Situation Awareness in LPNs: a Pilot Study

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Situation Awareness in LPNs: A Pilot Study

A Dissertation Presented

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Abstract

Purpose: The purpose of this pilot study was to describe situation awareness (SA) among licensed practical nurses (LPNs) working in direct patient care.

Specific Aims: The specific aims for this study are 1) **t**o examine SA scores, as measured by the Situation Awareness Global Assessment Technique (SAGAT), in LPNs working in direct patient care and compare to published data on SA in registered nurses (RNs), 2) to examine the relationship between SA scores and years of LPN experience, 3) to examine differences in SA scores by type of workplace setting and 4) to describe the relationship between levels of satisfaction with simulation, as measured by the Satisfaction with Simulation Experience Scale (SSES) and SA scores among LPNs.

Framework: Situation Awareness Theory, as described by Endsley, was used as the framework for this study.

Design: A cross-sectional, descriptive design using the Situation Awareness Global Assessment Technique was used to gather data from a convenience sample of LPNs.

Results: LPNs (N=24) participated in the study and achieved an average SAGAT score of 72.6%. There were no differences in scores between those LPNs enrolled in an RN program and those who were not enrolled. Individual scores on the SAGAT were comparable or better than scores in a similar study of RNs.

Conclusion: LPNs in this study demonstrated adequate situation awareness.

Key Words: Situation awareness, licensed practical nurse, patient deterioration, clinical simulation

Introduction

Well-developed situation or situational awareness (SA) is essential for recognizing and responding to a deteriorating patient situation (McKenna et al., 2013). Conversely, underdeveloped SA can result in poor detection of patient deterioration and subsequent failure-to-rescue (Brady et al., 2013; Fore & Sculli, 2013; Reime et al., 2016). Nurses involved with direct patient care require well-developed SA to recognize an acute change of condition in their patients, in order to intervene and avert a potentially negative outcome. This is true for nurses and patients in any setting, from extended care facilities to trauma centers.

SA has become a focus of nursing research, as it has significant implications for patient safety (Despins, 2018). SA is the ability over time to perceive critical elements in each situation, comprehend the meaning of those elements with respect to the environment, and then project what is likely to happen in the near future (Endsley & Jones, 2012). Perception, comprehension and projection make up the three levels of SA, with perception being the lowest level, and projection being the highest.

SA is developed through experience, including clinical experiences, case studies, and simulated scenarios (Endsley & Jones, 2012). It is these experiences that help develop the working memory capacity, schema and mental models that experienced practitioners draw from when faced with deteriorating patient scenarios (Endsley & Jones, 2012).

SA levels have been studied among healthcare professionals, including physicians, registered nurses and nursing students (Cooper et al., 2010; Lavoie, Cossette & Pepin, 2016; McKenna et al., 2014). But minimal research has been done to look at SA in licensed practical nurses (LPNs). Recent data suggests that almost one fifth (18.6%) of actively employed nurses are prepared at the LPN level (“National Nursing Database”, 2018), a large percentage of which work in extended care facilities (38%) and home care (12%) ("Progress and precision: the NCSBN 2018 environmental scan", 2018). As the population ages and patient care moves out of the hospital and into the community, the demand for LPNs is projected to grow significantly (Buerhous, Skinner, Auerbach, & Staiger, 2017; "Progress and precision: the NCSBN 2018 environmental scan", 2018).

Research on SA levels in LPNs is needed, as it can demonstrate the abilities of LPNs to recognize and appropriately intervene in deteriorating patient situations. The purpose of this study is to describe SA among LPNs working in direct patient care.

The specific aims for this study are:

Aim #1: To examine SA scores, as measured by the SAGAT, in LPNs working in direct patient care and compare to published data on SA in other health care providers.

Aim #2: To examine the relationship between SA scores and years of LPN experience.

Aim #3: To exam differences in SA scores by type of workplace setting (acute care, long-term care, subacute care, or a home care setting).

Aim #4: To describe the relationship between levels of satisfaction with simulation, as measured by the Satisfaction with Simulation Experience Scale (SSES) and SA scores among LPNs.

Background and Significance

Most studies examining SA levels have been conducted in acute care settings. As the population ages the demand for nurses is projected to shift away from these types of settings, especially hospitals (Buerhous, Skinner, Auerbach, & Staiger, 2017). Current projections for growth in demand for nurses include ambulatory care and home care (Jacobs, 2018), with expected increases of 26% and 54% by 2030, respectively. In contrast, demand for hospital positions for nurses is projected to increase by only 7%.

Recent data (“National Nursing Database”, 2018) suggest that almost one-fifth (18.6%) of the active nursing workforce consists of LPNs, also referred to as licensed vocational nurses (LVNs). According to the 2018 National Council of State Boards of Nursing (NCSBN) Environmental Scan, a significant percentage of LPNs work in nursing and residential facilities (38%) and home healthcare services (12%). (“Progress and precision: the NCSBN 2018 environmental scan”, 2018). The scan also notes that the supply of LPNs through 2030 is expected to grow by around 26%, while the demand is expected to grow by 44%. This increase in demand is coupled with regional shortages, with an expected shortage in 33 states across the U.S. As an example of state shortages, Colorado expects to see a 78% increase in demand for LPNs in long-term services by 2030, followed by Utah (75%) and New Mexico (72%) (Smiley et al., 2018).

The numbers of practicing LPNs has decreased in recent years (“Progress and Precision: the NCSBN 2018 Environmental Scan”, 2018), but the growing population of elderly people needing care has prompted the current and projected demand for more LPNs in the workforce (DeMuth, 2018; Garner & Boese, 2017). The aging baby boomer population may exceed the current workforce, and the expected increase in RN retirement is expected to decrease the overall number of experienced nurses (“Progress and precision: the NCSBN 2018 environmental scan”, 2018). As an example of the current and growing demand, DeMuth (2018) notes that the state of Georgia is already experiencing an acute shortage of LPNs. In response, area hospitals have partnered with community colleges to increase LPN programs. LPNs are not only going to remain part of the nursing workforce, they will continue to make up a significant part of it.

In addition, the Centers for Medicare and Medicaid is continuing a 2012 initiative to reduce “potentially avoidable hospitalizations” among nursing facility residents (Segal, Rollins, Hodges, & Rooseboom, 2014, p. E2; Feng et al., 2018), as these hospitalizations often have negative effects on health outcomes. Feng et al., (2018), found that patients could safely be monitored and treated in skilled nursing facilities, with appropriate support and training. As LPNs make up a significant portion of the nurses in these types of facilities, they will need to be able to detect patient changes and adequately manage them in order to avoid unnecessary hospitalizations.

