Boston College

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EMERGENCY NURSE EFFICIENCY AS A MEASURE OF EMERGENCY NURSE PERFORMANCE

a dissertation

by

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Abstract

Background: Emergency department crowding (EDC) is a major issue affecting hospitals in the United States and has devastating consequences, including an increased risk of patient mortality. Solutions to address EDC are traditionally focused on adding resources, including increased nurse staffing ratios. However, these solutions largely ignore the value of the experience and expertise that each nurse possesses and how those attributes can impact patient outcomes. This dissertation uses Benner's *Novice to Expert* theory of professional development to describe how individual emergency nurse expertise influences patient length of stay in the emergency department and how it can be part of the strategy in addressing EDC.

Purpose: The purpose of this program of research was to identify, articulate, and demonstrate a new approach to emergency nurse performance evaluation that integrates patient outcome data and emergency nurse characteristics.

Methods: First, in a scoping review, we explored the different approaches to measuring nurse performance using patient outcome data and identified common themes. Second, a concept analysis introduced *Emergency Nurse Efficiency* as a novel framework to understand how emergency nurses can be evaluated using patient outcome data. Finally, a retrospective correlational study established the association between nurse expertise and emergency patient length of stay.

Results: In Chapter Two of this dissertation, the researchers conducted a scoping review of nurse performance metrics and identified twelve articles for inclusion. We identified three themes: the emerging nature of these metrics in the literature, variability in their applications, and performance implications. We further described an opportunity for future researchers to work with nurse leaders and staff nurses to optimize these metrics. In Chapter Three, we

performed a concept analysis to introduce a novel metric, called *Emergency Nurse Efficiency*, that is a measurable attribute that changes as experience is gained and incorporates the positive impact of an individual nurse during a given time while subtracting the negative. Using this measurement to evaluate ED nurse performance could guide staff development, education, and performance improvement initiatives. In Chapter Four, we performed a retrospective correlational analysis and administered an online survey to describe the relationship between individual emergency nurses, and their respective level of expertise, and their patients' ED LOS. We found that, when accounting for patient-level variables and the influence of the ED physicians, emergency nurses are a statistically significant predictor of their patients' ED LOS. A higher level of clinical expertise among emergency likely produces a lower ED LOS for their patients, and nurse leaders should seek to better understand these metrics for professional development and quality improvement activities.

Conclusions: This dissertation made substantial knowledge contributions to the literature regarding the evaluation of individual emergency nurses and the influence that they have on patient outcomes. It established, first, that the measurement of individual nurse performance is varied and inconsistent; second, that considering emergency nursing as a team activity similar to professional sports results in a conceptual framework that can evaluate individual performance within a group context; and, third, that there is a relationship between the individual emergency nurse and their patients' ED LOS, and that relationship can be further understood within Benner's *Novice to Expert* theoretical model. We recommend that nurse leaders use these data as part of their strategy to decrease EDC.

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Inclusive of high school, college, and graduate school, I am among the privileged few to soon hold four different degrees from Boston College, where I have spent almost half of my life and which has indelibly shaped my world. This dissertation represents the culmination of that time, and I could not have made it this far without the help, support, and encouragement of so many individuals. Specifically, though, there are several people that merit special recognition.

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This is dedicated to Clara, Josie, and Frances—

You can do hard things!

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Chapter I:

Introduction to the Dissertation

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Introduction

This body of research is presented in a manuscript dissertation format to showcase the variety of methodologies that, together, form the basis of a program of research (S. Robinson & Dracup, 2008; Smaldone, Heitkemper, Jackman, Joanne Woo, & Kelson, 2019). This dissertation's focus was to propose a novel approach in addressing emergency department crowding (EDC) by evaluating and measuring the influence of individual emergency nurses on their patients' length of stay (LOS). It identified the emerging field of individual nurse performance metrics, provided the conceptual basis for adapting those metrics for emergency nurses, and then demonstrated how the work of individual nurses in the emergency department (ED) can be viewed as a metric that quantifies their impact on the ED LOS of their patients.

Emergency department crowding remains a problem that has yet to be solved using traditional approaches that address the structure and process of care of emergency patients. Emergency nursing represents an untapped resource of experience and expertise that, if utilized properly, could be part of the solution to decrease crowding while promoting positive patient outcomes. Team activities outside of healthcare that involve multiple individuals working toward a common goal, including professional sports, represent opportunities for nurse leaders to approach performance evaluation in a novel way. Emergency nurses leverage their expertise, as defined in Benner's *Novice to Expert* theory, to decrease patient length of stay while maintaining a high level of care quality. This phenomenon is not well understood and is the focus of this body of research.

Chapter One will describe this dissertation's aims, program of research, and how it fits in the broader academic literature. Chapter One includes the following sections: background and significance of the research proposal; a brief literature review; the overarching theoretical

framework on which it is based; the purpose of the proposed program of research; and the implications of this research for both nurse scientists and practitioners in the ED.

