Situation Awareness and the Decision-making Processes of Final Year Nursing Students

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Aims and objectives

To investigate final year nursing students’ use of situation awareness (SA) when making clinical decisions about patients’ progress post-surgery.

Background

Making clinical decisions about patient care is a generic nursing competence, developed in pre-registration nursing programs and critical to providing safe patient care. SA is an important precursor to making decisions and is linked to improved clinical outcomes. However there is evidence to suggest that nursing students feel inadequately prepared to make clinical decisions.

Design

Endsley’s (2000) 3-level situation awareness framework was used to guide the study. Level 1 SA is perception of information required to make a decision. Level 2 relates to comprehending the information. Level 3 SA is projecting how this information will inform the future. Twelve final year nursing students were recruited to participate. Think aloud research method was used to capture students’ decision-making, followed by semi-structured interviews. Data was analysed using an adapted protocol analysis and was encoded inductively. The COREQ checklist has been used in reporting the study.

Results

Students demonstrated levels 1, 2 and 3 SA when making clinical decisions. However, it was not demonstrated consistently and at times subsequent decision-making was inappropriate. Three themes emerged: ‘systems approach to assessment of post-operative patients’; ‘policy drives
practice'; and 'deferring decisions to registered nurses'. Within the themes students demonstrated differing levels of SA.

**Conclusion**

Making safe clinical decisions is a paramount skill for nurses however student nurses are ill equipped to undertake this skill. SA is important in informing safe decision-making but students’ use of SA is variable. Cognitive apprenticeship, applied to supporting development of SA, affords the opportunity to develop students’ decision-making.

**Relevance to Clinical Practice**

Clinical decision-making is a generic competence for all registered nurses and imperative for safe practice. However, student nurses are unprepared to undertake this skill once registered.

**Introduction**

Making clinical decisions about patient care is a complex process, which involves processing information and evaluating evidence, while applying critical thinking and problem solving skills (Thompson, Aitken, Doran & Dowding, 2013). Nurses make clinical decisions frequently. Indeed, it is thought that nurses make clinical decisions approximately every ten minutes in acute health care environments (Thompson et al. 2013) and it is an expectation that nurses exhibit sound decision-making skills as a critical component in delivering safe patient care (Dowding et al. 2011).

However, there are concerns about nurses’ preparedness to make clinical decisions. In particular there is evidence to suggest that more than half of all graduating nursing students feel inadequately prepared to make clinical decisions (Harmon & Thompson, 2015). Added to this is literature to suggest that nursing students exit their programs as novice nurses who are deficient in key clinical decision-making skills and unprepared for clinical practice, leaving them at greater risk of making mistakes (Perkins & Kiesel, 2013). Wolfe (2017) tracked and analysed frequency and type of student errors (related to clinical decision-making) and highlighted the importance of addressing clinical decision-making with student nurses in order to reduce error rates and enhance patient safety. Wolfe (2017) reported decision-making errors related to documentation, communication, not following policy and not asking questions when information was needed, and noted that error rates with medications increased over the period of her study. Of concern, in a study by Canova, Brogiato, Roveron and Zanotti (2016) it was suggested that over a 10-year time period that nursing students’ demonstrated a reduction in clinical decision-making ability.
There is also literature related to issues with novice and new graduate nurses’, decision-making. For example, Saintsing et al. (2011), between 49% and 53% of novice nurses are involved in making errors related to provision of nursing care. These include errors in medication management, supervision of patients, and inability to follow medical orders. Of concern is that it is estimated that 37% of errors relate to failure to recognise or intervene in relation to patient care.

Making effective clinical decisions involves utilising a cognitive process to make judgments about the care needed by patients. It is complex and requires clinical knowledge, reliable supporting resources and a supportive environment in order to influence the quality of the decisions (Banning, 2008; Johansen & O’Brien, 2016). Making effective clinical decisions is a multi-layered process and involves rapidly determining the relevance of subjective and objective information that is relevant to the patient’s condition. For example, noticing, recognising and reacting to cues that indicate a change in a patient’s expected progress (Burbach & Thompson, 2014; Johansen & O’Brien, 2016). To do this successfully requires nurses to utilise clinical reasoning skills that include critical thinking, in order to understand the significance of patient data that will inform making safe clinical decisions (Harmon & Thompson, 2015).

Background

Whilst there is a growing body of literature related to decision-making by student nurses and by novice nurses there is a lack of consensus in the literature about what model might best support development of sound clinical decision-making skills in a practice context (Ellis, 2017). Burbach and Thompson (2014) identified the importance of cue recognition for novice nurses (who they defined as undergraduate students through to one year post registration) and described how they use pattern recognition and intuition to support decision-making. They also described how novice nurses drew on visual, auditory and tactile information when eliciting cues about patients’ conditions. However, it was also noted that novice nurses struggled to differentiate between relevant and non-relevant cues and this sometimes led to inappropriate responses (Burbach & Thompson, 2014). There have been similar findings in other studies related specifically to students’ clinical decision-making, for example, Nibbelink and Brewer (2018). In this study the researchers found that whilst students were able to discuss their decision-making, the care they administered was reactive rather than proactive.