As noted, LPNs are going to be needed in greater number to help address the changing demographics of healthcare settings (the aging population, the shift away from hospitals). In addition, the demographic make up of the LPN population can help achieve more cultural diversity in the healthcare workforce (Villarruel, Washington, Elcher, & Carver, 2015). LPNs tend to be more racially diverse than RNs, and often more accurately reflect the racial make-up of the general population (Garner & Boese, 2017). The 2017 National Nurse Workforce Survey found that 29% of LPN's surveyed identified as racial minorities, while only 19.3% of RNs identified as such (Smiley et al., 2018). A more diverse healthcare workforce has been shown to have a positive impact on patient health outcomes, as expanded upon by the Sullivan Commission on Diversity in the Healthcare Workforce report (Sullivan Commission, 2004).

There is limited research examining the effect of LPNs on patient outcomes. Aiken, Clarke, Cheung, Sloane, and Silber (2003) found that increasing the proportion of nurses with higher degrees by 10% decreased the risk of mortality and failure to rescue by a factor of 0.95 (adjusted odds ratio of 0.95; 95% confidence interval, 0.91-0.99). A retrospective, correlational study by Frith, Anderson, Tseng, and Fong (2012) found that an increase of one hour of LPN patient care hours per day (from the mean number of patient care hours) resulted in a 3% increase in medication errors, as opposed to a 0.16% decrease in errors for RNs with the same increase in patient care hours. A cross-sectional study by Glance et al. (2012) found that a 1% increase in LPN total nursing time was associated with a 4% increase in the odds of mortality (adjusted odds ratio 1.04; 95% confidence interval: 1.02-1.06, $p = 0.001$), and a 6% increase in the odds of sepsis (adjusted odds ratio 1.06; 95% confidence interval: 1.03-1.10, $p<0.001$). These studies looked at LPNs as part of a ratio of mixed nursing staff (RN to LPN ratio).

An integrative review (Ridley, 2009) also suggested that acute care centers that employed more RNs in proportion to LPNs reported fewer adverse events. This review also pointed out that only a few studies examined the effect of the LPN independent of RNs on levels of patient safety (Ridley, 2009). In contrast, a study done by Bae, Kelly, Brewer and Spencer (2014) did find that an increase of one hour in LPN hours per day resulted in a decrease in the rates of falls in hospitals (incident rate ratio 0.54, standard error 0.150, $p<0.05$), when compared to a greater rate of falls with 0.3 hours or more of nursing care by temporary RNs (incident rate ratio 1.552, standard error 0.260, $p<0.01$). Several studies on nursing staff mix noted that more research should to be done specifically with LPNs (Bae et al., 2014; Glance et al., 2012; Ridley, 2009). The question of whether LPNs can adequately detect and manage patients who begin to deteriorate has not been studied.

The projected need for more LPNs in the healthcare workforce, the relatively small amount of research done with this population, and the projected shift in patient care areas to home care and long-term care settings suggests the need for more research into the abilities of LPNs to manage deteriorating patients. These non-acute care settings can be as cognitively demanding as acute care settings (Feng et al., 2018), and LPNs must be prepared to detect subtle changes in patients before their condition deteriorates. Assessing SA abilities among LPNs is urgently needed.

Situation Awareness (SA)

SA is a concept that was originally developed for the field of military aviation (Endsley, 1995). Briefly, it is the ability for a person to enter a situation, perceive relevant information in relation to the environment and situation, comprehend what that information signifies, and then project what is likely to happen. It is divided into 3 levels that range from lowest to highest: Level 1 is "perception of the elements in the environment", Level 2 is "comprehension of the current situation", and Level 3 is "projection of future status" (Endsley & Jones, 2012, p. 14).

Although it was developed for aviation, the concept of SA has been further developed for nursing (Fore & Sculli, 2013). Fore & Sculli equate the level of vigilance and monitoring required of a nurse, as described in the 2004 IOM report *Keeping Patients Safe,* with having high levels of SA. Fore and Sculli further note that it may be more difficult for nurses to maintain necessary levels of SA than it is for airline pilots, due in part to task load (caring for multiple patients), time pressure, and distraction. Sitterding, Broome, Everett and Ebright (2012) also analyzed SA as a concept, and note that nursing work environments can be highly complex and demanding due to the need for focused attention and constant priority setting, with little room for mistakes. They consider attention to be the biggest factor influencing SA, and defined SA in terms of perceiving and comprehending relevant cues in a patient's environment. Sitterding et al. (2012) then developed the three levels of SA based on how the nurse makes sense of those cues and anticipates or projects what will likely happen. Both Fore and Sculli (2013) and Sitterding et al. (2012) noted that experience increases levels of SA among nurses, just as Endsley (2012) contends happens in other fields. Concepts common to nursing, such as critical thinking, clinical reasoning and clinical judgment are all related to SA, but the concept is considered distinct (Fore & Sculli, 2013).

SA is developed through several processes, which include developing working memory capability, long-term memory stores and the ability to form mental models (Endsley & Jones, 2012). This comes from study, exposure and experience. A well-developed working memory allows for new information to be added to existing knowledge, in order to continuously develop a mental model of the current and changing situation (Endsley & Jones, 2012). A mental model is the systematic understanding of how something works, or general rules that can be applied to different situations (Garner & Boese, 2017). This is what allows a health practitioner to accurately project how a situation will evolve, even if they have never seen that particular situation before. Both of these cognitive processes contribute to SA, and are developed over time and with repeated exposure.

A lack of SA often precipitates cases of failure-to-rescue with deteriorating patient situations (Brady et al., 2013). Failure-to-rescue occurs when health care professionals fail to identify changes in a patient's condition as they are happening, and then consequently fail to respond to those changes in a way to prevent a negative outcome (Despins, 2018; "Failure to rescue", 2018). In the United Kingdom, 2015 figures estimate that up to 1000 deaths per month were attributable to failure-to-rescue (Waldie, Day & Tee, 2016), in part due to the nurses' inability to recognize a deteriorating patient. Endacott et al. (2011) found that part of the reason for cases of failure-to-rescue among hospital RNs was that they 1) did not feel encouraged to use high level monitoring devices, such as peak flow meters, and 2) they were dependent on the support from doctors, or had a low sense of autonomy. LPNs often work in settings where they may be the first ones to pick up on the cues that herald deterioration in a sick patient.

SA levels can be quantified, and are most commonly measured using simulated scenarios of deteriorating patients (Blackburn, Harkless & Garvey, 2013; Chang et al., 2017; Cooper et al., 2010; Hogan, Pace, Hapgood, & Boone, 2006; Lavoie et al., 2016; McKenna et al., 2014; Phillips, 2014). Research using simulation to assess for SA has been done with practicing nurses and physicians and among interprofessional teams (Hogan et al., 2006; Morgan et al., 2015). Simulation allows for participants to form mental models and develop working memory capacity and long-term memory in a safe environment, where deteriorating patient scenarios can be played out and practitioners can act in situations where no actual harm comes to patients. It can also be used to assess practitioners' abilities to draw from their own working memory and mental models, as they work through simulated scenarios.