Background and Significance

Emergency department crowding (EDC) is an overwhelming problem among United States hospitals that leads to increased numbers of patients leaving the emergency department (ED) without completing their treatment, increased frequency of medication errors, and increased inpatient hospital mortality rates (Carter, Pouch, & Larson, 2014; Johnson & Winkelman, 2011; Rasouli et al., 2019; Woodworth, 2020). One proposed cause of EDC is inadequate nursing resources to meet the demands of increasing patient volume and patient complexity, which in turn increases emergency department length of stay (ED LOS) (Clopton & Hyrkäs, 2020; Henneman et al., 2015; Hoot & Aronsky, 2008; Recio-Saucedo et al., 2015). From 2001-2008, the number of ED visits increased 60% faster than population growth and ED occupancy rates (i.e., the average number of patients present) rose by 27% (Pitts, Pines, Handrigan, & Kellermann, 2012). Between 2002-2015 that there was a 12% increase in ED visits with a concomitant decrease in seeking care from primary care providers among elderly patients and Medicaid beneficiaries, who tend to be more medically complex than younger patients and those with private insurance (Chou, Venkatesh, Trueger, & Pitts, 2019). ED patients require more time-intensive diagnostics and treatments than ever before (Chou et al., 2019; Pitts et al., 2012). There are multiple proposals to decrease EDC, but none examine the effect that individual ED nurses and their clinical expertise have on improving patient outcomes.

Existing Emergency Room Crowding Solutions

Traditional solutions to improve EDC are rooted in the Donabedian framework, where a clinical outcome is a seen as a product of the structure and process in which the care was

delivered (Donabedian, 1966). The model proposes that high quality clinical care is delivered when the patient is placed in an environment that is inclusive of the appropriate equipment and personnel (Donabedian, 1968). These solutions focus on the institutional resources available, including the number of emergency nurses assigned to a shift, the physical design of the ED, and the processes to expedite the patient through the department (Bruno, 2017; Forbes, Osborne, Hartsell, & Wall, 2014; S. O. Murphy, Barth, Carlton, Gleason, & Cannon, 2014; Pati, Harvey Jr, & Pati, 2014; Wolf, Perhats, Delao, Clark, & Moon, 2017). Emergency nurses classify EDC as a barrier to providing safe, high-quality patient care (Dos Santos, Pestana, Erdmann, Da Silva Lima, & Garlet, 2013; Källberg, Ehrenberg, Florin, Östergren, & Göransson, 2017). Proposed nursing solutions to decrease ED overcrowding focus on increasing nurse to patient staffing ratios, requiring more overall nursing staff in the department without considering the expertise of the individual nurses (DeAnda, 2018; Rowe et al., 2011; Shindul-Rothschild, Read, Stamp, & Flanagan, 2017). However, individual nurses are not interchangeable, and the level of their experience influences emergency nursing practice, such as triage decisions during times of increased crowding (van der Linden, Meester, & van der Linden, 2016). Further exploration of individual ED nurse characteristics (e.g., nurse experience and expertise) and their associated decision-making processes are the focus of this program of research and may offer a new approach to address EDC.

Review of the Literature

Emergency Nursing

The ED presents unique challenges in anticipating appropriate staffing levels, including both predictable and unpredictable fluctuations in patient volume, a lack of homogeneity in patient acuity, and the skill mix of the healthcare providers (Anderson, Pimentel, Golden, Wasil,

& Hirshon, 2016; Considine et al., 2012; Elder, Johnston, & Crilly, 2015; Otegbeye, Scriber, Ducoin, & Glasofer, 2015; Weber, 2003; Weigl, Müller, Holland, Wedel, & Woloshynowych, 2016). Emergency nursing has unique characteristics that make it a challenging and rewarding career choice, and it is essential to work both in tandem with other healthcare professionals, including physicians, and in teams with other nurses (Kennedy, Curtis, & Waters, 2014; Schriver, Talmadge, Chuong, & Hedges, 2003). Similar to nurses in other critical care settings, emergency nurses must possess specific skills, including situation awareness, adaptability, and teamwork (Cone & Murray, 2002; Sheehy, 2020). As nurses acquire these skills, they better prepare the nurse to handle and navigate more complex and demanding clinical situations while maintaining clinical care at a high level.

Clinical Judgment and Situation Awareness

The judgments made by individual nurses are influenced by multiple factors, including patient needs, available resources, and previous experiences (Nibbelink & Brewer, 2018). Clinical judgement is the synthesis of a given situation and a nurse's previous exposure to patient care in similar situations (Tanner, 2006). Developing clinical judgment involves repeated interactions with patients with subsequent self-reflection (Benner, Tanner, & Chesla, 2009; Lasater, 2007; Tanner, 2006). Clinical judgment can also be gained with simulation and direct feedback, especially among nursing students and new nurses, as a way to develop nurses professionally (Kavanagh & Szweda, 2017; Lasater, 2007). As nurses accumulate expertise, their clinical judgement and decision-making ability improves until they possess an inherent understanding of how to provide excellent care and optimize patient outcomes (Johansen & O'Brien, 2016; Tanner, 2006). Evaluating the level and progression of clinical judgement of a

nurse is valuable in understanding their professional progression, but it also has utility in evaluating nurse performance and their effect on patient outcomes.

