Published in final edited form as:

J Adv Nurs. 2010 May ; 66(5): 1183–1192. doi:10.1111/j.1365-2648.2010.05269.x.

Flight nursing expertise: towards a middle-range theory

Andrew P. Reimer, BSN, RN and

Doctoral Candidate, Frances Payne Bolton School of Nursing, Case Western Reserve University, Cleveland, Ohio, USA

Shirley M. Moore, PhD, RN

Edward J and Louise Professor of Nursing, Frances Payne Bolton School of Nursing, Case Western Reserve University, Cleveland, Ohio, USA

Abstract

Aim—This paper presents a middle-range Theory of Flight Nursing Expertise.

Background—Rotary-wing (helicopter) medical transport has grown rapidly in the USA since its introduction, particularly during the past 5 years. Patients once considered too sick to transport are now being transported more frequently and over longer distances. Many limitations are imposed by the air medical transport environment and these require nurses to alter their practice.

Data sources—A literature search was conducted using Pubmed, Medline, CINAHL, secondary referencing and an Internet search from 1960 to 2008 for studies related to the focal concepts in flight nursing.

Discussion—The middle-range Theory of Flight Nursing Expertise is composed of nine concepts (experience, training, transport environment of care, psychomotor skills, flight nursing knowledge, cue recognition, pattern recognition, decision-making and action) and their relationships. Five propositions describe the relationships between those concepts and how they apply to flight nursing expertise.

Implications for nursing—After empirical testing, this theory may be a useful tool to assist novice flight nurses to attain the skills necessary to provide safe and competent care more efficiently, and may aid in designing curricula and programmes of research.

Conclusion—Research is needed to determine the usefulness of this theory in both rotary and fixed-wing medical transport settings, and to examine the similarities and differences related to expertise needed for different flight nurse team compositions. Curriculum and training innovations can result from increased understanding of the concepts and relationships proposed in this theory.

Keywords

flight nursing expertise; middle-range theory

Correspondence to A.P. Reimer: axr62@cwru.edu.

Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

AR and SM were responsible for the study conception and design; were responsible for the drafting of the manuscript; and made critical revisions to the study for important intellectual content.

Introduction

Flight nursing (FN) is a specialized area of transport nursing that differs in several ways from other areas of acute care nursing. These differences include an unstructured work environment, limited supplies, limited support and altered assessment approaches. As a result of these differences and limitations of the work environment, Topley *et al.* (2003) have proposed that expertise specific to FN is required in order for these nurses to practise effectively and safely. Although expert nursing practice has been investigated in multiple clinical settings, only three studies have been conducted focusing specifically on FN (Stohler 1998, Pugh 2002, Topley *et al.* 2003).

Transport nursing continues to grow in many countries, including the United States of America (USA), Canada, United Arab Emirates, Australia, India and Turkey, as healthcare systems implement time-sensitive treatments and move patients from community hospitals to tertiary care centres that offer consolidated, higher levels of care. Further understanding of the specialized expertise needed by flight nurses is necessary to develop advanced training programmes for these nurses. The purpose of this study is to propose a middle range Theory of Flight Nursing Expertise.

Background

Acute illness or injury of a patient often requires timesensitive specialty services such as trauma care, cardiac catheterization and surgery or neurosurgical intervention, and requires the patient to be rapidly transported a long distance from the scene of an accident or injury, or from a regionally located community hospital to a large, centrally located tertiary care centre. Air medical services (AMS) are an important means of providing timely transport of patients to increased levels of care. Use of AMS has been shown to save lives and reduce the cost of health care on both an individual patient level and system-wide level by bringing more advanced treatment capabilities to the patient sooner (FARE 2006). AMS also provide the ability to rapidly move critically ill patients over long distances and reduce out-of-hospital time for patients who require transfer to hospitals that offer more advanced and specialty care. As a result of these recognized advantages, the use of AMS has increased, as has the demand for flight nurses and their specialized knowledge.

Rotary-wing (helicopter) medical transport in particular has grown rapidly since its introduction, especially during the past five years. In the USA, according to the Atlas and Database of Air Medical Services (ADAMS), in 2003 there were 242 AMS operating 545 rotorcraft from 472 bases (ADAMS 2003). In 2007 that number grew to 312 AMS operating 810 rotorcraft from 664 bases (ADAMS 2007), completing approximately 500,000 transports a year (Services 2008). This staggering growth in air transport has created a critical need for FN expertise.