Theoretical framework

SA theory (Endsley, 1995) was developed from Wickens' (1992) work on information processing theory, depicted in his Model of Human Information Processing. Information processing theory describes how humans perceive and respond to stimuli, given their attention resources and long- and short-term memories. Attention is considered that which describes the limits of one's ability to process information about multiple tasks and "their perceptual and cognitive elements" (Vidulich, Wickens, Tsang, & Flach, 2010, p. 194). Short-term memory is termed working memory, and is the capacity to hold information gathered from the senses (Wickens, 1992). This type of memory both informs and draws from long-term memory, in order to form mental models of stimuli gathered from a situation. Working memory breaks down quickly, and is constantly being informed by changes in the situation. Both long-term and working memory capacities are developed through experience.

SA theory takes the tenets of attention and working memory to describe how humans direct their attention to aspects of a given situation (Endsley, 2000). Attention is often directed to information based on how important a person perceives that information to be in relation to the situation. In a changing situation, directing and prioritizing attention to information is considered one of the most challenging aspects of SA. Working memory is where that information is stored in the short term, and can be used to form a mental model, which then contributes to comprehending the information in the situation.

Experienced decision makers are able to direct their attention based on mental models that form, draw information from long-term memory, and use these models to project where the situation is likely headed (Endsley, 2000). The more experienced the person is, the more quickly they will be able to direct and focus their attention, based on their developed mental models. Mental models are selected based on goals. For example, if a nurse comes into a room and sees a patient having trouble breathing, they will quickly make sure the patient is sitting upright. The goal is to maintain the person's airway and breathing ability. Simultaneously the nurse will begin to look for sources of the difficulty, based on what they know from experience and what they anticipate may be the problem.

Information Processing Theory (Wickens, 1992)	Situation Awareness (SA) (Endsley, 1995)	Example Situation
"What we pay *attention* to" Perception of stimuli based on: 1) *Senses* (sight, hearing, smelling, touching) 2) *Working (short-term) memory* (↓Retrieves ↑↓ Informs↑) 3) *Long-term memory* Perception is influenced by: a) draws on attention (distractions, interruptions) b) working and long-term memory c) outcomes of our actions	Informed by tenets of Information Processing Theory **Level 1 Perception** what information we pay attention to **Level 2 Comprehension** information held in working memory and informed by long-term memory **Level 3 Projection** informed by patterns, which are developed through experience and stored in long-term memory SA is the ability to *perceive* the elements in the environment, *comprehend* what is happening to the patient with respect to perceived data, and then *project* what will likely happen in the near future.	HR 115 RR 28 BP 102/68 Audible wheezes Drink at bedside Patient in a soiled gown Patient in a wet brief Tissues on the floor Dentures on table Cookies in crumbs on bed ***Perception***: An experienced nurse will pick up on the signs of respiratory distress in the patient. A less experienced nurse might pay more attention to the dentures on the table, or the tissues on the floor. ***Comprehension***: Respiratory distress related to bronchial constriction. ***Projection***: Patient will begin to desaturate if medication is not given promptly.

Figure 1. Model of Information Processing Theory and SA as they relate to clinical practice.

SA is considered a “state of knowledge about a dynamic environment” (Endsley, 2000, p. 25). This state is continuously evolving based on actions taken within the changing situation. It is not the process of gathering information or decision-making, but rather the end result of information gathered and attended to.

Methods

Design

A cross sectional descriptive design will be used for this study. Institutional Review Board (IRB) permission will be obtained prior to beginning any study-related procedures. A fact sheet will be provided to the participants at the beginning of the study.

Sample

A convenience sample of practicing LPNs who are alumni of a community college in the northeast will be recruited from a list serve of LPN graduates (obtained through the nursing office) from the past 10 years. There are 448 LPN graduates from 2009-2018. This population was chosen because, as graduates of the same institution, they will all have had some exposure to simulation experiences as part of their nursing school curriculum. The simulation lab at the community college has been in operation for 10 years. All students have been exposed to simulation scenarios, but to different degrees since the curriculum changed over time with an increase in simulation resources and with an increase in faculty expertise.

Participants who are not graduates of the community college will also be recruited through snowball sampling, in order to achieve the desired sample size. Simulation in nursing education is common, and it is reasonable to expect LPNs to have had some exposure to it in their education. A question regarding comfort level with simulation is provided in the demographics survey, in order to control for this variable.

Participants will be recruited through emails, the community college social media platforms (Facebook®, Twitter®, etc), flyers placed in local long-term facilities, and through snowball sampling. Recruitment will begin after IRB approval, and scenarios will be conducted during the Spring and Summer of 2019. Participants will receive a $25 Amazon gift card at the completion of the one-day study and will be awarded 2 contact hours (2 hours to prepare students, complete scenarios, debrief, and complete forms) of continuing education units as an incentive for participation in the study. Contact hour approval will be sought through the University of Massachusetts School of Nursing.

Inclusion criteria include holding a valid LPN or LVN (licensed vocational nurse, the term used in New Hampshire and some other states) license, working at least 24 hours per week, and working in acute care, long-term care, subacute care, or a home care setting. LPNs will be excluded if they completed or are enrolled in an RN program.

Sample size

Endsley and Jones (2012) recommends having a minimum of 30 participants for each query (query is the term used for the questions administered with each scenario). However, previous SA studies (N=9) that reported both the sample size and the number of scenarios tested (Bogossian et al, 2014; Chang et al, 2017; Cooper et al. 2010; Hogan et al., 2006; Morgan et al., 2015; McKenna et al, 2013; O'Meara et al, 2015; Phillips, 2014; Weiler, 2017) reported sample sizes that ranged between 16 and 97 with the average number of participants per query being 13 (range 2-33 participants/query). Therefore, the planned sample size for this study will include approximately 40 subjects per query or up to 60 LPNs.

Setting

The study will take place in the simulation lab, which is situated in a community college located in the northeast of the U.S. The lab consists of 4 simulated patient rooms, with 4 high fidelity human patient simulators. It is equipped with video cameras, and a separate room where participants can be monitored, and an operator can respond to participants' actions and statements during a simulation. There is an adjacent but separate room, which can be used for preparation before a scenario and debriefing after a scenario.

Procedure

Informed consent will be obtained by the principal investigator (PI) prior to the start of any study procedures.

Simulation

The study will incorporate two simulation scenarios typically encountered with an aging population in skilled nursing facilities and home care: 1) chronic obstructive pulmonary disorder (COPD) or asthma that leads to respiratory distress and 2) a urinary tract infection that leads to urinary sepsis. These were chosen out of a group of nine conditions identified by the Centers for Medicare and Medicaid as conditions that often result in potentially avoidable hospital stays (Segal, Rollins, Hodges, & Roozeboom, 2014). The scenarios will be derived from National League of Nursing scenarios developed for teaching the care of aging patients. Prior to the study, each scenario will be reviewed by a team of three expert faculty members in the LPN program at the community college. This will be done to make sure the scenarios accurately reflect the topics being tested.