Thompson, Aitken, Doran and Dowding (2013) commented that it would be tempting to assume that teaching students about clinical decision-making would improve the quality of care.
decisions about patient care. However, they caution that there is limited evidence of effectiveness and trying to teach ‘more’ does not equate to better performance. This may be related to students’ limited practice experience and supports Nibbelink & Brewer’s (2018) hypothesis that experience was the largest influence on decision-making. This is not to say that students should not be taught clinical decision-making strategies but suggests that considerable work needs to be done to support students to make clinical decisions.

In the nursing literature there are three main theories that inform clinical decision-making: information processing models; intuitive-humanist models and clinical-decision-making theory (Banning, 2008; Johnasen & O’Brien, 2016). Information processing models have their roots in medicine and use a scientific or hypothetico-deductive approach to support metacognitive reasoning. Hypothetico-deductive approaches involve recognising and interpreting cues and forming and evaluating hypotheses (Johnasen & O’Brien, 2016). However, these approaches assume that the decision-maker uses a transparent and rational logic in decision-making, and key to this is the experience of the decision-maker and their ability to recognise what might impact on their decision (Banning, 2008). Importantly, the quality of decisions can be affected by inaccurate reasoning structures and relies on knowledge and experience being available and accurate (Pearson, 2013). This is of particular significance to nursing students who have limited knowledge or experience of the context of nursing practice (Krishnan, 2018).

Intuitive-humanist models of clinical decision-making focus on the role of intuition and relationships between knowledge and experience to enrich decisions (Pearson, 2013). Intuition is a component of judgment and deciding what to do in uncertain situations. It is drawn from synthesising empirical, ethical, aesthetic and personal knowledge related to previous experiences and leads the decision-maker to act on awareness of this (Johansen & O’Brien, 2016). However, concerns have been raised related to these models of decision-making in that they rely on detecting cues, which stem from memory and memory may be inaccurate. Additionally, cues are used to inform pattern recognition that guide decisions and if cues are inaccurately remembered this can lead to inappropriate decisions (Krishnan, 2018). Related to student nurses’ clinical decision-making, these models present challenges in that students have limited experience in practice to develop knowledge and experience to develop intuitive skills.

A further model to support clinical decision-making involves computerised decision support systems. These draw on concepts of both hypothetico-deduction and pattern recognition and recognise the multidimensional nature of decision-making. Key features include investigating pre-encounter data, anticipation and control of risk, providing standardised nursing
care based on patients’ needs which forms a hypothesis that guides nursing care. However, utility of this theory is limited by lack of robust evaluation (Banning, 2008; Johnasen & O’Brien, 2016).

Increasing complexity in patients’ needs and safety in patient care has resulted in growing research related to decision-making and situation awareness (SA) as precursor to clinical decision-making (Brady, Wheeler, Muething & Koyagal, 2014). The tenets of this model stem from the argument that in order to make effective decisions the decision-maker needs to identify important cues and have a sense of what is important. This includes understanding what is happening currently as well as projecting how the current might influence the near future (Endsley, 2015). The latter has important implications in patient care. Information that will stimulate decisions is influenced by memory of certain cues and how meaningful they are, drawn from mainly working and long-term memory. Long-term memory stores information in the form of mental models, which are organised sets of knowledge that help to integrate and direct information in an efficient way, and can transfer information into the working memory (Flin & O’Connor, 2008).

There are three levels of SA. Level 1 SA is related to perception and information gathering and is the most basic level. This can include monitoring, collecting auditory, visual, tactile cues or simple recognition for example, leading to an awareness of the current state (Endsley, 2015). Related to health care this might include monitoring of vital signs. It should be noted that errors may occur in level 1 SA when data is not available, is difficult to detect or is misinterpreted (Flin & O’Connor, 2008). Level 2 SA relates to interpretation and synthesis of combined cues to understand how it might impact on a situation and how significant the information is, thereby providing more comprehensive information. This is influenced by mental models (Flin & O’Connor, 2008). Level 3 SA is the highest level of SA and relates to the ability to project or think ahead about what might happen next and how the situation might develop. For example, in health care this might include projecting that a trend in vital signs might eventuate in harm to a patient. Level 3 SA develops from knowledge and comprehension that, when combined, the decision-maker determines possible outcomes (Flin & O’Connor, 2008).

In clinical decision-making there is evidence to suggest that higher levels of SA are linked to improved clinical outcomes for patients (Stubbings, Chaboyer & McMurray, 2012). However, research has focussed on SA in teams and interprofessional environments, particularly in emergency situations or where patient deterioration is occurring. This applies to research related to students’ use of SA as well, where available research is sparse and perhaps out-dated. See for example, McKenna et al. (2014) and O’Meara et al. (2015) both of whom reported low SA in
students related to detecting or managing deteriorating patients. This is supported by studies that extend outside of SA. For example, a study of final placement students’ decision-making by Perkins and Kiesiel (2013) identified that not only did students struggle to recognise deteriorating patients but that they also struggled to interpret cues and data related to ‘routine’ post-operative patients’ progress.