Similar to clinical judgment, situation awareness is an acquired skill obtained through a three-stage process, in which an individual perceives the elements in his or her environment, interprets the meaning of those elements, and predicts a likely outcome based on these factors (Stubbings, Chaboyer, & McMurray, 2012; Wickens, 2002). Within healthcare, measuring and developing situation awareness among clinician has potential to improve clinical outcomes for patients, especially in the emergency department setting (Cooper, Porter, & Peach, 2014). However, the evaluation of the quality of nursing care, and the evaluation of nurses, lack metrics that assess a nurse's clinical judgement and situation awareness and their influence on patient outcomes as it develops over time.

What is Known about Nurse Expertise

The advancement of a nurse's clinical judgement and skill acquisition requires active reflection and a robust performance evaluation in the clinical environment (Benner, Tanner, & Chesla, 1997; Stubbings et al., 2012). Benner describes how experience shapes nursing clinical competence and provides a methodology for identifying differences in level of expertise among individual nurses (Benner, 1984). However, Benner's methods are time intensive and require an evaluator with specific skills to guide the nurse interviews (Benner, 1994). Additionally, her *Novice to Expert* model provides a theoretical framework that outlines how a nurse develops skills with experience and reflection on those experiences (Benner & Wrubel, 1982). The manner in which the nurse practices adapts so that care delivered is optimized as a nurse progresses from novice to expert in his or her career (Benner et al., 1997). Per Benner, as nurses accumulate "experience and mastery the skill is transformed. And this change brings about improvement in

the performance" (Benner, 1984, p. 83). There is, thus, an opportunity to measure that improvement in performance as a substitute for measuring expertise.

Nurse Performance Evaluation: Strengths and Limitations

The historical goals of nurse performance evaluation aim to facilitate staff development and improve quality of care (Bernhardt & Schuette, 1975; Tate, 1962). Over time, both nurse managers and nurse scientists identified challenges in structuring a performance evaluation that characterizes good nursing practice (McCloskey & McCain, 1988; Schwirian, 1976). Nurse performance evaluation evolved to reflect differing administrative priorities, with the evaluator changing from supervisor to a peer to self, yet the information delivered remains subjective, composed of opinions with minimal supporting clinical information (Brooks, Olsen, Rieger-Kligys, & Mooney, 1995; Greenslade & Jimmieson, 2007; Stull, 1986). Despite attempts to improve the process, nurse performance evaluation continues to lack the data required to evaluate the impact of an individual nurse on patient outcomes.

Inferences from Physician Performance Evaluation

Like nurses, physicians are also evaluated using input from peers, patients, and self-evaluation tools (Overeem et al., 2012). More recently, however, the desire for increased transparency within the American healthcare system resulted in the Physician Compare tool, allowing patients access to individual physician outcomes data (Li, Das, & Chen, 2019). Thus far, the metrics may be of limited utility due to a small number of quality-related events, but they are attempting to associate individual providers to the outcomes of their patients (Burnside et al., 2014; Hudson Scholle et al., 2010; Li et al., 2019). Identifying outcome measures that are both

clinically significant and attributable to an individual physician is a worthwhile and potentially fruitful endeavor (Berwick, 2009).

Physician-related metrics are widely used in the operating room, specifically to evaluate a patient's operative course (Gabriel, Gimlich, Ehrenfeld, & Urman, 2014; O'Reilly, Talsma, VanRiper, Kheterpal, & Burney, 2006). By collecting times associated operative events, including the start and end of a procedure, evaluators can observe trends of individual surgeons and anesthesiologists (Gabriel et al., 2014). Performance metrics, such as timing of prophylactic antibiotics, can also be measured, providing individual providers with the ability make specific changes to support quality initiatives that improve patient outcomes (O'Reilly et al., 2006). Additional proposed measures to assess individual physicians include compliance with clinical guidelines, hospital length of stay, re-admissions, adverse events, and mortality (Scott, Phelps, & Brand, 2011). For emergency medicine physicians, appropriate metrics specific to the ED and to ED patients is necessary in benchmarking individual provider performance (Baker, 2009). Evaluating individual physicians with patient outcome data gives each provider the opportunity to focus and improve on a specific aspect of their care delivery, yet nurses continue to be measured in aggregate.

Nurse Outcome Measurement

Inadequate hospital nurse staffing levels are associated with poor patient and nurse outcomes, including increased patient mortality, increased failure-to-rescue rates, and increased nurse burnout (Aiken, 2010; Blouin & Podjasek, 2019; Butler et al., 2011). Moreover, there is further evidence of an association between patient outcomes and individual nurse attributes, specifically level of education and expertise (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Cho et al., 2015; Ericsson, Whyte, & Ward, 2007; Stalpers, de Brouwer, Kaljouw, &

Schuurmans, 2015). While the impact of a group of nurses is associated with specific patient outcomes, the effect of the performance of an individual nurse, and the characteristics of that nurse within an interdisciplinary environment, has only recently been examined in the field of obstetrics (Edmonds, O'Hara, Clarke, & Shah, 2017). For nurse leaders and educators, a better understanding the value within their existing nurse resources should be the priority of any performance evaluation.

