DEVELOPING NURSING STUDENTS’ CLINICAL REASONING SKILLS FOR PATIENT SAFETY: CHALLENGES AND TEACHING STRATEGIES

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QS World University Rankings by subject (2019)
UTS Nursing ranked 1\textsuperscript{st} in Australia and 10\textsuperscript{th} in the world.
OUTLINE OF PRESENTATION

Patient stories → Statistics → Systematic reviews → Implementation of teaching & learning strategies → Rigorous evaluation → Clinical translation
Adverse events in healthcare represent a major source of morbidity and mortality.

In developed countries it is estimated that:

- 10-17% of people are harmed whilst receiving healthcare. [3]
- Over 17 million adverse events occur each year. [4]
- Healthcare errors are the third leading cause of death. [5]
- 50-80% of all adverse events are preventable [1,3].

These statistics fail to depict the distress caused to patients and their families when ‘things go wrong’ in healthcare.
Vanessa Anderson - a healthy 16 year old girl who died as a result of a preventable medication error.
INQUEST FINDING

Vanessa Anderson died from a respiratory arrest due to the depressant effect of opioid medications.

The death of Vanessa Anderson at the very young age of 16 years was a tragic and avoidable death ... the circumstances of Vanessa’s death should constantly remain in the forefront of the minds of all medical practitioners and nursing staff. Vanessa’s case should be used as a precedent to highlight how individual errors of judgment and failure to communicate led to the worst possible outcome for Vanessa and her family.

Magistrate Milovanovich,
NSW Deputy State Coroner.
Decision handed down at Westmead Coroners Court on 24/1/2008.
THE ROLE OF EDUCATORS

- Educators have a distinct and important role to play in improving patient safety as ‘it is in the formative years of undergraduate education that attitudes are forged and skills imparted which shape the quality of engagement with patients for years to come’. [1]

- A competent workforce is a fundamental tenet of patient safety, and ensuring that nursing graduates have the skills and knowledge to transition effectively to their roles as registered nurses is a key priority. [2]
Clinical reasoning errors have been identified as a factor in 57% of adverse clinical events … this includes failure to collect, interpret and act on clinical data’. [1].

Nurses with well developed clinical reasoning skills have a positive impact on patient outcomes.

Conversely, those with poor clinical reasoning skills often fail to detect impending patient deterioration resulting in a ‘failure to rescue’. [6]

Adverse patient outcomes are often attributed to a lack on knowledge or procedural skills, yet these factors are rarely the main cause.
SIMULATION AS A STRATEGY TO TEACH CLINICAL REASONING

- Over the last decade simulation has emerged as a commonly strategy to teach clinical reasoning.
- Internationally, there has been a significant investment in, and rapid uptake of simulation in healthcare education. [7]
- The key driver for simulation is the need to improve the quality and safety of healthcare. [8]
Effectiveness of Patient Simulation Manikins in Teaching Clinical Reasoning Skills to Undergraduate Nursing Students: A Systematic Review

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KEYWORDS  
clinical reasoning; undergraduate nursing students; human patient simulation; manikin; systematic review

Abstract: Human patient simulation manikins (HPSMs) are being used extensively in the education of health professionals, but their effectiveness in the teaching of clinical reasoning skills to undergraduate nursing students is not clear. The aim of this systematic review is to identify the best available evidence for their effectiveness in this regard. The review included all English-language randomized controlled trials from 1999 to 2009 that assessed the effectiveness of high-fidelity HPSMs in educating undergraduate nursing students. The results indicate that the use of HPSMs improves knowledge acquisition and critical thinking and enhances students' satisfaction with the learning. 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. Further research is required to ascertain the effectiveness of the use of HPSMs as an educational strategy to improve the clinical reasoning skills of undergraduate nursing students.
The results indicated that the use of simulation improves critical thinking but there was a lack of unequivocal evidence of the effectiveness of simulation in the teaching of clinical reasoning skills.