Given the importance of effective clinical decision-making and the relationship between SA and positive clinical outcomes this research aims to investigate the use of SA by final year nursing students.

Research question

How do final year nursing students use SA to make decisions about expected progression of post-operative patients?

Methods

This study is situated in a naturalistic inquiry paradigm. Naturalistic inquiry is a form of interpretive research (Lincoln & Guba, 1985). ‘Think aloud’ research methods were employed, followed by semi-structured interview, to capture information and uncover new phenomena (Ericsson and Simon, 1993). These methods emerged from the psychological disciplines and involve participants verbalising what they are thinking, doing and feeling while completing a task and gives insight into cognitive processes employed when completing tasks (Ericsson and Simon, 1993).

This paper reports on the ‘think aloud’ data captured. As the students undertook the activity of completing post-operative assessments they ‘thought’ aloud as they completed it (Ericsson & Simon, 1993; Kuusela & Pallab, 2000; Young, 2005). Endsley’s (2000) work on SA was used as a framework to guide and conceptualise the study. The COREQ checklist (see supplementary file 1) has been used in reporting the study (Tong, Sainsbury & Craig, 2007).

Setting and Sample

The study setting was in a simulated ward teaching area, located in a large tertiary hospital. Six (6) patient scenarios were created using medium fidelity mannequins that represented general surgical cases across a range of complexity (for example, laparoscopic appendectomy, laparoscopic cholecystectomy, tonsillectomy, anterior vaginal wall repair, infected pilonidal sinus, resection of anterior colon). In all scenarios patients were 6 – 7 hours post-operative. Scenarios
were reviewed by two researchers with recent and relevant clinical experience (BW and AB). Mannequins were prepared with appropriate wounds, monitoring equipment and intravenous access. Scenarios included appropriate post-operative bedside documentation – nursing notes, fluid balance charts, observation charts and medication charts.

Purposive sampling was employed to provide information-rich cases that could be studied intensively (Patton, 2001). Twelve (12) final year nursing students were recruited via an on line announcement which included a participant information sheet. Interested students were invited to contact the research team to participate. Consent was obtained by the researchers in the study setting prior to students undertaking the activity. Students were aged between 21 and 28 years old and had studied full time in the nursing program. All students were in their final semester prior to graduation. Participants had a range of medical and surgical nursing experience across different hospitals over the three (3) years of their program. All participants had been exposed to the same model of simulated learning over the course of their study.

**Ethics**

Ethical approval was gained from the university and was in accordance with the National Health & Medical Research Council (NHMRC) requirements for ethical conduct in human research (NHMRC, 2007).

**Data collection**

Participants were invited to the simulation area one at a time, where they were briefed by the research assistant (ET) about the study in using think aloud methods as they assessed the post-operative patients. Participants were given a patient handover and were asked to verbalise what they were thinking as they read the patients’ charts and conducted their patient assessments. Think aloud data was recorded by voice recorder for each scenario. On completion of the activity a semi structured interview was conducted to give further depth to participants’ thinking and expand on the data that had been collected. This paper reports on the think aloud data collected.

**Data analysis**

Audio recordings were transcribed verbatim during ongoing data collection. Data was analysed using an adapted protocol analysis (Yang, 2003) and was guided by the work of Endsley (2000) and Flin and O’Connor (2008) to evidence cues related to situation awareness. The adapted protocol analysis involved listening to the recordings, reading the transcripts and encoding the
written data into segments or sentences. The sentences were encoded inductively using a coding schema to identify cues (level 1 SA), comprehension and interpretation of cues (level 2 SA) and projection of thinking (level 3 SA). Level 1 SA was ascribed when students noted cues related to patients’ current post-operative status. Level 2 SA was ascribed when students analysed or interpreted the meaning of cues and level 3 SA was ascribed when students projected what this might mean in terms of the patients’ required needs or their post-operative progress. Data was interpreted by three members of the research team to enhance credibility (MT, AT, BW).

Results

The findings suggest that students demonstrate levels 1, 2 and 3 SA when making clinical decisions about the progress of post-operative patients. However, it was not demonstrated consistently across patient scenarios and at times although students demonstrated SA their subsequent conclusions or decisions about what the data meant was inconsistent. Also of note is that students did not verbalise what procedure each patient had undergone although they eluded to linking their decision-making to the diagnosis when they made statements such:

*I’m not familiar with this procedure so I would have to find out more.* David

The overall findings suggest students were able to draw together relevant cues (level 1 SA) that supported their expectations of how patients might progress following surgery and follow a predicted pattern of recovery. Most students were also able to identify cues, for example, low oxygen saturations that suggested patients might not be progressing according to the expected pattern of recovery and understood this could have untoward consequences for the patient in terms of recovery if they did not intervene but this was not consistent. When students struggled to understand cues related to a patient’s recovery, for example why a patient had a slightly elevated temperature, they sometimes sought extra cues that extended beyond the information that had been provided at the bedside and in handover to try to find a pattern of cues that made sense for them (level 2 SA). However, when unable to find a pattern in cues that matched their mental model about what might be expected in terms of patients’ post-operative progress they sometimes spent several minutes trying to locate cues that supported a pattern of recovery that might be expected as ‘normal’ progress. For example, relating frequency of use of analgesia in managing pain.