Value-Added Care

The effect of individual nurses on patient outcomes can be measured as a function of the economic impact of their salaries and the collective outcomes of their patients (Yakusheva, Lindrooth, & Weiss, 2014). Calculations of *value-added care*, and more recently *value-informed nursing practice*, allow managers to assess how nurses spend their time, including both with and without direct patient interaction (Upenieks, Akhavan, Kotlerman, Esser, & Ngo, 2007; Yakusheva, Rambur, & Buerhaus, 2020). *Value-added care* creates the opportunity to better design a nurse workflow that focuses on improving patient outcomes while mitigating activities that do not add value (Capuano, Bokovoy, Halkins, & Hitchings, 2004). The descriptions of *value-informed nursing practice* illustrate how new metrics that assess individual nurse productivity can be measured and evaluated (Yakusheva et al., 2019). Further development of individual nurse performance metrics that incorporate background characteristics as well as value-added calculations could change future staffing models (Welton & Harper, 2016). Staffing decisions may soon be based on which nurses, based on skill mix, experience, or expertise, are available rather than how many (Welton & Harper, 2016). Providing appropriate and timely care is an essential component of an emergency nurse's performance, and patient outcome metrics, such as ED LOS, are measures that can provide insight into a nurse's work.

Measures of Work

The term *productivity* is used when describing the measurement of the value of an employee's performed work in economic terms (Nicholson et al., 2006; von Thiele Schwarz, Sjöberg, Hasson, & Tafvelin, 2014). In her concept analysis on nursing productivity, Holcomb describes the financial expenses associated with staffing costs and then defines *productivity* as a function of the resources invested and the outcomes observed (Holcomb, Hoffart, & Fox, 2002). She also describes the use of the terms *productivity* and *efficiency* as interchangeable, identifying sources that included *efficiency* as part of the definition for *productivity* (Holcomb et al., 2002). Nurse productivity, examined through the lens of the economic concept of *individual productivity*, accounts for both the quantity and quality of work that can be attributed to an individual nurse (Yakusheva, Needleman, Bettencourt, & Buerhaus, 2020). Similarly, the term *efficiency* is used to describe institutional or organizational structures, such as an endoscopy unit (Kaushal, Chang, Lee, & Muthusamy, 2014) and even an emergency department (Melon, White, & Rankin, 2013). Often, the descriptions of *efficiency* in the literature are measured as a function of time, where an outcome is evaluated, in part, by how quickly it can be achieved (Upenieks, 1998). The basis of the use of efficiency in this way asserts that the quality of patient care delivered is dependent on how well nurses use their time (Upenieks, 1998). The evaluation of *efficiency* as a function of input and output in high-volume environments, like the ED where timeliness is associated with positive patient outcomes, can provide insight into the work being done.

Introduction of Emergency Nurse Efficiency

Emergency nursing requires the concurrent, and seemingly contradictory, qualities of being both autonomous and a team member while delivering care to a patient (Sheehy, 2020).

Analogously, professional basketball players possess similar characteristics, with individual achievements recorded as measured statistics, such as points scored, assists recorded, and rebounds attained, while also being able to seamlessly work with other players for their team to be successful. This presents a challenge in trying to measure the impact of an individual player on the success or failure of his team, as well as the success or failure of his teammates. John Hollinger attempted to tackle this exact challenge when he wrote his *Pro Basketball Prospectus*, where he explains how he developed the *Player Efficiency Rating,* which he describes as representing the difference between a player's positive and negative accomplishments and is measured in a per-minute rating (Hollinger, 2002). He then uses this rating, which does not incorporate any financial input data, to evaluate player performance, including both the strengths and weaknesses (Hollinger, 2002). In this context, the term *efficiency* is used to describe how well the player utilizes his time on the court performing actions that contribute to wins for his team while avoiding actions that do not or that contribute to losses.

Related to this program of research, when *efficiency* is applied to the analysis of emergency nursing performance, it can be considered a function of those actions that contribute to improved patient outcomes and those actions lead to poor patient outcomes and complications. Due to the high-volume and time-dependent nature of emergency nursing, we introduced the concept of *Emergency Nurse Efficiency* which focused on ED LOS as a targeted positive patient outcome.

Purpose and Specific Aims

The overall purpose of this body of work was to identify, articulate, and demonstrate a new approach to emergency nurse performance evaluation that integrates patient outcome data and emergency nurse characteristics. Three specific aims were identified and are each

represented as a manuscript (Table 1.1). These aims were captured in the cumulative work that consists of a scoping review, a concept analysis, and a retrospective correlational study.

The first aim identified ways that the influence of an individual nurse on patient outcomes are documented in the literature. We accomplished this aim with a scoping review that examined the ways nurses are evaluated using patient outcome data. Given the relative paucity of published material related to this topic, the study also explored what opportunities exist in using individual metrics in nurse performance evaluation.