Few nursing programs taught or assessed clinical reasoning or clinical decision making as discrete skills, and of those that did, only 25% used a specific model or definition of clinical reasoning.
DEFINING CLINICAL REASONING

‘The process by which nurses (and other clinicians) collect cues, process the information, come to an understanding of a patient problem or situation, plan and implement interventions, evaluate outcomes, and reflect on and learn from the process’ [6].
CLINICAL REASONING CYCLE

1. Consider the patient situation
2. Collecting cues/information
3. Process information
4. Identify problems/issues
5. Establish goal/s
6. Take action
7. Evaluate outcomes
8. Reflect on process and new learning
Clinical Reasoning Cycle

- Reflect on process and new learning
- Collect cues/information
- Process information
- Establish goal(s)
- Synthesize facts and inferences to make a definitive diagnosis of the patient’s problem.
- 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).
- Identify problems/issues
- Evaluate outcomes
- Evaluate the effectiveness of and actions outcomes. Ask: “has the situation improved now?”
- Take action
- Consider the patient situation
- Describe or list facts, context, objects or people.
- Contemplate what you have learnt from this process and what you could have done differently.
- 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, best practice evidence, culture, context of care, ethics,
Describe or list facts, context, objects or people.

Consider the patient situation.

Reflect on process and new learning.

Evaluate
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, best practice evidence, culture, context of care, ethics,
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.
Evaluate the effectiveness of and actions outcomes. Ask: "has the situation improved now?"

Select a course of action between different alternatives available.

Describe what you want to happen, a desired outcome, a time frame.
Evaluate the effectiveness of and actions outcomes. Ask: "has the situation improved now?"
Contemplate what you have learnt from this process and what you could have done differently.
## Clinical Reasoning Errors - Examples

<table>
<thead>
<tr>
<th>Error</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Ascertainment bias</td>
<td>When a nurse’s thinking is shaped by biases, prior assumptions and preconceptions, for example ageism, stigmatism and stereotyping.</td>
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<tr>
<td>Premature closure</td>
<td>The tendency to accept a nursing diagnosis without sufficient evidence and before it has been fully verified.</td>
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<td>Overconfidence bias</td>
<td>A tendency to believe we know more than we do, and act on incomplete information or hunches.</td>
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Aim:
- To evaluate the effect of the level of manikin fidelity on clinical reasoning ability

Design:
- A quasi-experimental design with participants randomly allocated to either a control (medium fidelity manikin) or experimental (high fidelity manikin) group

Level of Fidelity:
- Medium fidelity manikin - Laerdal’s Megacode Kelly with VitalSim capability
- High fidelity manikin - Laerdal’s 3G SimMan™
CLINICAL REASONING STUDY (PART A)

**Intervention:**

- A 20 minute immersive simulation
- The ‘patient’ was an 75 year old man with hypervolaemia and early stage pulmonary oedema.
- Participants (2nd year nursing students) worked in pairs and were instructed to use their clinical reasoning skills to identify and respond to clinical deterioration.
- Participants were asked to ‘think aloud’
Participants received one point for every item on the clinical reasoning checklist performed correctly and in the proper sequence.

**Examples of correct cues:**
- O2 sats, BP, PR, RR, lung sounds, urine output, FB chart, IV rate etc

**Examples of correct nursing actions:**
- Reduce IV rate, sit patient in a high fowler’s position, administer oxygen, recognise hypervolaemia, phone the medical officer using ISBAR, obtain an order for frusemide.
CLINICAL REASONING STUDY (PART A)

Participants:
- 38 pairs of students

Results:
- Participants’ clinical reasoning scores ranged from 10 to 74/94.
- Control group (medium fidelity manikin) - mean of 19.2 (SD = 11.0).
- Experimental group (high fidelity manikin) - mean 42.9 (SD = 15.7).
- An independent t-test indicated a statistically significant difference in clinical reasoning scores between the control and the experimental groups $t (36) = -5.29, p < 0.05.$
CLINICAL REASONING STUDY (PART A)

Conclusion:

- The use of high fidelity simulation manikins had a positive impact on participants’ clinical reasoning scores.
- The audio and visual stimuli of high fidelity manikins created a sense of urgency and provided a source of additional cues about the ‘patient’s’ deterioration. [10]
Aim:
To examine how participants collected, clustered and interpreted cues, used to them formulate a nursing diagnosis, and initiate appropriate nursing actions during clinical reasoning.
**CLINICAL REASONING STUDY (PART B)**

**Design:**

- Concurrent protocol analysis of video recordings from the quasi-experimental study was conducted to examine cue collection.