While students did at times express their thoughts about potential outcomes, this was not consistently articulated across patient scenarios or by individual students (level 3 SA). At this point students appeared reluctant to articulate potential patient outcomes and instead"
Acknowledged there might be a ‘problem’ and then sought out and deferred to other sources of information for confirmation.

Detailed analysis revealed three (3) themes emerged related to assessment of patients’ post-operatively and students demonstrated differing levels of SA within these themes: ‘systems approach to assessment of post-operative patients’; ‘policy drives practice’; and ‘deferring decisions to registered nurses’ to determine possible issues with post-operative recovery. The themes and students’ SA are discussed below.

**Systems approach to assessment of post-operative patients**

When students were introduced to their patients and received handover they undertook a systematic assessment of their patient. The assessment was systematic in terms of process and body systems as they looked for cues that would tell them about their patients’ recovery (level 1 SA). Invariably students first spoke about patients’ observations (temperature \([T]\), pulse \([P]\), respirations \([R]\), blood pressure \([BP]\) and oxygen saturation levels \([SaO2]\)). When thinking aloud about patients’ post-operative observations students compared what they were seeing on the charts to what they expected from a post-operative patient (level 2 SA). For example, Mary demonstrated level 2 SA when she located cues about her patient’s vital signs and was able to interpret observations such as BP, that were below what would be considered normal, and place these into the patient context to determine the patient was progressing in her recovery (level 3 SA).

*I’m pretty happy with her resp rates, her O2 sats are good, blood pressure is a bit low but pretty stable low for her. Heart rate again pretty stable, it just drops off a few times, temperature, I’m pretty happy with the temperature, she’s afebrile (level 2 SA). I’m happy with her vital signs.* (level 3 SA) Mary

Students were able to recognise cues and interpret observations as being within normal limits for their particular patient. At times, when patients’ observations were ‘borderline’ what was expected, students engaged in a lengthy process of searching for more cues that might present a familiar pattern to analyse. They sought further cues to test their emerging clinical decision.

*So this patient’s resp are 12 and their sats are 95. I don’t think she’s on oxygen but she’s on morphine by PCA [patient controlled analgesia] (level 1 SA). She should technically be on oxygen because the morphine is going to decrease her resp. That’s what I would do. She needs to be on oxygen.* (level 2 SA) David
At times students struggled to bring cues and data together to interpret. Although students were alert to potential complications their interpretation of some of the cues was cautious and students were reluctant to draw conclusions about what it might mean for the patient. When assessing a patient who had an anterior vaginal wall repair whose observations might be considered ‘borderline’ normal, the student struggled to find a reason for the cues related to this patient’s ‘borderline’ observations. His thoughts suggested he was interpreting a range of cues and data related to the patient and was trying to test his interpretations of cues and understand what that might mean for her in terms of her recovery.

Resps are a little high but not too high (18) (level 1 SA). Her blood pressure is a little high but within normal range (140/95) (level 2 SA). Her heart rate is 96 at 1900 (level 1 SA). I’m assuming that these are all high though because of her pain (pain documented as 2/10) (level 2 SA). If she was to be given Panadol then it might go down (level 3 SA). Temperature-wise I’m not so sure (37.4), it could be……I don’t know. She had Panadol recently so obviously that didn’t really work for her. (level 2 SA) David

After assessing observations students focussed their think aloud on assessing patients’ intake and output post-operatively. Of interest, students spent longer interpreting this data than was spent interpreting observations. It was clear from the data that many students did not have the same familiarity related to patterns of cues to observe for when assessing intake and output and their decision-making was informed by level 1 SA. Whilst they verbalised cues such as the patient had been drinking or had an intravenous infusion, or verbalised a urine output volume they struggled to interpret what this implied in terms of the patient’s progress. This at times might have led to students reading incorrect data as they searched for cues that might indicate ‘normal’. For example, Elizabeth did not identify appropriate cues to suggest any potential issues with a patient’s intake/output (750mL intake, 344mL output).