The second aim introduced the concept of *Emergency Nurse Efficiency* as a construct for evaluating emergency nurse performance. A concept analysis established the uses of the term *efficiency* as it relates to individual nurse performance and proposed a novel way to evaluate emergency nurses based on patient outcome data. In establishing a new paradigm to assess individual nurse performance in the context of a multidisciplinary environment, the study created a framework of understanding individual nurse contributions to patient outcomes.

The third aim study identified the associations between patient ED LOS, the emergency nurses who cared for those patients, and their acquired level of expertise. We used a retrospective correlational design to determine the emergency nurse characteristics, including the progression along Benner's *Novice to Expert* model, that were associated with improved ED LOS. This study provided an example of how *Emergency Nurse Efficiency* can be operationalized in measuring the influence of an individual emergency nurse.

Theoretical Framework

In 1982, Patricia Benner introduced her *Novice to Expert* theory as a response to an increased acuity of patients with a decreased opportunity for nurses to deliver care, creating a

need for nurses with a depth of experience (Benner, 1982). The challenge, at the time, was how to retain nurses and develop nursing expertise in the acute-care setting. The subsequent publication of her research created a lasting framework of nursing skill acquisition that has since guided nurse education, career development, and clinical recognition programs (Benner, 1984). Now, more than 40 years later, there is an opportunity to look at the theory from a different perspective and gain more insight about the practice behaviors of nurses across the novice to expert skill continuum.

Development and Key Concepts

When the *Novice to Expert* model was developed, there was a paucity of research and a lack of understanding of how nurses use their knowledge and experience in their practice (Benner, 1984). The concepts of *theoretical knowledge* and *practical knowledge* are first defined and then used as a foundational basis for the construction of the model.

Theoretical knowledge is defined as formal statements of the necessary information required for adequate care in a real situation (Benner, 1984). Theoretical knowledge can be simplified as all of the material that can be known in the absence of prior experience with a phenomenon and is typically acquired in the education of a nurse prior to entering clinical practice (Benner et al., 2009). It is also described as is described as *knowing that*, meaning the nurse can repeat the knowledge even without contextualizing it from practice experiences (Benner, 1984).

In contrast, practical knowledge is knowledge obtained by directly practicing skills and working in a culture of nursing (Benner, 1984). It is described as *knowing how* and extends beyond the knowledge that be learned without experiencing a phenomenon (Benner, 1984). Nurses can acquire skills and adapt their practice to fit the needs of an individual patients in a

specific situation by accumulating practical knowledge over time and comparing it to their theoretical knowledge (Benner et al., 2009). How a nurse synthesizes theoretical knowledge, often learned from textbooks during their tenure in school, with practical knowledge, only learned by experience in the clinical setting, is the basis of Benner's categorization of skill acquisition (Benner & Wrubel, 1982).

Nurses are often not self-aware of gaining clinical knowledge, and it is theorized that it is gained incrementally (Benner, 1984). There is a transition in levels of skill acquisition that can be categorized into five categories: novice, advanced beginner, competent, proficiency, and expert (Benner, 1982). The transitions from one category to another are based on two aspects of clinical performance. First, there is a transition from a reliance on abstractions or principles learned from school to a use of past experiences to guide practice (Benner, 1982). Second, there a change in how a nurse perceives a clinical situation, where instead of a compilation of multiple relevant components, a situation is wholly experienced (Benner, 1982). These two aspects, in different combinations with each other, are the hallmarks of each of the five levels of development on the continuum of novice to expert.

Five Stages

The five categories that Benner uses to describe nursing skill acquisition are derived from the work of Stuart and Hubert Dreyfus, professors of engineering and philosophy, respectively, who developed the idea of incremental skill acquisition in their study of Air Force pilots (Dreyfus & Dreyfus, 1980). Their findings revealed four mental functions (recollection, recognition, decision, and awareness) that each have a primitive and sophisticated version, and advancement through the stages of development include the transition of each function to its sophisticated form (Dreyfus & Dreyfus, 1980). That is, to advance from one skill level to the

next, one of the mental functions must advance from a primitive to a sophisticated form, which can only be done in the practice setting that is primarily guided by concrete evidence that is experienced and comprehended (Dreyfus & Dreyfus, 1980). In this development of mental functions, the pilot advances through the five stages (novice to expert) of skill acquisition.

Each of the five stages is represented by unique performance characteristics that were established by extensive interviews with nurses, in which they described clinical exemplars to the researchers that highlighted their decision-making processes (Benner, 1994). Novice nurses are typically nursing students, who have had no clinical exposure, and therefore no experience in applying theoretical knowledge to a practice setting. Their behavior is based on inflexible rules or principles without the ability to make exceptions or improvise (Benner, 1984). The advanced beginner encounters enough clinical situations to notice the meaningful aspects of a given situation and can deliver care in an acceptable manner (Benner, 1984). However, advanced beginners still lack full recognition of aspects in a situation that impact the future course of the patient (Benner, 1984). Nurses who are able foresee the long-term implications of his or her interventions with a patient are considered to have reached the competent stage of development (Benner, 1984). Competent nurses are able to create a plan of care that can prioritize the aspects of the current situation that are considered the most important for the patient's future situation and will ignore aspects that are not essential (Benner, 1984). Proficient nurses perceive situations in their entirety rather than a series of accumulated events, and their practice is guided by maxims rather than rules (Benner, 1984). There is a transition that occurs between competence and proficiency that incorporates a holistic understanding into a clinical situation where nurses are now comparing the current situation with past experiences of similar situations (Benner & Wrubel, 1982). This is a departure from a base of theoretical knowledge toward a reliance on