- This included quantification of vocalised ‘think aloud’ discourse and behaviours related to clinical reasoning.

- The ‘patient’ was an 75 year old man with hypervolaemia and early stage pulmonary oedema.
CLINICAL REASONING STUDY (PART B)

Also observe:
Communication, collaboration and teamwork
CLINICAL REASONING STUDY (PART B)

Results:

- Of the 34 student pairs, 13 solved the clinical problem and 21 did not.
- The average number of correct cues collected and interpreted when the problem was solved was 9.7.
- The average number of cues collected and interpreted when the problem was not solved was 3.5.
- Those who obtained an order for the diuretic had larger and more complex cue clusters.
- Of the students who did not obtain an order for the diuretic, many made a medical emergency team (MET) call very early in the simulation before collecting more than 1-2 cues.
CLINICAL REASONING STUDY (PART B)

**Conclusion:**
- Skills in cue collection and interpretation are an essential component of clinical reasoning.

**Implications:**
- When teaching clinical reasoning educators must focus on teaching students how to conduct a complete and focused clinical assessment, to interpret cues collected, and to use that information to formulate nursing diagnoses and identify and implement appropriate nursing actions.
Background:
- 70-87% of the errors in healthcare and related to communication errors.

Aim:
- To examine the impact of communication and teamwork skills on nursing students’ clinical reasoning ability.
Design:

- Data were collected from video recordings and analysed using the Oxford NOTECHS scoring taxonomy [4].
- Student pairs were scored for positive and negative behaviours in the categories of leadership, teamwork, communication, and situation awareness.
- A correlational approach was used to examine the relationship between communication/teamwork scores and clinical reasoning scores.
Examples of positive communication behaviours:

- Responding to other person’s request for help
- Discussing concerns and decisions together
- Being polite and using eye contact
- Speaking up if unsure
- Using initiative
- Being assertive
Examples of negative communication behaviours:

- Working independently (ignoring each other)
- No role delegation or task allocation
- Being impolite, rude, demanding and/or aggressive
- Not speaking up if unsure
- Not taking initiative
- Being passive
Results:

- There was a **significant correlation** between clinical reasoning and communication scores, Pearson Chi Square = 3.967, df =1, P<0.05.

- Students were more likely to effectively engage in clinical reasoning and resolve the clinical problem if they used positive communication and teamwork skills.
CLINICAL REASONING STUDY (PART C)

Conclusion:

- A lack of collaboration/consultation, and teams in which one member dominated and the other did not speak up led to failures in clinical reasoning.

- When teaching clinical reasoning educators must also focus on teaching clinical communication and teamwork skills as a strategy to improve patient safety.
TRANSLATION TO PRACTICE
In the simulations at uni you would go through all the steps of the clinical reasoning cycle and think ‘I’m never going to get this’. But once you’re actually working as a new grad you use the clinical reasoning cycle without even thinking about it.
In the debrief after the hypervolaemia simulation we got out the clinical reasoning cycle and went through it. The educator told us we had actually achieved every step of the clinical reasoning cycle in the simulation. So I realised ‘oh okay I get this’!

Then, when it happened to me as a new graduate I felt pretty confident knowing what I had to do … reduce the IV rate, administer oxygen, and escalate care etc. That simulation definitely helped and made me more confident.
The simulations help to piece everything together so that clinical reasoning changes from a model on paper to something relevant to real practice ... and it could save a life because you pick up and make sense of the cues, and do what you need to do.
Cyril is burnt into my mind, I will never forget him. When somebody is appears to be over hydrated, I think ‘oh my goodness... it’s Cyril all over again. It’s Cyril going into fluid overload’. So I immediately go into clinical reasoning mode checking electrolytes, O2 stats, hourly urine output etc. So I really took a lot of things from those clinical reasoning simulations.
I wanted to let you know that we have a student in paediatrics who has an amazing rapport with staff, kids and their parents. She has also detected on a few occasions the need to escalate care due to clinical deterioration and notified the RN very quickly to ensure optimal care for the patient was provided. Indeed, there were a couple of occasions where her clinical reasoning skills probably prevented a serious outcome for her patient.