The Situation Awareness Global Assessment Technique requires that the queries be administered during freezes or stops in the scenario. This method has been shown to be reliable (Cronbachs' alpha 0.767) in human patient simulation studies (Hogan et al., 2006). The stops can be somewhat cumbersome (McKenna et al., 2014), but have also been shown to have no effect on the simulation experience as a whole (Cooper et al, 2010; Endsley, 2015).

A pilot trial scenario will be conducted for both scenarios, in accordance with best practices as outlined by the International Nursing Association for Clinical Simulation and Learning (INACSL Standards Committee, 2016). Pilot trials will be done with volunteers recruited from nursing faculty at the community college.

Participants will be oriented to the study purpose, and to the simulation lab. They will be given 10-15 minutes to become familiar with the high fidelity human simulator (one that is not being used in the study), and how the equipment surrounding the simulator works (how to obtain a blood pressure or pulse oximetry reading, for instance).

Scenarios will be run with each participant participating in the role of the LPN. Study participants will be given report prior to the start of the scenario, in the form of a nursing hand-off report. Each scenario will be 8-minutes long with the first stop between 3-4 minutes after the beginning of the scenario, as recommended by Endsley and done by previous studies. The second stop will be done at the end of the scenario. Participants will be asked to turn away from the monitors and the simulators during the stops, the curtains will be pulled, and they will answer the twelve queries or questions adapted from Cooper et al. (2011) for the scenario. The questions will be provided on a sheet of paper attached to clipboard, and participants will be given up to 5 minutes to complete them. A research assistant will be hired to provide scripted answers for questions asked of the high fidelity human simulator during the simulation, in order to provide consistency in the scenarios.

Each scenario will be followed by a 20-minute debriefing session where participants can reflect on the scenario. Debriefing will be done with standard questions derived from the NLN

Simulation Design Template ("Simulation Design Template", 2018). The debriefing session is done in accordance with best practices, as defined by the International Nursing Association for Clinical Simulation and Learning (INACSL Standards Committee, 2016). Debriefing sessions will be recorded on a secure recorder, for future analysis.

Measures

Situation Awareness Global Assessment Technique (SAGAT)

The SAGAT was developed by Endsley (2012) to assess levels of SA in simulated situations in many different fields, including medicine and nursing (Cooper et al., 2010; Hogan et al., 2006; McKenna et al., 2014; Morgan et al., 2015; Phillips, 2014). It has been used to assess SA in both practicing professionals and pre-licensure students.

SA will be evaluated using the SAGAT queries as developed by Cooper et al. (2011) in their study with registered nurses. The queries will be slightly adapted to fit the two scenarios developed for this research study, as is permitted by Endsley. These queries look at 4 areas: physiological perception (3 items), global situation perception (3 items), comprehension (2 items) and projection (4 items). Each item will be scored dichotomously, with 0 points for an incorrect answer and 1 point for a correct answer. As done in previous studies, answers that require a value, such as "What is the BP at the moment?" are considered correct if they are within 10% of the actual value (McKenna et al., 2014; Cooper et al. 2011). Perception is divided into 2 subscales, in order to assess a participants' perception of the patient (physiological) and of the environment (global) in the scenario. For examples of the SAGAT queries, see Appendix 1 and Appendix 2.

Scores for the SAGAT are quantified in the aggregate (as a total score, or a maximum of 24 points, 12 for each stop), and as specific SA level totals (a maximum score of 6 for global perception, for example). These scores will then be converted to percentages (percentage correct), in order to compare to other studies done on registered nurses.

This measure has been found to be reliable and valid in studies done with healthcare practitioners. Hogan et al. (2006) determined adequate reliability (Cronbach's alpha of 0.767) in his study using the SAGAT with medical students and physicians. Phillips (2014) found Kuder-Richardson-20 reliability scores of 0.77 and 0.696 for her sophomore and senior nursing students, respectively, in her study using the SAGAT.

Endsley (2000) found high reliability (test-retest scores 0.98, 0.99, 0.99, and 0.92) for mean SAGAT scores with fighter pilot simulations. Endsley also noted that the freezes or stops incorporated into the technique do not impact performance in studies with aviation.

Demographics

Demographic data will be collected that include age, gender, race/ethnicity, years practicing as an LPN, and type of work setting (acute care, extended care, subacute care, home care), experience with simulation exercises and comfort levels with simulation. A question regarding participants' self-rated ability to pick up on cues of patient deterioration will also be included.

Satisfaction with Simulation Experience Scale (SSES)

This 18-item scale measures participants' satisfaction with the simulation experience and has 3 subscales a) debriefing and reflection (n=9 items), b) clinical reasoning (n=5 items) and 3) clinical learning (n=4 items). This scale was designed for use with scenarios with patient deterioration, and was used in one of the studies that also used the SAGAT (O'Meara, et al., 2015).

The overall Cronbach's alpha for this scale was 0.77. Subscale alphas were: debriefing and reflection (0.935), clinical reasoning (0.855), and clinical learning subscale (0.85) (Levett-Jones et al., 2011).

Data Management

Each participant will be given a unique identification number, in order to match their SAGAT scores with their demographic information and their SSES results. SAGAT and SSES scores will be gathered on paper, and identified by the unique identification numbers assigned each participant. Demographic data gathered through the questionnaire data will be collected on hard paper copies. All hard copies will be secured in a locked file cabinet in the office of the researcher.

Data will be entered into SPSS®, and the data stored on password protected research drive with access limited to the PI and the 3 dissertation committee members.

Data analysis

Data will be reviewed for accuracy, missing values, and improbable values. Descriptive statistics will be run on demographic data to describe the sample.

Aim #1: To examine SA scores, as measured by the SAGAT, in LPNs working in direct patient care and compare to published data on SA in other health care providers.

For specific aim #1, descriptive statistics will be used to describe SA scores in the study sample and compare them to published scores in other populations of health care providers.

Debriefing sessions will be recorded on secure recording devices. This data will not be included in this study, but will be retained for future studies.

Aim #2: To examine the relationship between SA scores and years of LPN experience.

For specific aim #2, the Pearson's correlation coefficient will be used to examine the relationship between SA scores and years of LPN experience A Spearman rank correlation will be used if data do not meet the Person r assumptions.

Aim #3: To exam differences in SA scores by type of workplace setting (acute care, long-term care, subacute care, or home care).

A chi-square test will be used to examine differences in SA scores by current workplace setting.

Aim #4: To describe the relationship between levels of satisfaction with simulation, as measured by the Satisfaction with Simulation Experience Scale (SSES) and SA scores among LPNs.