practical knowledge derived from previous experience (Benner et al., 2009). Finally, the hallmark of an expert nurse is the use of intuition to guide him or her in practice, a characteristic absent from novice nurses and only sparingly utilized in any other stage of skill development (Benner et al., 1997). Situations are experienced without a deliberate engagement with stored knowledge, and a nurse is able to anticipate the clinical course of a patient because of similar previous experiences (Benner, 1984). As a nurse progresses through the stages of skill acquisition, it is inherent Benner's model that the nurse can achieve improved patient outcomes more efficiently, without wasting time or energy on actions that will not contribute more effectively to a desired outcome.

Experience Versus Expertise

Critical to understanding Benner and nurse skill acquisition is difference between experience and expertise within the model. Benner defines the gaining of experience as an active process in which previously held notions are challenged and refined in the face of actual clinical observations (Benner, 1984). Notably, experience, as defined by Benner, is not simply the passage of time or accumulated years working (Benner, 1984). In both the Benner and Dreyfus descriptions of the process in which individuals acquire skills and transition through the stages from novice to expert, the role of experience is represented as an active, iterative, reflective process in which the individual practitioner is comparing the event that is currently being experienced to both the theoretical knowledge learned about the event as well as any similar past experiences (Benner & Wrubel, 1982; Dreyfus & Dreyfus, 1980). Experience is the element of skill acquisition that shapes both theoretical and practical knowledge and is accrued after repeated encounters that either confirm or dispel previously held concepts of clinical processes and situations (Benner, 1984).

Expertise is developed as the clinician tests their theoretical and practical knowledge in the clinical environment (Benner, 1984). An essential component of expertise is the comparison of previous clinical situations to current ones and identifying the differences and similarities (Benner, 1984). She describes expertise as a hybrid of practical and theoretical knowledge that requires the nurse to actively reflect on their practice (Benner, 1984). An assumption in this definition is that it results in the best possible outcome for the patient, as an expert nurse would not adjust his or her practice to produce a worse patient outcome than could be obtained by a novice with only a foundation of theoretical knowledge. Experience is the process to obtain expertise, yet both require active engagement by the nurse (Benner, 1984). There will be nurses that, despite years of working in a particular setting, will not accumulate experience and, therefore, will not develop professionally.

Benner and *Emergency Nurse Efficiency*

This dissertation used Benner's *Novice to Expert* model in two ways. First, the conceptual definition of *Emergency Nurse Efficiency* is the application of Benner's professional development trajectory to the ED setting. As emergency nurses accrue experience and develop expertise, they become more efficient in shepherding their patients through the ED to their final disposition. Second, through a proxy measure of an individual nurse's level of expertise, we confirmed that there is a measurable effect of that expertise and demonstrated a way to identify those emergency nurses who are clinical experts by measuring their patients' ED LOS.

Implications for Practice

The implications for practice of this cumulative body of research is twofold. First, it established a new perspective on the performance evaluation of emergency nurses by focusing on individual nurse contributions to patient outcomes, which may be extrapolated to other

practice environments where individual nurses work in a multidisciplinary group dynamic. This knowledge can be applied by nurse leaders to optimize patient outcomes by focusing on how they allocate their available resources. It also allows nurse leaders to measure nurse progression based on patient outcome data.

Second, this body of research identified a previously unidentified relationship between emergency nurse expertise and patient ED LOS. There is a presumption within the Benner *Novice to Expert* model that nurse expertise is manifested in the care delivered to patients, but this body of work was the first to articulate a method to measuring that relationship. By taking steps to develop nurse expertise in the emergency setting, nurse leaders can increase *Emergency Nurse Efficiency* and can measure it by tracking patient ED LOS. The resulting improvements in ED LOS may represent a solution to EDC that leverages existing resources instead of requiring more.

Summary

The collective body of work set forth in this program of research proposed a new way of evaluating emergency nurse performance within Benner's theoretical framework. First, a scoping review established a lack of published material on individual nurse evaluation using patient outcome data. Second, a concept analysis introduced *Emergency Nurse Efficiency* to measure the contribution of an individual nurse within a multidisciplinary group caring for patients. Third, a retrospective correlational study identified the link between individual emergency nurses, emergency nurse expertise, and patient outcomes. The results of this dissertation could change how individual nurse performance is measured and how, specifically in the emergency department setting, nurse professional development can be evaluated.