With the increase in use of AMS has come an increase in the level of severity of illness and injury of transported patients. Those once considered too sick to transport are now being transported more frequently and over longer distances. Managing acutely or critically ill patients during the transport process differs in several ways and presents different challenges from care in other acute care nursing settings. There are limitations imposed by the air medical transport environment, including limited supplies, limited resources and usually only one other healthcare provider with whom to work. This practice environment alters assessment approaches because of excessive noise and vibration, and is an unstructured work environment that requires the flight nurse to maintain rigorous situational awareness of the patient's condition and the safety of the crew, patient and public. The increased level of illness or injury of transported patients, the intensive care that these patients require, and the challenges faced

while transporting them require that flight nurses practise at an expert level (Topley *et al.* 2003). Developing a Theory of Flight Nursing Expertise could further aid in describing FN expertise, critical care nursing practice and provide a framework for research in this nursing specialty. This need to refine FN expertise further is the impetus for the development of the middle-range Theory of Flight Nursing Expertise described in this study.

Review of literature

Most research on FN, and more generally on air medical transport, is clinical in nature, focusing on the feasibility and effectiveness of clinical procedures (Lowe *et al.* 1998, Bacon *et al.* 2001, Bozeman & Young 2002, Frakes 2002, 2004), and clinical outcomes (Boyd *et al.* 1989, Cunningham *et al.* 1997, Thomas *et al.* 2002). Only three studies have been conducted addressing FN practice.

Of these, one phenomenological study by Topley *et al.* (2003) focused specifically on explicating FN expertise. The study was conducted with nurses who cared for multiple patients in military fixed-wing aircraft transports. It included 12 nurses with five or more years of nursing experience and one or more years of critical care air transport experience, and who were recognized as expert by peers. Through written narratives and individual and group interviews, the researchers found that the flight nurses practice was altered by the environment and required altered assessment approaches because of excessive noise, which limited their ability to hear breath sounds and obtain blood pressure readings. In addition, the flight nurses stated that current critical care experience and theoretical knowledge related to flight physiology and the impact of the transport environment was important. The researchers concluded that, because of the environmental factors and limited resources and supplies, flight nurses must expand their level of practice expertise beyond that of hospital-based critical care nurses.

Two other phenomenological studies have been conducted to investigate FN practice. Pugh (2002) interviewed six flight nurses with two or more years of experience and focused on their decision-making in emergency situations. Three themes were identified: (1) knowing the patient, (2) contexts of knowing – such as aviation environment and practice guidelines and (3) reflective practice. Stohler (1998) also studied, through interviews, six flight nurses with five or more years of experience. This study focused on team interaction in air medical transport and four themes related to high performance in air medical team interaction were identified: (1) collaboration, (2) mutual respect and trust, (3) fitness standards and (4) synergy. Based on these three phenomenological studies, the themes of environment, knowledge and experience are central concepts addressed in the Theory of Flight Nursing Expertise proposed in this study.

Another concept, identified in both the FN expertise and general nursing expertise literature, is the expert's use of intuition (Benner 1984, Benner & Tanner 1987, Young 1987, Cioffi 2001, Christensen & Hewitt-Taylor 2006a, Bergdahl *et al.* 2007). Although the use of intuition has been examined in depth and is considered an important attribute of nursing expertise, our understanding of intuition remains unclear. One view is that intuition is better understood and explained from a cognitive psychology perspective that posits that the vague understanding and descriptions of intuition may be because of the decision-making process in which an expert engages. The concepts of chunking (Simon & Chase 1973), long-term working memory (Ericsson & Kintsch 1995) and pattern recognition (Simon & Chase 1973, Cioffi 2001, Currey & Botti 2006, Ericsson *et al.* 2007,) provide a more detailed explanation of intuition. Therefore, the concept of intuition is not included in the proposed Theory of Flight Nursing Expertise because we think the more specific concepts of cue and pattern recognition give a better description and more detailed understanding of this cognitive process.

The concept of expertise has been investigated widely in other clinical settings in nursing (King & Clark 2002, Reischman 2002, Bonner 2003, Currey & Botti 2006, Bergdahl *et al.* 2007) and other disciplines, such as medicine and cognitive psychology. Christensen and Hewitt-Taylor (2006a) found that the nature of medical and nursing expertise in intensive care nursing may be similar, giving support for the integration of findings across these two disciplines. Ericsson (2006) found that expertise across the range of professional disciplines and arts and sports revealed sufficient similarities in the theoretical principles mediating the phenomena of expertise, and thus he proposed that a general theory of expertise be created. As a result of the Christensen and Hewitt-Taylor's (2006a) and Ericsson's (2006) findings of similarities exhibited in expertise, this phenomenon appears to show similar characteristics across disciplines that can be incorporated into a succinct theory. This has not, however, been done to date. Additionally, no studies have focused on FN expertise in rotary-wing medical transport, and only one has focused on fixed-wing FN expertise (Topley *et al.* 2003). Therefore, a theory of FN expertise could be useful for both practice settings of fixed-wing and rotary-wing.