Looking at her urine output, it looks like she’s had half a litre in and some ice chips. Her catheter has drained about 600mL (incorrect amounts observed) (level 1 SA). I’m pretty happy about that. Elizabeth

The time spent thinking aloud about patients’ intake and output suggested that students were less sure of the cues that matched expected patient progress post-operatively, related to intake and output, especially in the absence of numeric data recorded on a fluid balance chart. The search for cues to match a pattern to inform their decision-making also suggested that students
relied on isolated data that was recorded on specific charts, for example observations charts and fluid balance charts, and struggled to bring the different data together to provide a more robust approach to decision-making about how their patient was progressing. They did not think aloud about other cues related to physical assessment that may have informed their decision-making about a patient’s fluid balance, for example, skin turgor. Most often they also did not extend their analysis of data to related information that might impact on patients’ progression post surgery. One example was when a student assessed a patient with type I diabetes who had undergone an appendectomy. The students’ analysis did not suggest an ability to relate the cues available to the context of caring for a post-operative type I diabetic patient and the potential for complications such as hypoglycaemia. Instead, the student applied a formulaic approach to assessment. Whilst several pertinent cues were identified the student used a linear formula which effectively ended this decision-making process. Instead the student sought a different decision-making approach by asking the patient:

Looking at his fluid balance chart, his cannula is patent, he’s had Hartmann’s running through, that’s at a total of almost the full litre now. He’s had orange juice, water, sandwiches and tea. He’s had overall about a litre and a half. He’s passed urine twice – small and large (level 1 SA). He doesn’t have an IDC in, so it would be tough to know how much output he’s actually having (level 2 SA). I’d probably just ask him how much he thought he’d pee’ed’. Peta

A further observation made by students was related to patients’ post-operative pain. When assessing patients’ pain, students clearly articulated that this was an important part of their assessment of post-operative patients’ recovery. They used key information and cues to provide a comprehensive assessment of each patient’s pain status. This often meant that students were able to interpret cues (level 2 SA) and apply their interpretations to what this might mean for the patient (level 3 SA), which then underpinned their decision-making. For example, when assessing the post-operative patient who had a bowel resection (pain documented over time as between 2 and 6/10, currently 3/10), the student commented:

I’d ask the patient about the site of their pain and if the pain is like 5,6,7,8 or 9 out of 10 (level 1 SA). I’d probably consider that the PCA may not be giving adequate pain relief (level 2 SA). So that’s when I would call the anaesthetist and let them know the patient is still in pain. (level 3 SA) Lauren

However, of concern, when numeric data was variable students spent time thinking aloud about cues that might confirm an expected pattern rather than cues that might discount it. This left
them unable to progress past level 1 SA to support decision-making. For example, Mary, when assessing the same patient said:

*Her pain score seems to be kept under a 5 (which is good) … looking at her PCA [patient controlled analgesia] observations chart… she’s had a total of 10 tries, six have been good. She had a lot of attempts – early on at 1 o’clock with only three good tries (level 1 SA).*

This suggests that because the cues regarding the numbers of tries and attempts on the PCA didn’t match a familiar pattern and the student did not know how to manage alternate information and therefore did not use this information to inform whether the patient’s pain indicated she was progressing as expected in her post-operative recovery. Instead she discounted the information and said:

*Okay, so looking at her fluid balance chart. Mary*

It was evident in the findings that students do use SA at different levels to inform their decision-making related to applying a systematic assessment of post-operative patients’ recovery. In particular when assessing observations and patients’ pain, students demonstrated they were able to collect cues, interpret them and begin to determine what this might mean for the patient in order to inform their decision about how the patient was progressing post-operatively. However, when assessing post-operative patients’ intake and output students demonstrated low SA to inform their decision-making. Importantly, SA and decision-making was informed by data collected in a linear fashion related to the patients’ paperwork – observation chart, fluid balance chart and PCA charts. Rarely did students seek subjective data that may have informed their decision-making. Whilst they did seek patient numeric reports of pain to clarify interpretations they clearly did not rely on other forms of information such as checking wounds or seeking information from patients to inform their decision-making.

**Policy determines practice**

The second theme to emerge from the analysis was connected to how students related to policy that guided practice to inform their interpretation of data and subsequent decision-making. It was clear from the think aloud data that when students were unable to identify a pattern that matched the cues they detected, or were unsure about how to interpret information, that they relied on local policies to inform decision-making. This resulted in students making decisions that did not take into account the patients’ individual histories or individual post-operative progress. For example, when assessing a patient who had a bowel resection one student noted
that the recorded frequency of measuring the patient’s observations did not match what was expected in her current clinical placement environment. She went on to say that her decision-making regarding frequency of measuring the patient’s observations would be policy driven.

\textit{At the hospital I'm at now, the policy is taking their observations every thirty minutes for the first two hours and then every hour for two hours after that. So depending what hospital I'm at I just ensure that I look at the hospital policies and how regularly I should monitor the patient.} Lauren

It was interesting to note that students cited policy to inform decision-making only when they thought aloud about measuring patients’ observations. They did not refer to policy when considering assessment of other patient information, for example patients’ intake and output or assessing or managing post-operative pain.