For specific aim #3, a Pearson's correlation coefficient will be used to examine the relationship between SA scores and the SSES scores. A Spearman rank correlation will be used if data do not meet the Person r assumptions.

Conclusion

Well-developed SA has been shown to decrease failure-to-rescue rates among patients (Brady et al., 2013), and is essential for patient safety in all types of patient care settings. LPNs will begin to grow in numbers in response to a growing demand, and will consequently constitute a greater percentage of the nursing workforce in the coming years. As our aging population continues to grow and health care moves away from the hospital, it is reasonable to expect that more people will be cared for by the LPN. An assessment of their ability to detect and respond to patient deterioration and prevent failure-to-rescue will help educators and employers identify areas of strength and weakness in the LPN.

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Summary of Changes from the Proposal

The research approach, a cross-sectional descriptive study, was executed as outlined in the research proposal with the following changes:

1. As a means of (a) recruiting participants, and (b) making interested participants aware of upcoming research study sessions, I created a separate Facebook Page for my study. This page would be included in recruitment efforts already approved, such as placing the recruitment flyer on the MWCC Nursing Facebook page, and the MWCC College Facebook Page.
2. I removed the exclusion criteria, which excluded licensed practical nurses who were enrolled in a registered nurse program of any kind. This was done in to increase my participant numbers, as enrollment in the study had been slow.
3. A chance to win one of three $100 cash prizes was added to the incentives for participation. This was in addition to the incentives of a $25 Amazon gift card and 2 continuing education units.

Situation Awareness in Licensed Practical Nurses: a Pilot Study

Meghan Picone
University of Massachusetts Medical School

Introduction

Situation Awareness (SA)

Ability to recognize and respond to significant changes in a patient situation

Essential to detect subtle cues of patient deterioration
(Brady et al, 2013; Cooper, Porter & Peach, 2014)

SA levels studied in a variety of healthcare professionals

- RNs, MDs, EMTs, paramedics, students, interprofessional teams

Minimal research done with licensed practical nurses (LPNs)

Background & Significance: LPN & Patient Outcomes

- LPNs make up ~ 17% of nursing workforce (National Nurse Database, 2019)
- 51% work in residential facilities and homecare ("Progress and precision", 2018)
- By 2030: demand for LPNs will increase by 44%, while supply will increase by 26% ("Progress and precision", 2018)
- Limited research examining LPN independent of RN

Literature review (patient outcomes) - acute care - LPN hours compared to RN hours	
Frith et al. (2012)	Increase in LPN hours resulted in more med errors
Glance et al. (2012)	Increase in LPN time resulted in higher patient mortality
** Bae et al. (2014)	Increase in LPN time resulted in decreased fall rate

Purpose Statement & Aims

To describe situation awareness (SA) among LPNs working in direct patient care.

Aims

1) Examine SA scores in LPNs working in direct patient care and compare to published data on SA in RNs.

2) Relationship between SA scores and years of LPN experience.

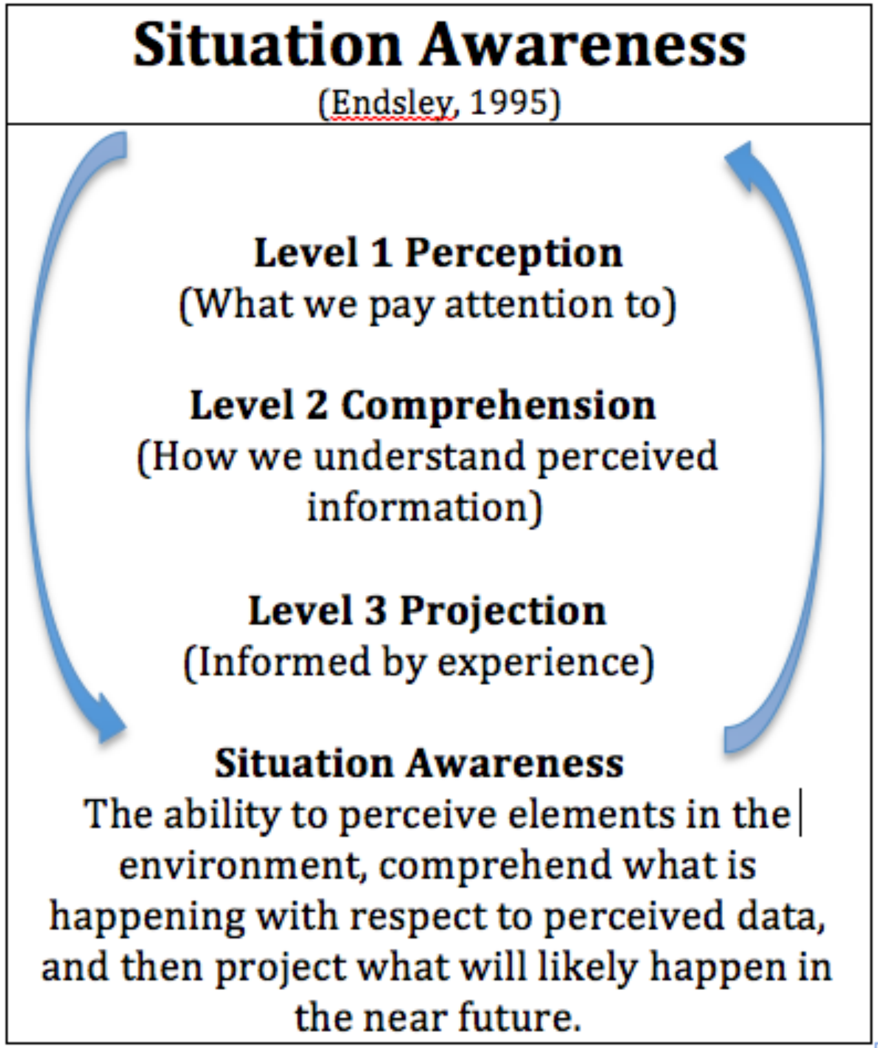
3) Differences in SA scores by type of workplace setting (long-term care/subacute or other).

4) Relationship between levels of satisfaction with simulation and SA scores among LPNs.

Theoretical Framework

Information Processing Theory
(Wickens, 1992)

Attention & Perception based on:
1) Sensory data
2) Working memory
3) Long-term memory



Example situation

HR: 115
RR: 28
O2 Saturation: 91% on room air
Audible wheezes

Drink at bedside
Tissues on bed and floor
Cookie in crumbs on the bed

Methods

- **Design**: Cross-sectional descriptive
- **Sample**: Convenience sample of LPNs
- **Sample size**: 24
- **Inclusion criteria**:
  - * LPN/LVN
  - * Work at least 24 hours/week
  - * Work in direct patient care (long-term/subacute or other)
- **Exclusion criteria**: Not working in direct patient care, or working less than 24 hours/ week
- Informed consent (fact sheet)
- IRB approval from UMMS

* due to slow enrollment decision was made to change inclusion criteria to include LPNs enrolled in an RN program

Procedure - Measures

Demographics form - participants								
Age	Gender	Race	Years since graduation from LPN program	Type of work setting	Self-rated ability to pick up on cues of patient deterioration	Exposure to simulation scenarios	Comfort levels with simulation	Enrollment in RN program

Procedure - Measures

- **Situation Awareness Global Assessment Technique (SAGAT)**
- Technique reliable and valid (Endsley, 2000; Hogan et al., 2006)

- Questions measure 3 levels of situation awareness
- 12 Questions adapted from Cooper et al. (2011). Used with permission.