Need for the Theory of Flight Nursing Expertise

Explicating FN expertise, and more importantly developing a middle-range Theory of Flight Nursing Expertise, is important for several reasons. First, expertise is considered necessary to practice (Topley *et al.* 2003) in AMS. This requirement can be most notably recognized in initial requirements to gain entry into the specialty, which usually include 2–5 years of critical care experience and multiple certifications to be obtained either before or soon after hiring. There also has been a recognized need to differentiate between expert and novice nurses to improve education of novice clinicians and to ensure the safe care of patients (Taylor 2002). More importantly, a theoretical framework of FN expertise will help identify and specify the relevant concepts (Ericsson & Smith 1991) of FN expertise to guide future meaningful inquiry in this emerging area of specialized nursing practice. The proposed middle-range Theory of Flight Nursing Expertise will also facilitate the acquisition of expertise through further identification of the critical competencies to include in advanced FN training programmes and curricula. Therefore, the aim of the Theory of Flight Nursing Expertise is to define and describe the relationships among a set of concepts that are of an abstract enough level so as not to be contextually constrained; that is, they are not limited to a particular practice setting, fixed-wing or rotary-wing, but specific enough to be descriptive of FN expertise.

Data sources

Method

The method used to develop the Theory of Flight Nursing Expertise was theory synthesis, described as the construction of theory from empirical evidence (Walker & Avant 2005). Current literature and the first author's clinical experience were used to construct this new theory. Both inductive and deductive reasoning were used in an iterative process.

The first step in forming this theory was the identification of focal concepts (expert practice and expertise) to guide the literature search and review. The second step, the literature review, revealed factors related to the focal concepts and specified the nature of the proposed relationships. The review was conducted using Medline, Pubmed, CINAHL and Internet searching for studies related to the focal concepts, as well as secondary references in identified studies. The keywords used were expert, expertise, FN, expert practice and transport nursing; studies were included if they were published between 1960 and 2008 in English. The third step entailed a concept analysis of expertise to identify the salient concepts and their relationships for inclusion and further development. The final step in theory formation was an iterative process among theory developers and practicing flight nurses to organize the concepts and

relationships into an integrated and efficient representation of the phenomena. Each concept was then defined based on supporting empirical evidence and supplemented when necessary with our own experience.

Discussion

Middle-range Theory of Flight Nursing Expertise

The Theory of Flight Nursing Expertise is both explanatory and predictive. Five assumptions guide this theory:

- Nursing is a practice discipline.
- Nursing practice consists of cognitive and psychomotor processes.
- The nursing process is continuous.
- The practice environment is dynamic and influences the nurse's decision-making and practice.
- FN is unique in its practice settings and required skills.

Figure 1 is a diagram of the Theory of Flight Nursing Expertise. The concepts depicted in the diagram are shown as a process from left to right, with the left-hand section containing the input concepts of experience and training. The middle of the diagram displays the throughput or processes concepts used during decision-making, and the right-hand sections depict the output, the actions taken by the flight nurse. The propositions for this theory, which describe the relationships among the concepts in Figure 1, are:

- Psychomotor skills, cue recognition and pattern recognition are expertise concepts (represented by the dashed line in Figure 1) that influence decision-making.
- The transport environment of care influences decision-making, the use and delivery of psychomotor skills, and cue and pattern recognition.
- Flight nursing knowledge influences the use and delivery of psychomotor skills, increases cue and pattern recognition, and influences decision-making.
- Experience and training contribute to factors associated with decision-making (transport environment of care, psychomotor skills, cue and pattern recognition, and FN knowledge).
- Decision-making influences actions taken or not taken.

Transport environment of care—The definition of transport environment of care is the surrounding or setting (aircraft fuselage) in which the flight nurse is providing care. Flight nurses practise in a variety of dynamic, structured and austere environments (Smith 2008), including: (i) prehospital – motor vehicle crash site and natural or technologic disaster, (ii) an ambulance, (iii) various hospital units and (iv) aircraft fuselage. Each environment of care entails considerations during decision-making that vary depending on the flight nurse's current and future care environments. Flight nurses must provide the same standards of care as hospital-based critical care nurses while practising in austere (Smith 2008) and dynamic environments; this ability differentiates FN practice from hospital-based nursing and explicates FN expertise.