Even when patients’ observations were anomalous or cues did not follow a predicted pattern, students still at times stated that their interpretation and subsequent decision-making would be policy driven rather than by the cues provided in their assessment of the patient. This meant that even though they collected the appropriate cues, the interpretation of the significance of the cues was informed by policy. At times this resulted in poor decision-making by students. For example, when assessing a patient who had returned to the ward seven (7) hours ago following drainage of an infected pilonidal sinus, a student noted the following observation data recorded on the observation chart: temperature 37.7°C (consistently elevated), pulse 87 (range 87-112), BP 140/95 mmHg (range 150/100 – 140/95), oxygen saturations 96% (range 94-98) and pain score of 7/10 (range 4-7). When thinking aloud about these observations, the student clinical decision was that the patient’s observations should be re-assessed in 2 hours as directed by policy.

\textit{He's not due for observations again for another two hours because we've just done them} (level 1 SA). Sasha

This approach to decision-making was not consistent amongst students when thinking aloud and making decisions about observations for this particular patient. Some students said they would re-take the patient’s observations immediately whilst others suggested taking them every hour or second hour. However the decision around frequency was mainly related to policy requirements. Only one student demonstrated level 3 SA to inform her decision-making, when she expanded on what the patient’s observations might indicate and how it might direct practice away from the stated policy.
His obs are supposed to be every two hours now (level 1 SA). His temp is borderline so I’d do it hourly just in case (level 2 SA). He’s got a bit of an infection risk going on and a lot can change in an hour (level 3 SA). Everything is a bit borderline, so two hourly, personally I don’t feel it is appropriate (level 2 SA), and I don’t feel there is any harm in doing his temps, resps and pain score. Simi

Whilst policy is useful to guide nursing practice it was evident that students relied on it at times to inform their decisions about patients’ post-operative recovery. This suggests that students were unable to identify and analyse pertinent and individual patient data to inform their clinical decisions about post-operative patient recovery. When this occurred students relied on policy to direct their practice.

**Deferring conclusions**

The third theme to emerge from the data analysis was related to how students deferred their conclusions and sought guidance from ‘others’, usually registered nurses or sometimes doctors when they wanted clarification or confirmation about either their interpretation of cues and data, or confirmation about what it might mean in terms of the patients’ recovery post-operatively.

Importantly, students realised that when patients’ observations did not match their expected interpretations that there was the potential for the patient to not progress in an expected manner. They then articulated that they would seek more information. For example when thinking aloud about a patient who had surgery for an infected pilonidal sinus, one student searched for cues that might have explained the patient’s pain level of 7/10 and temperature of 37.7 degrees, seven hours post surgery. It was clear that the student felt her interpretation of cues and data available did not match what she would have expected, and she determined that she needed to know more in order to make a decision about the patient’s progress.

*I don’t know exactly what is required. It’s a hole in my knowledge. I’d talk to a more experienced nurse as well, as they would probably know what that is.* Emma

Whilst students struggled when cues did not match the expected pathway they also acknowledged that they needed to address knowledge deficits. When caring for a patient who had a tonsillectomy Arvind queried whether the patient should have intravenous antibiotics and stated:

*I would go and research and find out more, or discuss with the medical officer or surgical team.*

Arvind

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In terms of interpreting cues and data, while thinking aloud students verbalised when cues related to patients’ diagnoses or progression along the post-operative recovery pathway did not match what they expected. They were able to detect and analyse cues that might suggest their patient was not following a predicted pathway or match and expected pattern of recovery, but were unsure or cautious in affording weight to the significance of their interpretations. When cues or data didn’t suggest a predicted pathway post-operatively students sought in the first place to clarify or confirm their interpretations with a registered nurse before making a clinical decision about the patients’ recovery. For example, when unsure about the analysis of a set of observations and how they might relate to the patients’ diagnosis and surgery one student stated:

*I would go ask somebody that knows, like a team leader or higher registered nurse than myself*

David

Students most often detected and interpreted cues related to the patient’s condition that did not match what they would have expected from a patient at this stage of post-operative recovery, but articulated they would have to have their interpretations confirmed if it varied from what would be expected. For example, when assessing the BP (110/85) of a patient who had undergone a laparoscopic appendectomy and who had type I diabetes, Simi stated:

*I don’t know if that’s normal (for a diabetic), I would need more education on that and get someone to double check.*

Simi

This suggests that the student is also developing level 3 SA as she considers if there is a relationship between the patient’s BP and underlying type I diabetes that might inform her decision about his post-operative progress.

It was clear that when interpreting significance of cues and data and what it might mean for patients’ post-operative recovery (level 3 SA), that students often did not rely on their interpretations and projections sufficiently to make a clinical decision about patients’ progress.