Table 1.1

Outline of Specific Aims and Papers to Address Each Aim

Specific Aim	***Chapter/Title of Paper***
Aim 1: Identify how the contribution of individual nurses has been measured using patient outcome data.	*Chapter II:* Nurse performance metrics: A scoping review
Aim 2: Introduce the concept of *Emergency Nurse Efficiency* as a construct for evaluating emergency nurse performance.	*Chapter III: Emergency Nurse Efficiency*: A concept analysis
Aim 3: Explore a novel method for evaluating the effect of an individual emergency nurse on patient ED LOS. Aim 4: Calculate whether patients who are cared for by nurses with higher expertise, as described in Benner's *Novice to Expert* model, have a lower ED LOS compared to those cared for by nurses with a lower level of expertise. *Hypotheses:* *H1: The emergency nurse, as an individual, is a variable in predicting patient ED LOS.* *H2: Expert and proficient emergency nurses, as defined by Benner, exhibit more efficiency than advanced beginner and competent emergency nurses as evidenced by their patients' ED LOS.*	*Chapter IV:* The association between emergency nurse expertise and ED length of stay

References for Chapter I

Refer to Cumulative Reference List

Chapter II

Nurse Performance Metrics: A Scoping Review

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This manuscript replaces the review of the literature section of the traditional dissertation. Mr. DePesa was the primary author on this paper; Dr. Jurgens was the second author; Dr. Lee was the third author; and Dr. O'Reilly-Jacob was the senior author on this paper. Mr. DePesa completed the review and synthesis under the supervision of Dr. O'Reilly-Jacob. A version of this paper was published in the February 2023 issue of the Journal of Nursing Administration, which is an indexed and peer-reviewed journal with an impact factor of 1.27. This is a non-final version of an article published in final form in DePesa, C. D., Jurgens, C. Y., Lee, C. S., & O'Reilly-Jacob, M. (2023). Nurse Performance Metrics: A Scoping Review. JONA: The Journal of Nursing Administration, 53(2), 110-115. *The readership for this journal includes nurse executives, directors of nursing, and nurse managers in hospital, community health, and ambulatory care environments.*

Abstract

Objective: The purposes of this scoping review are (1) to identify instances in the literature that describe measuring individual nurse performance and (2) characterize those metrics.

Background: The impact of nurses on patient outcomes has been demonstrated at the unit- or hospital-level, with nurses measured in aggregate. There is an opportunity to evaluate individual nurse performance by creating metrics that capture it.

Methods: A scoping review based on the framework published by the Joanna Briggs Institute was performed in May 2022.

Results: The researchers identified twelve articles. Three themes were identified: the emerging nature of these metrics in the literature, variability in their applications, and performance implications.

Conclusions: Individual nurse performance metrics is an emerging body of research with variability in the types of metrics developed. There is an opportunity for future researchers to work with nurse leaders and staff nurses to optimize these metrics.

The measurement of nurse performance has been a subject of inquiry for decades among nurse scientists (Aiken, 2010; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Cho et al., 2015; Dall'Ora et al., 2022). However, researchers have primarily focused on assessing the impact of nurses collectively, at the unit, department, or hospital level (C. W. Brennan, Daly, & Jones, 2013; Griffiths et al., 2019; Shin, Park, & Bae, 2018). Measuring nurses in the aggregate limits the ability of nurse leaders to understand the effect of individual nurse attributes on patient outcomes (L. S. Murphy, Wilson, & Newhouse, 2013). Recently, new metrics that capture the impact of an individual nurse on patient outcomes have been developed (Yakusheva, Rambur, & Buerhaus, 2022). The purpose of this scoping review is to identify and characterize what is known about measures of individual nurse performance.

Introduction

In 2004, the National Quality Forum (NQF) published a consensus report that created a framework in which nursing performance could be measured. Fifteen nursing-sensitive quality indictors to establish performance measures that could report the influence of nurses on patient care were proposed (National Quality Forum, 2004). The report recommended that future research focus on the relationship between patient outcomes, nurses, and their interactions (National Quality Forum, 2004). Nursing outcomes research, including studies published both before and after the NQF report, conceptualized nursing care as a collective variable and a component within the Donabedian model of outcome measurement (Aiken, 2010; Dall'Ora et al., 2022; Shin et al., 2018).

The Donabedian model asserts that high quality clinical care is delivered when the appropriate personnel are given the appropriate resources (Donabedian, 1966). Nurses, when considered within this framework, are collectively part of the process and structure that

influences patient outcomes (C. W. Brennan et al., 2013). There is evidence from nursing outcomes research that there is a relationship between the quality of nursing care and patient mortality and adverse events (Griffiths et al., 2018; Shin et al., 2018). More specifically, research on nurse staffing suggests that higher nurse staffing levels is associated with decreased patient mortality (Dall'Ora et al., 2022). There also is a relationship between unit-level nurse characteristics (e.g. level of education or experience) and patient-related adverse events (Cho et al., 2015; Stalpers et al., 2015). Collectively, the work of nurses has been examined, but the effect of an individual nurse is not well described.