The aircraft fuselage is an environment that presents many unique challenges and limitations specific to FN practice. Limitations in this environment include space, which sometimes restricts access to the patient, and excessive noise and vibration produced by the aircraft, which can limit assessment capabilities and the flight nurse's ability to treat and monitor the patient. Additional stressors imposed in the air medical environment include fatigue, gravitational

forces, decreased humidity and barometric pressure changes, as well as decreased partial pressure of oxygen. An example of the influence that the current or future environment of care has on the flight nurse's decision-making is airway management. A flight nurse may choose to intubate a patient with a compromised airway or a high potential to develop respiratory complications. The decision to intubate a patient may take place in a referring emergency department or in the back of an ambulance prior to air transport to avoid having to carry out intubation in the aircraft during flight. Performing such procedures in the back of the aircraft potentially can be dangerous to the crew and patient because of the limited assessment abilities; for example, inability to auscultate breath sounds, and the repositioning or unlocking of the cot or flight crew harnesses to reposition themselves or the patient to perform procedures.

Decision-making—A central concept of FN expertise is decision-making, which is defined as the process of making a choice between two or more options that follows consideration of all variations of the options (Matteson & Hawkins 1990); it is done by experts in a rapid and confident manner (King & Clark 2002). Decision-making ultimately influences action (Pesut 2008). Action, the outcome of decision-making, is defined as performing an activity. In this situation, action can also include choosing to withhold activity.

Clinical decision-making and situational awareness are considered necessary components of expertise (Endsley 2006). Flight nursing practice is time-sensitive, the environment is constantly changing, and the condition of patients is often critical. Rapid and accurate decision-making are required to function at the expert level in FN to ensure good air medical crew interaction and operation and optimal patient outcomes.

Examples of clinical decision-making conducted by flight nurses include providing psychological support and care for patients experiencing acute illness or injury; deciding if, when, and where to perform procedures such as airway management; and determining how best to move a patient. This decision-making is conducted while taking into consideration all relevant factors that differentiate FN practice. For example, flight nurses consider differently the administration of medications or other treatments that would normally be administered in a hospital setting. The flight nurse may choose to withhold the administration of a particular medication in anticipation of negative side effects the patient may experience, such as hypotension, which is more difficult to manage with the limitations imposed by the transport environment. These medications would otherwise be given in a hospital setting where there are more resources, including additional healthcare providers and more accurate vital sign monitoring, enabling the nurse in that setting to handle any change in patient condition better.

Another type of decision-making is related to safety, particularly situational awareness. There are multiple challenges throughout the transport process of which flight nurses must be aware to practise safely and effectively. Situational awareness is continuously required while operating in the dynamic and unstructured environments of AMS. These unstructured environments include motor vehicle crashes or natural or technologic disasters that present many dangers the flight nurse must monitor while delivering care. Dangers include toxic agents, downed power lines, watery environments and the moving aircraft blades. Constant awareness of surroundings is vital for the safety of flight nurses, their crew members, and those for whom they are caring.

Psychomotor skills—Psychomotor skill is defined as voluntary muscular movements involving both mental and motor processes (OED 2008); psychomotor skills are usually gained through experience and training, and are performed proficiently. Thompson *et al.* (1990) propose that the essence of expertise is the ability to perform the required physical activity rapidly and accurately (psychomotor skills), and that it develops over time as a result of relevant clinical and educational experience. Two studies indicate that experts exhibit increased skill

(Baumann 2006, Bergdahl *et al.* 2007), but are unclear about what type of skill was addressed, such as decision-making or procedural skill; however, expertise in several studies is specifically described as including the ability to perform psychomotor skills or tasks proficiently (Benner 2004, Dunphy & Williamson 2004, Bonner & Greenwood 2006). The ability to perform procedures or tasks proficiently with minimal conscious processing gives the individual more working memory for attending to other information and increased situational awareness (Endsley 2006). This ability to have increased situational awareness, as previously mentioned, is crucial for the flight nurse.

Psychomotor skills are typically required of flight nurses to perform procedures such as obtaining central venous access, intubation, surgical airways, surgical cutdowns, and thoracotomy or thoracostomy. Flight nurses' proficiency or lack of confidence in their psychomotor skills can dictate how they choose to manage a patient. During decision-making, flight nurses think about their psychomotor skill level when considering treatment options, and their decisions are especially dependent on the environment of care in which they are in or may soon be practising.

Cue recognition—Cues are defined as pieces of a clinical situation that can be recognized, fitted together to form a recognizable pattern, and interpreted for appropriate actions (Thiele *et al.* 1986). Flight nurses use multiple cues and rely heavily on the use of visual cues when practising in unstructured and aircraft environments. Cues are used by experts in decision-making, are often identified several at a time, and are weighted according to their importance as being more or less significant (Balla *et al.* 1983, Fuller & Conner 1996, Reischman 2002, Hedberg & Satterlund Larsson 2003, Baumann 2006, Hardy *et al.* 2006). Experts identify more cues than novices (Fuller & Conner 1996) and use multiple cues during decision-making (Taylor 1997).