**Discussion**

Safe nursing practice relies on nurses being able to quickly detect cues about patients’ conditions and make appropriate decisions (Burbach & Thompson, 2014). Given that SA is critical in all areas of healthcare and has a direct relationship to patient safety (Flin et al. 2009) it is imperative that students are equipped with skills to develop good SA in order to make sound clinical decisions. However, skills involved in developing SA to inform clinical-decision making are complex and students struggle to apply the theoretical contexts of decision-making to practical
application in clinical environments (Perkins & Kisiel, 2013). This may be because teaching practical application of decision-making theory in the classroom is difficult and also because opportunities to practice in clinical environments are limited due to constrained curriculum hours (McCallum et al. 2011). Nevertheless, Saintsing et al. (2011) highlight the importance of addressing clinical decision-making with student nurses to help reduce error rates and enhance patient safety.

The findings in this study are reflected in other research related to post-operative assessment and decision-making. Cardona-Morell, Nicholson and Hillman (2015) suggest that inadequate assessment and clinical decision-making skills may be because nursing models have remained unchanged over years, despite increasing complexity of patients’ conditions. Indeed, there is concern that physical assessment by nurses is declining and as a result important clinical decisions are being overlooked (Yeung, 2012). Several authors cite students’ inability to recognise appropriate cues when assessing patients (Cooper at al. 2010 and Endacott et al. 2010). Importantly, it should be noted that the skills associated with conducting an appropriate post-operative assessment are core nursing skills (Douglas et al., 2015).

Findings from this study are supported by other studies related to nursing students’ use of SA as a precursor to clinical decision-making. For example, Cooper et al. (2010) and Endacott et al. (2010) found that whilst students were able to identify cues related to physiological deterioration, they had low comprehension of the cues. McKenna et al. (2014) also found that final year nursing students had poor SA related to deteriorating patients.

It was clear in this study that students did demonstrate SA in their decision-making. They were able to detect cues related to patients’ post-operative progress and tried to interpret what the cues meant for their patients’ progress. However, this was at times limited and their interpretation sometimes guided by the sources they used to make meaning of the information. For example, there was a reliance on policy for guidance related to making decisions. However, as Thompson et al. (2013) suggest, using clinical guidelines to support clinical decision-making should be done with caution, in that the internalised nature of the information taken from clinical guidelines is unreliable as it is often reconstructed, and cognitive shortcuts are taken to circumvent perceived meaningless information.

One issue related to developing students’ SA is that their SA may be limited by lack of familiarity with situations and therefore there is limited working and long-term memory of how to interpret and make meaning of clinical situations (Endacott et al. 2010). Long-term memory is
an important factor in decision-making. It stores information over an extended period in the form of mental models that provide comprehension of a situation and projection of possible outcomes (Endsley, 2000). However, concepts of SA can be taught as a decision-making framework for students to develop over time. Learning to use SA can be modelled by experienced nurses in the classroom and in the clinical setting by supporting students to think systematically to build their SA. One such framework to support development of SA is a cognitive apprenticeship model. Cognitive apprenticeship models of learning have been successfully used in many health disciplines to develop skills. For example, in psychotherapy skills training (Feinstein & Yager, 2013), in developing decision-making skills of medical personnel in paediatric settings (Linnett, Andersen & Balslev, 2012) and for developing practice learning skills for midwifery students (Finnerty & Collington, 2013).

Cognitive apprenticeship should not be confused with traditional apprenticeship models. In traditional apprenticeships learning is driven by job demands and is not pedagogically based and skills are taught in the context of their use (Collins, 2005). In cognitive apprenticeship tasks and problems illustrate the use of decision-making techniques by applying them in diverse settings and are sequenced to reflect changing demands of learning. Cognitive apprenticeship emphasises generalising knowledge by first articulating common principles, before extending to more complex tasks (Collins, Brown and Holum, 1991). In developing student nurses’ SA this could include delivering learning which grows in complexity and diversity in theoretical concepts, simulated learning and clinical practice which is mapped across a program of study.

Collins et al. (1991) suggest a cognitive apprenticeship framework, which focuses on four dimensions. The most recent framework (Collins, 2005) has been adapted to demonstrate its utility in developing students’ SA when assessing post-operative patients (figure 1).

The first dimension of the framework is content (Collins, 2005). This includes mastering domain and strategic knowledge which includes subject matter and heuristic strategies such as ‘tricks of the trade; metacognitive strategies which include monitoring, diagnostic and strategic components for example reading and interpreting a patient’s vital signs; and learning strategies which range from exploring to extending knowledge or undertaking complex tasks or analysing personal strengths and weaknesses (Stalmeijer, Dolmans, Wolfhagen & Scherpbier, 2009; Woolley & Jarvis, 2007). This could include delivery of curriculum content to provide core knowledge related to post-operative assessment and developing students’ problem solving and reflective skills related post-operative assessment.
The second dimension of the framework is method, which provides students with the opportunity to observe and engage in or discover strategies that fit the context of the problem (Collin’s 2005). Collins (2005) suggests six teaching methods – modelling, coaching, scaffolding, articulation, reflection and exploration. The proposed methods have utility in developing SA because they can make tacit knowledge explicit and help students undertake complex tasks and have been used successfully in other health disciplines such as medicine (Gavriel, 2015; Stalmeijer et al. 2009). Importantly, cognitive apprenticeship is non-linear and is student-paced to cater for individual learning. For example, some students may need more coaching or modelling after articulating or performing a skill.