  1) Perception: 3 physiologic and 3 global
  2) Comprehension: 2
  3) Projection: 4

- **Freeze**: scenario stopped after 4 minutes, participants turn away from scenario and answer questions (on paper).

- Answers scored dichotomously (correct or incorrect).
- Quantified as a total score and as specific SA level scores.

Procedure - Measures

- **Satisfaction with Simulation Experience Scale (SSES)**
  (Levett-Jones et al., 2011)

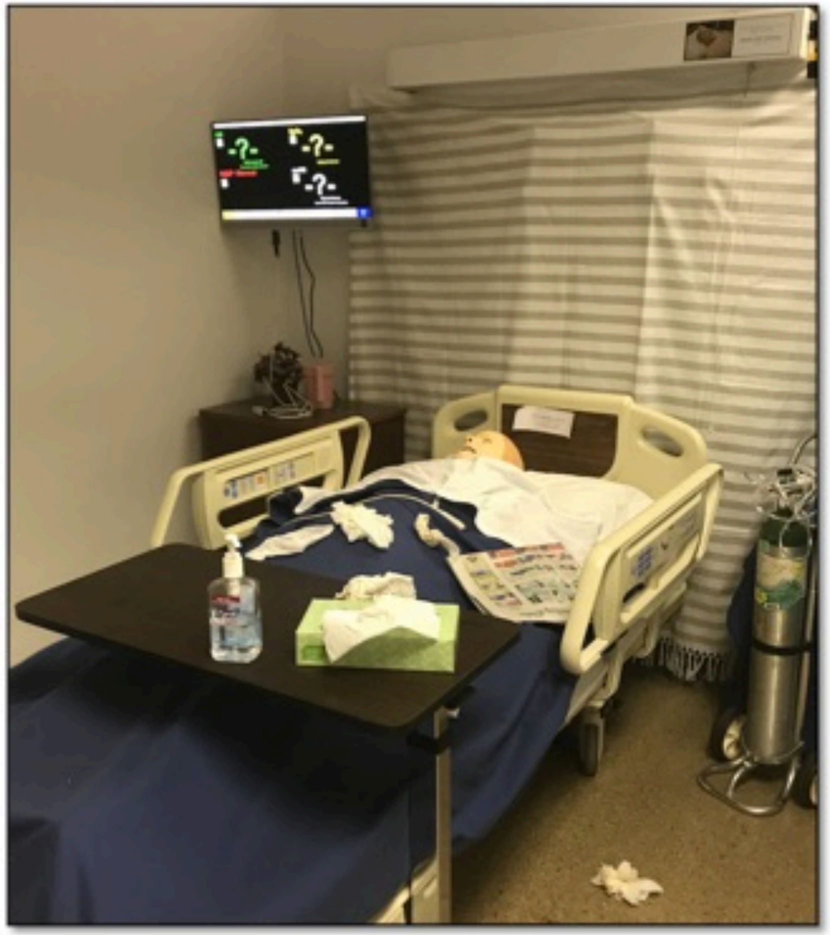
- Designed for use with simulation scenarios of deteriorating patients.
- 18-item scale:
  - Debriefing and reflection
  - Clinical reasoning
  - Clinical learning
- Reliability: Cronbach's alpha 0.77

Procedure - Simulation

- **2 simulation scenarios, each 8-minutes long**
- Study modeled after research by Cooper et al. (2011).
- Cooper study looked exclusively at RNs, and was used for comparison.
  RN scenarios: acute MI and COPD exacerbation in acute care.

- **Scenarios in long-term and subacute care:**
  1) COPD leading to respiratory distress (easier scenario)
  2) UTI leading to signs of urinary sepsis (more difficult scenario)
- **Scenarios chosen as:**
  1) typical of aging population in long-term and subacute settings
  2) identified by Centers for Medicare and Medicaid as conditions that often result in potentially avoidable hospitalizations (Segal et al., 2014)