Flight nurses must rely on the use of visual cues (Topley *et al.* 2003) during patient transport more than nurses working in a hospital setting because of the excessive environmental noise of the prehospital and aircraft environments. As previously mentioned, the inability to hear breath sounds forces flight nurses to rely more on visual and tactile cues than auditory cues. This is explicated in the case of detecting and diagnosing a tension pneumothorax during patient extrication or in-flight. Flight nurses rely more on touch – palpation of lack of chest wall movement – and sight – unequal chest excursion, respiratory distress, deviated trachea and other symptoms. The recognition and use of cues during decision-making increases and interacts with pattern recognition.

Pattern recognition—In several studies, pattern recognition is reported as a defining attribute of nursing expertise (Jasper 1994, Cioffi 2001, Dunphy & Williamson 2004, Currey & Botti 2006, Ericsson *et al.* 2007). Pattern recognition is defined as the ability to recognize relationships without prespecifying the components of the situation in which one recognizes configurations, relationships and recognizable patterns (Benner & Tanner 1987). Flight nurses, through experience and training, create patterns of cues and use this cognitive mechanism as they recognize patients or situations that fit, or are similar, to allow for rapid and accurate decision-making.

Pattern recognition works simultaneously with the recognition of cues. Recognizing cues can lead to the recognition of a pattern, and recognition of a pattern can direct the flight nurse to look for salient cues that may aid in decision-making. If a flight nurse is treating a patient and begins to recognize a pattern such as decreased oxygen saturation and increased respiratory effort, a working diagnostic hypothesis is developed, such as respiratory distress or pneumothorax. The flight nurse then further searches for other confirming cues to determine

a cause for the changes and subsequently decides on an appropriate intervention. This development of pattern recognition is heavily influenced by experience and training.

Flight nursing knowledge—Flight nursing knowledge is defined as a body of unified facts that are specific to FN practice. It can be acquired through experience and/or from study within the specialty field. Flight nurses must consider factors of care that influence patient management decisions and responses to therapy throughout the transport process that are additional to those considered by hospital-based nurses. It has been documented that nurse experts exhibit an advanced level of knowledge or domain-dependent knowledge (Thompson *et al.* 1990, Jasper 1994, Dunphy & Williamson 2004, Baumann 2006, Bonner & Greenwood 2006, Christensen & Hewitt-Taylor 2006b, Hardy *et al.* 2006, Ericsson *et al.* 2007). FN nursing knowledge expands critical care nursing knowledge to include understanding of the physiological stressors of flight and how they affect crew members and patients, and environmental considerations for patient care, such as exposure of the patient to low ambient temperatures during transport.

An example of FN-specific knowledge is the decision to place a chest tube in a trauma patient in a referring emergency department with a 15% pneumothorax prior to transport. If this same patient was to remain at the referring hospital, the pneumothorax would be monitored and not include intervention. The flight nurse, in placing the chest tube, does so realizing there is an inability to auscultate breath sounds during transport, and that fluctuation in barometric pressure because of altitude changes may worsen the pneumothorax. Such a situation is specific to FN experience and illustrates how FN knowledge can guide decision-making differently from hospital-based nursing.

Experience—Experience is defined as a process in which preconceived notions and expectations are challenged, refined or disproved by the actual situation (Heidegger, 1962 & Gadamer 1970 as cited by Benner 1984). When nurses are in a familiar situation they tend to reach conclusions quicker (Hammond *et al.* 1966), facilitating decision-making. The criteria of experience for expert nurses has been defined in multiple studies as having five or more years of experience (Benner & Tanner 1987, Greenwood & King 1995, Reischman 2002, Taylor 2002, Hedberg & Satterlund Larsson 2003, Topley *et al.* 2003), while three studies added an additional criterion of also being considered expert by one's peers (Benner & Tanner 1987, Jasper 1994, Topley *et al.* 2003). Experience alone neither guarantee the acquisition of expertise (Ericsson & Lehmann 1996, Christensen & Hewitt-Taylor 2006b), nor is it necessarily an indicator of expertise. Although it is unclear how much and what type of experience is required for FN expertise, experience is required to develop FN knowledge, cue recognition, pattern recognition and familiarity with practice environments.

There are several types of experience related to FN expertise. One type is that which is associated with a particular situation. Repeated exposure to a specific situation or problem can lead to increased awareness of that situation and facilitate decision-making (Cioffi 2001, Currey & Botti 2006). Two general types of experience that contribute to FN expertise are experience as a nurse in a hospital or other structured setting, which is considered essential (Suserud *et al.* 2003), and experience as a flight nurse. Additional training in rescue work and how to perform emergency care is necessary for nurses who are new to practising in unstructured environments (Suserud & Haljamae 1999). Because flight nurses operate in multiple structured and unstructured environments, it is a combination of their general nursing experience, additional training for unstructured environments and FN practice that contributes to better decision-making and FN expertise.

