
</tr>
<tr>
<td>2. Resolution of third space fluid shift can result in increased intravascular volume</td>
<td>2. Resolution of third space fluid shift can result in increased intravascular volume</td>
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<tr>
<td>3. Post-operatively confusion in older patients can result from ...</td>
<td>3. Post-operatively confusion in older patients can result from ...</td>
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<tr>
<td>4. Older patients can have renal insufficiency The</td>
<td>4. Older patients can have renal insufficiency The</td>
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<tr>
<td>5. Normal electrolyte levels are ...</td>
<td>5. Normal electrolyte levels are ...</td>
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<tr>
<td>6. Morphine can cause vasodilation and reduce urine output</td>
<td>6. Morphine can cause vasodilation and reduce urine output</td>
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<td>---------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Relates: discover new relationships or patterns; cluster cues together to identify relationships between them.</td>
<td>Verbalises: 1. Hypertension and tachycardia can result from increased intravascular volume 2. Increased intravascular volume can result in hypoxia, tachypnoea and wheeze 3. A decreased urine output can exacerbate fluid volume excess 4. Other relevant clinical pattern/s 5. Increased intravascular volume can cause confusion</td>
</tr>
<tr>
<td>Infers: make deductions or form opinions that follow logically by interpreting subjective and objective</td>
<td>Verbalises: 1. The patient’s cognitive changes may be the result of hypervolaemia and hypoxia</td>
</tr>
</tbody>
</table>
| Identify problem / issue | Synthesises facts and inferences to make a definitive diagnosis of the patient’s problem. | Verbalises:  
1. The patient is hypervolaemic  
2. The patient has pulmonary oedema |
|--------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Establish goals          | Describes what you want to happen, a desired outcome, a time frame. | Verbalises:  
1. Improved oxygenation levels within 20-30mins  
2. Improved vital signs within 60 mins  
3. Increased urine output within 15 mins  
4. Decreased confusion with 120 mins  
5. Improved RR, BP, HR within 60 mins |
| Take action              | Selects a course of action between different alternatives available | Initiates:  
1. Increase oxygen flow rate to 10 L via Hudson mask  
2. Sit patient in high Fowler’s position  
3. Monitor O₂ sats  
4. Reduce IV rate  
5. Phone MO using ISBAR  
6. Obtain order for diuretic  
7. Administer diuretic  
8. Monitor vital signs  
9. Monitor urine output |

Matches current situation to past situations or current patient to past patients (usually an expert thought process)  

Verbalises:  
1. I have seen this before when ...  
2. The patient could have a respiratory arrest

2. The patient’s wheeze may be from pulmonary oedema  
3. The patient confusion may be because of hypoxia or cerebral oedema

Cues; consider alternatives and consequences.
| Evaluate | Reviews:  
|----------------|
| 1. O₂ sats  
| 2. RR  
| 3. Urine output  
| 4. BP  
| 5. HR  
| 6. Lung sounds  
| 7. Cognitive status |

| Reflect on process and new learning | Contemplates what you have learnt from this process and what you could have done differently.  
|----------------|
| For debriefing:  
| Next time I would ...  
| I should have ...  
| If I had ...  
| I now understand ... |
A systematic review of the effectiveness of using human patient simulation manikins in the teaching of clinical reasoning skills to undergraduate nursing students:

The review included 8 studies conducted between 1999 to 2009 that met inclusion criteria.

- There is some evidence to indicate the use of HPSMs may improve learning outcomes fundamental to clinical reasoning (i.e. knowledge acquisition and critical thinking)

- However, there is a lack of unequivocal evidence of the effectiveness of using high-fidelity HPSMs in the teaching of clinical reasoning skills to undergraduate nursing students.

- There were significant methodological limitations in the papers reviewed.
Debriefing

A systematic review of the effectiveness of debriefing in simulation-based learning:

Systematic review: 13 RCTs involving HF simulations (range of health professionals).

- Performance in technical and nontechnical skills such as: vital signs assessment; psychomotor skills; cardiopulmonary resuscitation; task management; team working; and situation awareness significantly improved pre-test to post-test regardless of the type of debriefing conducted.

- No statistically significant differences in any outcomes between participants exposed to the different debriefing types.
Assumptions ...

Simulation = manikins

High fidelity = highly technical
Simulation: possibilities for teaching & learning

Cyril Smith

Video
http://www.youtube.com/watch?v=kDgsTjEAdf0

http://www.youtube.com/watch?v=G-YMIbF3_1c&feature=related
Clinical Reasoning Scenario:

Communication, clinical reasoning and patient outcomes ...
n = 39 pairs of students
A significant correlation between clinical reasoning and communication scores was obtained, Pearson Chi Square = 3.967, df =1, P<0.05.

NOTECH table (next slide)

19 simulation MF - Video

2 simulation MF - Video

### Teamwork and communication skills

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<tr>
<th>Domains</th>
<th>Elements</th>
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| Person-centred care           | Including patient/family in discussion  
Seeking and considering patient’s social and medical history  
Equipping patients with the skills to identify problems and to play an active role in their medication management |
| Teamwork and cooperation      | Awareness of and respecting the roles of team members  
Supporting others  
Understanding needs of the team  
Managing conflict  
Asking for help  
Valuing others’ contribution  
Sharing accountability and responsibility |
| Communication and interaction | Maintaining eye contact  
Demonstrating open body language  
Being polite and friendly  
Active listening  
Discussing together  
Asking questions  
Coordinating actions  
Expressing concerns freely  
Speaking up when unsure  
Communicating openly – including handover (ISBAR) |
| Leadership and management     | Taking the initiative  
Maintaining clinical standards  
Delegating  
Demonstrating gradated assertiveness  
Creating a “no-blame” culture |
| Problem solving and decision making | Collaborative problem solving  
Shared option generation  
Shared risk assessment  
Shared decision making  
Reviewing outcomes |
| Situational awareness         | Noticing  
Anticipating – identifying future problems and discussing contingencies  
Recognising the capabilities of others, cross-checking, and contacting outside sources when necessary |
| Adherence to guidelines       | Being familiar and adhering to relevant guidelines, policies and evidence-based resources |
| Documentation                 | Documenting clearly, accurately, contemporaneously and concisely  
Accessing and clarifying medical records |


References


Hoffman, K., Levett-Jones, T., Dempsey, J., Noble, D. & Kenny, R. (under review). Examining the impact of interpersonal communication and teamwork skills on nursing students' clinical reasoning ability and decision outcomes. *Nurse Education Today.*