Scenario set-ups



Respiratory scenario
Long-term care

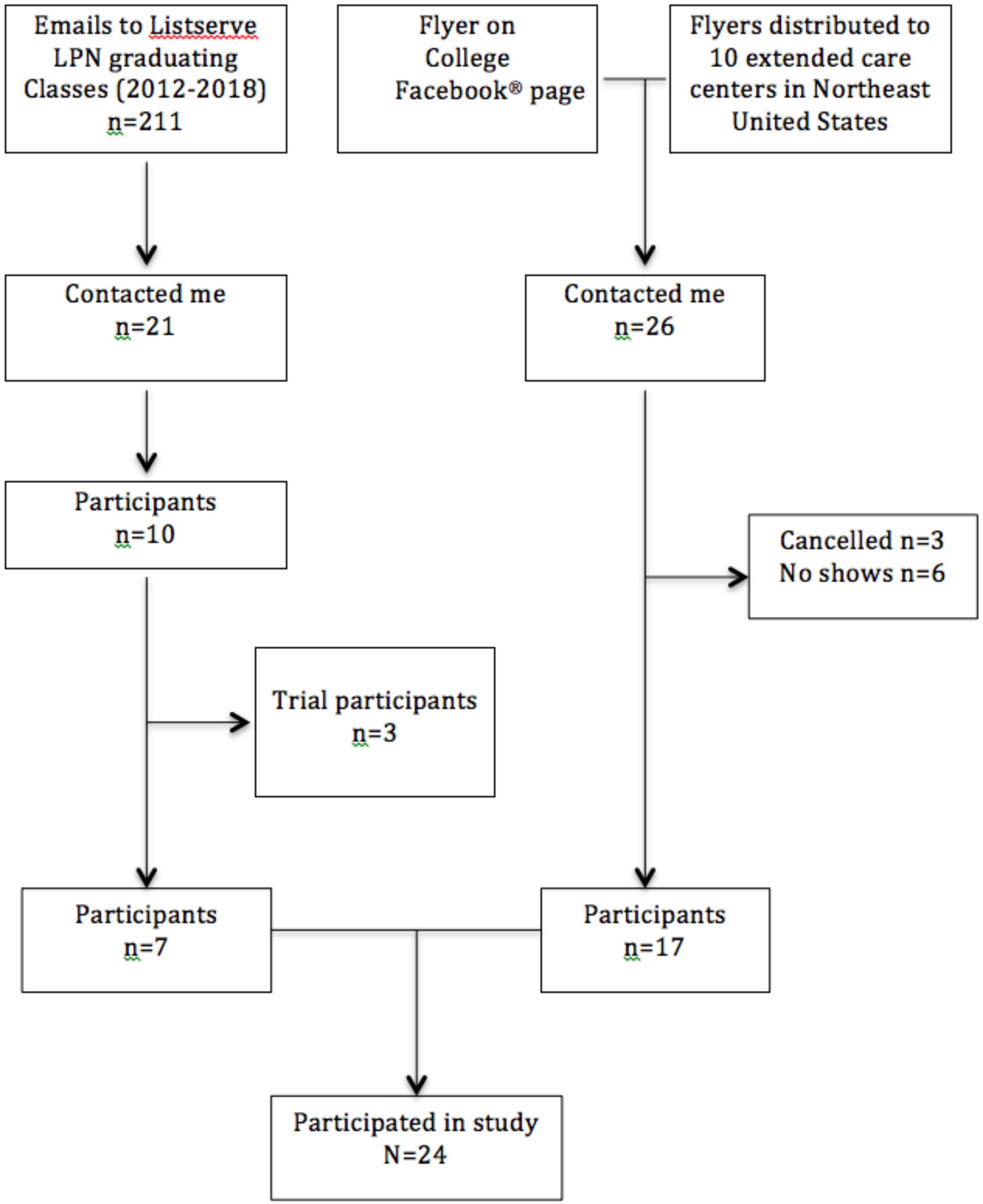
Urinary scenario
Subacute unit

Pilot testing

- 3 research assistants
  1) control of simulators
  2) appropriate mannequin responses
     (instrument fidelity)

- Trial with 3 LPN participants from community
  1) improved fidelity (realism) of scenarios
  2) identified areas of confusion
  3) improved mannequin responses
     * data not included in main study findings

Recruitment



Compensation: $25 Amazon gift card, 2 contact hours, chance to win $100.

Procedure - Simulation

Orientation

- Participants oriented to study, completed demographics form, reviewed fact sheet
- Pre-briefing: orientation to simulation mannequins, lab
- Brief hand-off report given

SAGAT

- Tested one at a time
- 8-minute scenarios, with one freeze 4 minutes into scenario
- Respiratory scenario followed by urinary scenario
- 12 SAGAT questions asked at the freeze, and again at the end
- Followed by 15-20 minute structured debriefing period

Data Management

- Unique identification number
- Data entered into SPSS® software
- Data maintained on an R-drive provided by UMMS
- All hard copies stored in a locked file in Principal Investigator’s office.

Data Analysis

Aim	Results Analysis
1: SA scores (SAGAT) in LPNs & comparison to published data on RNs.	*Descriptive statistics
2: Relationship between SA scores and years of LPN experience.	*Spearman's rho
3: Differences in SA scores by type of LPN work	*Chi-square
4: Relationship between satisfaction with simulation levels (SSES) and SA scores.	*Spearman's rho

Results - Demographics

		N=24	Enrolled in RN program (n=10)	Not enrolled in RN program (n=14)	p-value
Age (years)		37.8	35.6	38.6	0.47
Gender	Female Male	22 2	9 1	13 1	0.82
Race	**Black** **White**	**5** **19**	**4** **6**	**1** **13**	**0.05**
Ethnicity	Not Hispanic	100%			
Graduation from PN program (years)		5.9	3.9	7.3	0.14
Hours worked/week		**37.1**	**30.6**	**41.7**	**0.004**
Primary place of work	Subacute & Long-term Other	14 10	5 5	9 5	0.067
Exposure to simulation	Yes No Unsure	15 8 1	7 3	8 5 1	0.40
Comfort level with simulation	Very comfortable Comfortable Not comfortable	1 18 5	 9 1	1 9 4	0.058
Ability to pick up on cues	Likert Scale		3.3	3.6	0.30

SA scores for LPNs

KR-20 = 0.73

SA scores by Level (% Correct)	Respiratory Scenario	Urinary Scenario	Both Scenarios
Perception	62.7	68.8	65.7
Comprehension	88.5	76.3	82.4
Projection	85.9	73	79.5
SA Scores, totals	72.3	71.3	71.8

	Enrolled	Not enrolled	p-value
Total SA Scores (average)	71.9	72.9	0.83

* Higher scores indicate higher situation awareness

Comparison of SA Performance
LPN versus RN

Factor	**LPN (N=24)**	**RNs (N=33)** **(Cooper et al., 2011)**
	Average of SA scores on 2 scenarios	
Perception	65.7%	37.5%
Comprehension	82.4%	58%
Projection	79.5%	77.1%
Total Scores	71.8%	50%

* Higher scores indicate higher situation awareness

Results

- Experience and SA scores

Scenario	Relationship
Respiratory Scenario	No relationship (Spearman's rho = -0.05, p=0.83)
Urinary Scenario	Significant relationship (Spearman's rho = 0.49, p=0.02)

- Place of work and SA scores

Scenario	Differences
Respiratory	No difference (Chi square 10.6, p=0.30)
Urinary	No difference (Chi square 8.9, p=0.63)

Satisfaction with Simulation Experience Scale

- Reliability

Cronbach's alpha	**0.97**

- Satisfaction level

Average rating	**Range (Likert scale, 1-5)** ***higher numbers indicated higher satisfaction**
4.73	3-5

- Relationship to SA scores

No relationship	**(r=-0.06, p=0.78)**

Limitations

- Slow enrollment
- Small sample, but adequate for a pilot study
- Not generalizable

Conclusion

1) LPN scores demonstrated a good level of situation awareness. Specific to common patient deterioration situations in long-term and subacute care.

2) LPN scores were comparable to RN scores, and better in some aspects.

3) LPNs will remain a significant and vital component of the healthcare workforce, especially as our population ages.

4) More research needs to be done with this understudied nursing group.

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Dr. James Fain

PhD Cohort

Study Team

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Elizabeth DelSignore, MSN, RN

Cherie Trout, RN

Colleagues at MWCC

My family

Dissemination Plan

The primary description of this dissertation work was submitted as a manuscript on May 26, 2020 to *Nursing Education Perspectives* for review and consideration for publication.