Training—Training is the process of learning a skill or job. In FN training, this process takes the form of initial job orientation, such as on-the-job learning, psychomotor skills learning and

practice, forms of education and obtaining work-related certification. Training supports the learning, reaffirmation and refining of knowledge and skills. Developing proficiency in psychomotor skills and using case studies and simulations allow for learning cues and developing salient cue recognition and patterning. These processes combine to create efficient and accurate decision-making.

Implications for nursing practice

The middle-range Theory of Flight Nursing Expertise was both deductively and inductively developed from current knowledge of FN practice and the literature. The theory is abstract enough to be applicable to all settings of FN practice, including fixed-wing, rotary-wing and ground transport, in both civilian and military settings. Research is needed to test the relationships proposed in the theory and to test the theory as a complete framework. Future research to determine the usefulness of this theory in both rotary and fixed-wing settings is needed, as well as examination of the similarities and differences related to expertise needed for different flight team compositions. Curriculum and training innovations can result from increased understanding of the concepts and relationships posed in this theory. Additionally, this theory may be a useful tool to assist novice flight nurses to attain the knowledge, critical thinking and decision-making skills necessary to begin safe and competent practice sooner.

Conclusion

The Theory of Flight Nursing Expertise is a new conceptualization of FN practice that is both explanatory and predictive. In many countries nurses are working in prehospital and unstructured environments to provide care for patients experiencing acute illness or injury. Additionally, there is increasing development of new programmes that use nurses to provide care for patients requiring transport from community hospitals to comprehensive tertiary care centres. Thus, there is a need to understand the expertise required by flight nurses to support the development of effective and efficient training and educational programs. Further investigation of this proposed theory is warranted to determine its empirical validity and usefulness. The intent of proposing this middle-range theory is to offer a new framework for curricula development and to facilitate further theory development and research in this rapidly growing nursing specialty.

What is already known about this topic

- Flight nurses must expand their level of practice expertise over that of hospital-based critical care nurses because of environmental factors and limited resources and supplies.
- Flight nurses use unique knowledge related to their practice environment, which is gained through critical care experience and flight nursing experience.
- Using knowledge from multiple disciplines, a theory can be created by that appears to exhibit similar characteristics (concepts) describing the phenomena of expertise.

What this paper adds

- The first conceptualization of flight nursing expertise that describes relationships among the concepts that contribute to decision-making in this nursing specialty.
- The salient concepts included in this theory that describe flight nursing expertise are experience, training, transport environment of care, psychomotor skill, cue recognition, pattern recognition, flight nursing knowledge, decision-making and action.

- A description of each concept's relevance specific to flight nursing practice.

Implications for practice and/or policy

- Research is needed to determine the usefulness of this theory in both rotary and fixed-wing medical transport settings, and to examine the similarities and differences related to expertise needed for different flight nurse team compositions.
- Curriculum and training innovations can result from increased understanding of the concepts and relationships proposed in this theory.
- The Theory of Flight Nursing Expertise may be a useful tool to assist novice flight nurses to attain the knowledge, critical thinking and decision-making skills necessary to deliver safe and competent patient care more efficiently.

Acknowledgments

We would like to thank associate professor Patricia A. Higgins PhD, RN for her help in the development and conceptualization of this theory.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