In the context of this study modelling SA can include the nurse performing a task (behavioural modelling) while the student watches, or thinking aloud about decision-making while performing a task (cognitive modelling), drawing students’ attention to identification of and significance of important cues (Dennen, 2001). Coaching involves watching the student as they undertake a task and providing feedback, prompts, challenges and new tasks to build complexity (Collins, 2005). Group work provides opportunities to undertake skills and practice with the assistance and guidance of the nurse (Woolley & Jarvis, 2007). Coaching SA could involve practicing the skills related to post-operative assessment while the nurse prompts the student to demonstrate how they are applying SA to the task. Scaffolding refers to the support afforded by the nurse. This includes suggestions and support that gradually fades until the student is independent in their decision-making (Stalmeijer et al. 2009). Scaffolding students’ SA could include the nurse supervising the student complete a post-operative assessment and prompting the student to express what they are doing when needed. Articulation involves students explicitly stating their knowledge and problem solving process (Collins, 2005). Related to SA nurses can use inquiry teaching, posing questions to help students articulate their thinking and providing role-play opportunities whereby students undertake a post-operative assessment and explain how they are using SA to the group (Woolley & Jarvis, 2007). Reflection enables students to compare their decision-making processes to experts’ and affords an opportunity to replay the processes used and determine their strengths and weaknesses (Stalmeijer et al. 2009). Related to developing SA one strategy would be to provide simulated assessment for students to complete. This affords the opportunity for students to see how their use of SA might compare to an expert registered nurse. The final teaching strategy is exploration. This involves guiding students to solve their own problems by setting general goals and having students identify goals within this (Woolley & Jarvis, 2007). For example, having students explore the SA they used
when assessing a post-operative patient following a cholecystectomy and how they might apply this to other post-operative situations.

The third dimension of Collins (2005) cognitive apprenticeship model is sequencing. This includes increasing complexity of skills and decision-making, increasing the diversity of skills and tasks and providing students with a conceptual model by which to monitor their own progress and develop and self-correct their own decision-making processes (Collins, 2005). To develop students’ SA, this could include providing a SA framework to underpin decision-making and then introducing students to post-operative patients who have undergone similar procedures (for example, knee arthroplasty) and who were considered ‘stable’, before introducing students to a group of patients who had undergone a greater variety of surgical procedures. Using an SA framework, the nurse would support students to articulate their assessment to identify cues, communicate their significance and identify possible future outcomes for the patient.

The final dimension of the framework is the sociology of learning. This refers to the context of applying skills in the real world and encouraging productive beliefs towards problem-solving. This includes ensuring students have the opportunity to practice situated learning to carry out tasks and develop decision-making skills in an authentic way (Collins, 2005). Sociology of learning also involves promoting intrinsic motivation to learn by giving students the opportunity to undertake tasks that are important for them. The final element is exploiting cooperation by fostering collaborative problem-solving and decision-making (Collins, 2005). Applying this to developing SA, provides students with a framework to develop their post-operative skills in assessing patients in a ‘real’ clinical environment by identifying cues, communicating their significance and importantly, identifying possible outcomes for their patient.

Limitations

The findings from the study may be limited in that it was undertaken in a simulated environment with a small number of final year students. The use of medium fidelity mannequins may mean that the results might not be replicated in a clinical environment.

Conclusion

Making safe clinical decisions is a paramount skill for registered nurses however there is a wealth of evidence to suggest that student nurses are ill equipped to undertake this skill. SA is recognised as important in informing safe decision-making but it was evident in this study that
students’ demonstrated poor SA when assessing post-operative patients. A model of cognitive apprenticeship, applied to supporting development of SA, affords the opportunity to develop students’ decision-making skills in a structured manner using a framework, which can be developmental and articulated through classroom and practice settings.

Relevance to Clinical Practice

Clinical decision-making is a generic competence for all registered nurses and appropriate decision-making is critical to safe practice. However, research shows overwhelmingly that many student nurses are unprepared to undertake this skill one registered. Teaching SA, as a precursor to clinical decision-making, is an important task for teachers and registered nurses who work with students.

What does this paper contribute to the wider global community?

- Highlights the importance of developing SA to inform decision-making and enhance patient safety.
- In depth information related to student nurses’ strengths and weaknesses in applying SA to clinical decision-making related to assessing post-operative patients.
- An evidence-informed approach to strengthening students’ use of SA as a precursor to clinical decision-making.

Reference List


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Cognitive apprenticeship

Authentic application
Collaborative learning

Increasing complexity
Increasing diversity
Conceptual model

Sociology
• Social characteristics of learning environments

Content
• Types of knowledge required for expertise

Domain knowledge
Strategic knowledge

Secuencing
• Keys to ordering learning activities

Method
• Ways to promote development of expertise

Modeling
Coaching
Scaffolding
Articulation
Reflection
Exploration


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