Email - Nurse Unit Manager Paediatric unit
Hi Tracy

I had to share this moment with you. I’ve been in hospital and was extremely impressed with one of the nurses. She explained everything so well and contacted the doctor when she had concerns. She was fantastic, not missing any details.

She mentioned participating in simulations and learning about a girl called Vanessa. She said she had never forgotten what she had learned about patient safety from Vanessa’s story. I then told her that I was Vanessa’s father. She became a bit overwhelmed and said she would never forget that moment.

Regards Warren
CONSIDERATIONS FOR TEACHING CLINICAL REASONING

Use a scaffolded and integrated curriculum approach

Allow opportunities for deliberate practice

Use diverse teaching and learning strategies:

- Mind maps
- Games
- OSCEs
- Higher order questioning and Socratic dialogue

In clinical placements

- Promote and model ‘think aloud’ techniques
- Structured debriefing
- Reflecting on cognitive biases
- Written reports
- Oral exams
PATIENT SAFETY ONLINE QUIZ

A cross-sectional design used to:

- explore final year nursing students’ level of knowledge about key patient safety concepts.
- benchmark students’ performance across educational institutions.
- provide individual performance reports to motivate students to address areas of deficit and build on areas of strength in relation to patient safety knowledge.
PARTICIPANTS

- 2011 final year nursing students completed the 45 item Patient Safety Quiz
- n = 1900 representing Australian universities
- n = 111 representing educational institutions from New Zealand.
- Mean age 29 years.
- 84% (n = 1696) were female.
- Approximately half (53%, n = 1056) had experience working in the healthcare industry.
- The country of origin for the majority of the participants (67%, n = 1147) was Australia; the remaining participants were born in one of 14 other countries
## RESULTS

<table>
<thead>
<tr>
<th>Domain</th>
<th>Mean score /5</th>
<th>Mean percentage</th>
</tr>
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<tbody>
<tr>
<td>1. Person-centred care</td>
<td>4.08</td>
<td>81.57</td>
</tr>
<tr>
<td>2. Therapeutic communication</td>
<td>3.83</td>
<td>76.55</td>
</tr>
<tr>
<td><strong>3. Clinical reasoning</strong></td>
<td><strong>3.74</strong></td>
<td><strong>74.71</strong></td>
</tr>
<tr>
<td>4. Teamwork and collaborative practice</td>
<td>3.66</td>
<td>73.19</td>
</tr>
<tr>
<td>5. Cultural competence</td>
<td>3.29</td>
<td>65.72</td>
</tr>
<tr>
<td>6. Preventing, minimising and responding to adverse events</td>
<td>3.02</td>
<td>60.43</td>
</tr>
<tr>
<td>7. Evidenced-based practice</td>
<td>2.75</td>
<td>55.02</td>
</tr>
<tr>
<td>8. Medication safety</td>
<td>2.51</td>
<td>50.29</td>
</tr>
<tr>
<td>9. Infection prevention and control</td>
<td>2.48</td>
<td>49.58</td>
</tr>
</tbody>
</table>
RESULTS — HIGHLIGHTING UNIVERSITIES WHO TEACH AND ASSESS CLINICAL REASONING

![Bar chart showing universities who teach and assess clinical reasoning]
CONCLUSIONS:

- Curricula integration of simulation scenarios and other creative teaching and learning approaches can have a positive impact on students’ clinical reasoning skills and ultimately patient outcomes.
- Educators must focus on teaching students how to collect and interpret appropriate cues, to use that information to formulate a nursing diagnosis, and to identify, implement and evaluate nursing actions.
- Communication and teamwork skills must be taught and assessed as they are fundamental to clinical reasoning and patient safety.
REFERENCES


LEWIS BLACKMAN’S STORY

When things go wrong in healthcare …

Lewis was a 15 year old boy who died following elective surgery as a result of a preventable post-operative complications.