- ADAMS. Atlas and Database of Air Medical Services. 2003. Retrieved from http://www.adamsairmed.org/pubs/AMTC03_poster.pdf on 27 March 2008
- ADAMS. Atlas and Database of Air Medical Services. 2007. Retrieved from http://www.adamsairmed.org/pubs/AMTC07_poster.pdf on 27 March 2008
- Bacon CL, Corriere C, Lavery RF, Livingston DH. The use of capnography in the air medical environment. *Air Medical Journal* 2001;20(5):27–29. [PubMed: 11552109]
- Balla JL, Greenbaum DS, Rothert ML, Black NA. Diagnostic cues in gastroenterology. *Australian and New Zealand Journal of Medicine* 1983;13(5):469–477. [PubMed: 6580869]
- Baumann SL. What does expert nursing practice mean? *Nursing Science Quarterly* 2006;19(3):259–260. [PubMed: 16757793]
- Benner, P. From Novice to Expert. Addison-Wesley Publishing Company; Menlo Park: 1984.
- Benner P. Using the Dreyfus model of skill acquisition to describe and interpret skill acquisition and clinical judgement in nursing practice and education. *Bulletin of Science, Technology & Society* 2004;24(3):188–199.
- Benner P, Tanner C. Clinical judgment: how expert nurses use intuition. *American Journal of Nursing* 1987;87(1):23–31. [PubMed: 3642979]
- Bergdahl E, Wikstrom BM, Andershed B. Esthetic abilities: a way to describe abilities of expert nurses in palliative home care. *Journal of Clinical Nursing* 2007;16(4):752–760. [PubMed: 17402957]
- Bonner A. Recognition of expertise: an important concept in the acquisition of nephrology nursing expertise. *Nursing and Health Sciences* 2003;5(2):123–131. [PubMed: 12709167]
- Bonner A, Greenwood J. The acquisition and exercise of nephrology nursing expertise: a grounded theory study. *Journal of Clinical Nursing* 2006;15:480–489. [PubMed: 16553762]
- Boyd CR, Corse KM, Campbell RC. Emergency inter-hospital transport of the major trauma patient: air versus ground. *The Journal of Trauma* 1989;29:789–794. [PubMed: 2738976]
- Bozeman WP, Young S. Etomidate as a sole agent for endotracheal intubation in the prehospital air medical setting. *Air Medical Journal* 2002;21(4):32–35. (discussion 35–37). [PubMed: 12087322]
- Christensen M, Hewitt-Taylor J. Defining the expert ICU nurse. *Intensive and Critical Care Nursing* 2006a;22(5):301–307. [PubMed: 16513352]
- Christensen M, Hewitt-Taylor J. From expert to tasks, expert nursing practice redefined? *Journal of Clinical Nursing* 2006b;15(12):1531–1539. [PubMed: 17118075]

- Cioffi J. A study of the use of past experiences in clinical decision making in emergency situations. *International Journal of Nursing Studies* 2001;38(5):591–599. [PubMed: 11524105]
- Cunningham P, Rutledge R, Baker CC, Clancy T. A comparison of the association of helicopter and ground ambulance transport with the outcome of injury in trauma patients transported from the scene. *The Journal of Trauma* 1997;43:940–946. [PubMed: 9420109]
- Currey J, Botti M. The influence of patient complexity and nurses' experience on haemodynamic decision-making following cardiac surgery. *Intensive and Critical Care Nursing* 2006;22(4):194–205. [PubMed: 16563767]
- Dunphy BC, Williamson SL. In pursuit of expertise. Toward an educational model for expertise development. *Advances in Health Science Education: Theory and Practice* 2004;9(2):107–127.
- Endsley, MR. Expertise and situation awareness. In: Ericsson, KA.; Charness, N.; Feltovich, PJ.; Hoffman, RR., editors. *The Cambridge Handbook of Expertise and Expert Performance*. Cambridge University Press; Cambridge: 2006. p. 633–651.
- Ericsson, KA. An introduction to Cambridge handbook of expertise and expert performance: its development, organization, and content. In: Ericsson, KA.; Charness, N.; Feltovich, PJ.; Hoffman, RR., editors. *The Cambridge Handbook of Expertise and Expert Performance*. Cambridge University Press; Cambridge: 2006. p. 3–19.
- Ericsson KA, Kintsch W. Long-term working memory. *Psychological Review* 1995;102(2):211–245. [PubMed: 7740089]
- Ericsson KA, Lehmann AC. Expert and exceptional performance: evidence of maximal adaptation to task constraints. *Annual Review of Psychology* 1996;47:273–305.
- Ericsson, KA.; Smith, J. Prospects and limits of the empirical Study of Expertise: prospects and Limits. In: Ericsson, KA.; Smith, J., editors. *Toward a General Theory of Expertise*. Cambridge University Press; Cambridge: 1991. p. 1–38.
- Ericsson KA, Whyte Jt, Ward P. Expert performance in nursing: reviewing research on expertise in nursing within the framework of the expert-performance approach. *Advances in Nursing Science* 2007;30(1):E58–E71. [PubMed: 17299276]
- FARE. Air Medicine: Accessing the Future of Health Care. Foundation for Air-Medical Research and Education; Alexandria, VA: 2006.
- Frakes MA. Flight team management of in-place endotracheal tubes. *Air Medical Journal* 2002;21(6):29–31. [PubMed: 12585074]
- Frakes MA. Clinical features of patients intubated by a flight team. *Air Medical Journal* 2004;23(3):37–39. [PubMed: 15127043]
- Fuller BF, Conner DA. Distribution of cues across assessed levels of infant pain. *Clinical Nursing Research* 1996;5(2):167–184. [PubMed: 8704664]
- Greenwood J, King M. Some surprising similarities in the clinical reasoning of 'expert' and 'novice' orthopaedic nurses: report of a study using verbal protocols and protocol analyses. *Journal of Advanced Nursing* 1995;22(5):907–913. [PubMed: 8568065]
- Hammond KR, Kelly KJ, Schneider RJ, Vancini M. Clinical inference in nursing; information units used. *Nursing Research* 1966;15(3):236–243. [PubMed: 5178330]
- Hardy S, Titchen A, Manley K, McCormack B. Redefining nursing expertise in the United kingdom. *Nursing Science Quarterly* 2006;19(3):260–264. [PubMed: 16757794]
- Hedberg B, Satterlund Larsson U. Observations, confirmations and strategies – useful tools in decision-making process for nurses in practice? *Journal of Clinical Nursing* 2003;12(2):215–222. [PubMed: 12603553]
- Jasper MA. Expert: a discussion of the implications of the concept as used in nursing. *Journal of Advanced Nursing* 1994;20(4):769–776. [PubMed: 7822615]
- King L, Clark JM. Intuition and the development of expertise in surgical ward and intensive care nurses. *Journal of Advanced Nursing* 2002;37(4):322–329. [PubMed: 11872101]
- Lowe L, Sagehorn K, Madsen R. The effect of a rapid sequence induction protocol on intubation success rate in an air medical program. *Air Medical Journal* 1998;17(3):101–104. [PubMed: 10181919]
- Matteson P, Hawkins JW. Concept analysis of decision making. *Nursing Forum* 1990;25(2):4–10. [PubMed: 2235655]