Appendix 1. Situation Awareness Global Assessment Technique (SAGAT - 4 levels). Respiratory distress scenario (COPD)

Level	**Question**	**Scoring**	**Score**
Physiological Perception	1. What is the BP at the moment?	1= SBP/DBP within +/- 10% of actual value 0 = SBP/DBP > or < than +/- 10% of actual value.	
	2. What is the HR at the moment?	1= HR within +/- 10% of actual value 0 = HR > or < than +/- 10% of actual value.	
	3. What is the respiratory rate at the moment?	1= RR within +/- 10% of actual value 0 = RR > or < than +/- 10% of actual value.	
Total level score		Maximum = 3/ query	
Global Perception	4. Is oxygen available?	1 = yes 0 = no	
	5. What is on the patient's bedside stand?	1 = Used tissues, spilled coffee, inhaler 0 = don't know, none of the above	
	6. What is attached to the wall by the bed?	1 = call light, oxygen tubing 0 = don't know, none of the above	
Total level score		Maximum = 3/query	
Comprehension	7. Is the patient adequately oxygenated? List SPO2.	1= SPO2 within +/- 10% of actual value (85%) 0 = SPO2 > or < than +/- 10% of actual value.	
	8. What is wrong with this patient?	1 = (Respiratory distress, asthma attack, COPD exacerbation) 0 = other	
Total level score		Maximum = 2/query	
Projection	9. If the condition does not improve, what will happen to the HR initially?	1 = increase 0 = decrease or stay the same	
	10. If the condition does not improve, what will happen to the RR?	1 = increase 0 = decrease or stay the same	
	11. What tests (interventions) may be required?	1 = (Chest x-ray 0 = don't know	
	12. What medications may be required?	1 = albuterol, oxygen 0 = don't know, other	
Total level score		Maximum = 4/query	
Total scale score		Maximum = 12/query	

Appendix 2. Situation Awareness Global Assessment Technique (SAGAT - 4 subscales). Urinary Sepsis scenario (UTI)

Level	**Question**	**Scoring**	**Score**
Physiological Perception	1. What is the blood pressure at the moment? (86/62)	1= SBP/DBP within +/- 10% of actual value 0 = SBP/DBP > or < than +/- 10% of actual value.	
	2. What is the heart rate at the moment? (115)	1= HR within +/- 10% of actual value 0 = HR > or < than +/- 10% of actual value.	
	3. Is the patient adequately oxygenated? (no)	1 = no; 0 = yes	
Total level score		Maximum = 3/ query	
Global Perception	4. Is the call bell available to the patient? (no)	1 = yes 0 = no	
	5. What is on the wall by the bed?	1 = (Child's drawing) 0 = don't know, none of the above	
	6. What is on the patient's table?	1 = (uneaten meal, dentures) 0 = don't know, none of the above	
Total level score		Maximum = 3/query	
Comprehension	7. Is the patient adequately oxygenated? List SPO2. (88%)	1= SPO2 within +/- 10% of actual value 0 = SPO2 > or < than +/- 10% of actual value.	
	8. What is wrong with this patient?	1 = (infection, UTI, delirium) 0 = other	
Total level score		Maximum = 2/query	
Projection	9. If the condition does not improve, what will happen to the HR?	1 = increase 0 = decrease or stay the same	
	10. If the condition does not improve, what will happen to the heart rate?	1 = increase 0 = decrease or stay the same	
	11. What tests may be required?	1 = UA/C&S 0 = don't know	
	12. What medications may be required?	1 = (antibiotics, IV fluids) 0 = don't know, other	
Total level score		Maximum = 4/query	
Total scale score		Maximum = 12/query	

Appendix 3. Satisfaction with Simulation Experience Scale (SSES).

Subscale	**Question**	**Likert Scale** 1=strongly disagree 2=disagree 3=unsure 4= agree 5= strongly agree
Debrief and Reflection	The facilitator provided constructive criticism during the debriefing	1 2 3 4 5
	The facilitator summarized important issues during the debriefing.	1 2 3 4 5
	I had the opportunity to reflect on and discuss my performance during the debriefing	1 2 3 4 5
	The debriefing provided an opportunity to ask questions.	1 2 3 4 5
	The facilitator provided feedback that helped me to develop my clinical reasoning skills.	1 2 3 4 5
	Reflecting on and discussing the simulation enhanced my learning.	1 2 3 4 5
	The facilitator's questions helped me to learn.	1 2 3 4 5
	I received feedback during the debriefing that helped me to learn.	1 2 3 4 5
	The facilitator made me feel comfortable and at ease during the debriefing.	1 2 3 4 5
Clinical Reasoning	The simulation developed my clinical reasoning skills.	1 2 3 4 5
	The simulation developed my clinical decision making ability.	1 2 3 4 5
	The simulation enabled me to demonstrate my clinical reasoning skills.	1 2 3 4 5
	The simulation helped me to recognize patient deterioration early.	1 2 3 4 5
	This was a valuable learning experience.	1 2 3 4 5
Clinical Learning	The simulation caused me to reflect on my clinical ability.	1 2 3 4 5
	The simulation tested my clinical ability.	1 2 3 4 5
	The simulation helped me to apply what I learned from the case study	1 2 3 4 5
	The simulation helped me to recognize my clinical strengths and weaknesses.	1 2 3 4 5

Appendix 4. Demographics

Question	**Response**
1. What is your age?	_______ years
2. What gender do you identify with?	Female = 1 Male = 2 Other = 3 Please specify:
3. What is your race?	American Indian/Alaska Native = 1 Asian = 2 Black/African American = 3 Hispanic/Latino = 4 Native Hawaiian/Pacific Islander = 5 White = 6
4. What is your ethnicity?	Hispanic/Latino = 1 Not Hispanic/Latino = 2
5. How many years has it been since you graduated your PN program?	________ years
6. How many hours per week (on average) are you currently working as an LPN?	________ hours
7. What best describes your primary place of work (where you work more than half the time)?	Acute care = 1 Subacute care = 2 Extended care = 3 Home care = 4 Other = 5 Please specify:
8. If you work a second job as an LPN, what best describes that place (where you work less than half the time)?	Acute care = 1 Subacute care = 2 Extended care = 3 Home care = 4 Other = 5 Please specify:
9. Were you exposed to simulation scenarios (working with high fidelity human simulators) in your PN program?	Yes = 1 No= 2 Not sure = 3
10. How comfortable do you feel with simulation exercises?	Very comfortable = 1 Comfortable = 2 Not comfortable = 3
11. Please rate your ability to pick up on subtle cues when a patient's health condition is starting to deteriorate. (1= very limited skills to 5=highly proficient)	Very Limited ... Highly Proficient 1 2 3 4 5

Appendix 5. Debriefing template.

Directions • Debriefing should last about 15-20 minutes. • Alert participants that they are being audio recorded, but no identifying information will be included.
1. How did you feel throughout the simulation experience?
2. Give a brief summary of these patients and what happened in the simulations.
3. What were the main problems that you identified?
4. What were the key assessment and interventions for these patients?
5. Discuss how you identified these key assessments and interventions.
6. If you were able to do this again, how would you handle the situations differently?
7. What did you learn from this experience?
8. How will you apply what you learned to day to your clinical practice?
9. Is there anything else you would like to discuss?
Derived from the Simulation Design Template (2018, March) as developed by the National League of Nursing.