- OED. Psychomotor. In: Simpson, J., editor. Oxford English Dictionary. Oxford University Press; Oxford: 2008.
- Pesut, DJ. Thoughts on thinking with complexity in mind. In: Lindberg, C.; Nash, S.; Lindberg, C., editors. *On the Edge: Nursing in the Age of Complexity*. Plexus Press; Bordenton, NJ: 2008. p. 211-238.
- Pugh D. A phenomenologic study of flight nurses' clinical decision-making in emergency situations. *Air Medical Journal* 2002;21(2):28–36. [PubMed: 11896370]
- Reischman RR. Critical care cardiovascular nurse expert and novice diagnostic cue utilization. *Journal of Advanced Nursing* 2002;39(1):24–34. [PubMed: 12074749]
- Services, AAoA-M. Frequently Asked Questions About AAMS and Air Ambulance/Medevac. 2008. Available at <http://www.aams.org/content/navigationmenu/aboutaams/frequentlyaskedquestions/default.htm> on 12 March 2009
- Simon HA, Chase WG. Skill in Chess. *American Scientist* 1973;61(4):394–403.
- Smith KK. Critical care nursing in an austere environment. *Critical Care Medicine* 2008;36(7) (Suppl):S297–S303. [PubMed: 18594256]
- Stohler SA. High performance team interaction in an air medical program. *Air Medical Journal* 1998;17(3):116–120. [PubMed: 10181923]
- Suserud BO, Haljamae H. Nurse competence: advantageous in pre-hospital emergency care? *Accident and Emergency Nursing* 1999;7(1):18–25. [PubMed: 10232109]
- Suserud BO, Bruce K, Dahlberg K. Ambulance nursing assessment. Part two. *Journal of Emergency Nursing* 2003;11(1):14–18.
- Taylor C. Problem solving in clinical nursing practice. *Journal of Advanced Nursing* 1997;26(2):329–336. [PubMed: 9292367]
- Taylor C. Assessing patients' needs: does the same information guide expert and novice nurses? *International Nursing Review* 2002;49(1):11–19. [PubMed: 11928932]
- Thiele JE, Baldwin JH, Hyde RS, Sloan B, Strandquist GA. An investigation of decision theory: what are the effects of teaching cue recognition? *Journal of Nursing Education* 1986;25(8):319–324. [PubMed: 3023568]
- Thomas SH, Harrison TH, Buras WR, Ahmed W, Cheema F, Wedel SK. Helicopter transport and blunt trauma mortality: a multicenter trial. *The Journal of Trauma* 2002;52:136–145. [PubMed: 11791064]
- Thompson CB, Ryan SA, Kitzman H. Expertise: the basis for expert system development. *Advances in Nursing Science* 1990;13(2):1–10. [PubMed: 2124786]
- Topley DK, Schmelz J, Henkenius-Kirschbaum J, Horvath KJ. Critical care nursing expertise during air transport. *Military Medicine* 2003;168(10):822–826. [PubMed: 14620647]
- Walker, LO.; Avant, KC. *Strategies for Theory Construction in Nursing*. Appleton & Lange; Norwalk, CT: 2005.
- Young CE. Intuition & nursing process. *Holistic Nursing Practice* 1987;1(3):52–62. [PubMed: 3646259]

Figure 1.
Middle-range Theory of Flight Nursing Expertise.