There is a growing call to reexamine how nurse performance is evaluated and compensated ("ANA urges US Department of Health and Human Services to declare nurse staffing shortage a national crisis," 2021; Yakusheva, Rambur, et al., 2020). Recently developed methods that can calculate the *value-added care* of nurses allows managers to assess how nurses spend their time, including both with and without direct patient interaction (Upenieks et al., 2007). *Value-added care* has created the opportunity to more comprehensively design a workflow that maximizes activities which improve patient outcomes while minimizing activities that do not add value (Capuano et al., 2004). These calculations of individual nurse value, to both an organization and to patient care, could inform a payment structure that appropriately compensates individual nurses based on the quality of their work (Yakusheva, Rambur, & Buerhaus, 2022). The development of these metrics also has both clinical and administrative implications for nurse leaders looking to tailor quality improvement efforts to the performance of an individual nurse to improve patient outcomes (P. F. Brennan & Bakken, 2015). There is an opportunity for nurse researchers to identify and develop metrics that capture the value of individual nurses that could benefit patients, hospital operations, and the nurses themselves.

Objectives

The purposes of this scoping review were (1) to identify instances in the literature where measuring the influence of individual nurse performance was described and (2) to characterize those metrics in their applications and proposed uses.

Methods

Rationale for Scoping Review Methodology

Although there exists a robust body of research on aggregated nurse performance measures (at the unit- or hospital-level), there remains an opportunity to establish performance measures at the individual nurse level. A scoping review methodology, as described by the Joanna Briggs Institute, was selected to map the current state of the literature on individual nurse performance metrics (Peters et al., 2020). This methodological approach allowed the research team to be systematic in interrogating the literature while also affording us the flexibility to describe both the state of the science as well as the individual resulting items (Peters et al., 2020).

Identification of Search Terms

The research team sought to identify documented examples of metrics used to measure the contribution of an individual nurse on a collective outcome. Since the focus of this review primarily concerns nurses, we began by developing the appropriate search terms in the Cumulative Index to Nursing and Allied Health Literature (CINAHL). Once a combination of terms was identified to deliver an appropriate number of search results, that sequence then was used with the other databases (Appendix A).

Search Strategy

The research team performed the searches in May 2022, and each search included the keywords: *nurse* AND *performance* AND *metrics*. We used the following databases: CINAHL, PubMed, Scopus, and Web of Science. We followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guideline to present the results of this scoping review (Tricco et al., 2018). We compiled each database search and deleted duplicate results. If an article was included for analysis, we screened its reference list to identify related material that may have been missed due to limitations associated with electronic database indexing (Whittemore & Knafl, 2005).

Eligibility Criteria

We limited our review to any type of English language material published in an indexed journal, including research articles, opinion pieces, and conference presentations materials between January 2004 and May 2022, as the NQF introduced nurse sensitive measures in 2004. Eligibility criteria required that materials address performance metrics at the level of individual nurse.

Data Abstraction

As described in Figure 2.1, the initial search yielded 1350 sources, and, after removing duplicates, the research team identified 879 items to be screened. We screened these 879 items and removed 770 of them unrelated to the aim of the review. We then reviewed 108 manuscripts for whether the item's description of nurse performance could include metrics at the individual nurse level. We further excluded 98 items and documented the reasons for removal (Figure 2.1),

leaving 10 articles for analysis. After reviewing the reference lists of these final 10 items, we included two additional articles that met the inclusion criteria, leaving 12 articles for inclusion.

The research team reviewed the selected items in depth, with a focus on the metrics described and their uses, both demonstrated and proposed. Given the nature of the aim of this review, we considered any critical appraisal of the methodological quality irrelevant and excluded it (Peters et al., 2020). Table 2.1 describes the information abstracted from each included publication, including (a) type of nurse being measured, (b) clinical setting, (c) whether the metric was proposed or described by the article, (d) the name of the metric described, (e) a description of the metric, and (f) any proposed uses.

Results

The research team identified 12 articles that described individual nurse performance metrics published within the last 19 years across journals in the nursing, medical, and economic disciplines. We classified five of them as empirical reports, three as quality improvement papers, and four as commentaries. In reviewing the twelve articles, we identified three themes: (1) individual nurse performance metrics as an emerging body of research, (2) variability among the metrics described, and (3) implications for evaluating nurse performance.

An Emerging Body of Research

The first theme addresses the relative recency of creating and using performance metrics that capture individual-level behavior. Articles described this line of inquiry as emerging or new, (Bliss, Chambers, & Rambur, 2020; Welton, 2016b; Welton & Harper, 2016; Yakusheva, Needleman, et al., 2020) a result of a lack of previously available measures, (Castille & Robinson, 2011; Chambers et al., 2019; Kapu & Kleinpell, 2013) and/or as a novel or innovative

approach to performance evaluation (Yakusheva et al., 2014). Four of the 12 articles cite proposed metrics that have yet to be demonstrated in either a research or clinical setting and lack a specific description of how they were derived (Bliss et al., 2020; Chang et al., 2018; Welton, 2016b; Welton & Harper, 2016). This is further reflected in the variety of materials captured in the scoping methodology, including four articles that were neither reflections of research efforts or quality improvement projects (Kapu & Kleinpell, 2013; Welton, 2016b; Welton & Harper, 2016; Yakusheva, Needleman, et al., 2020). Further, our search criteria ranged from 2004 to 2022, and in those 19 years, 11 of the 12 included articles were published within the most recent decade (Figure 2.2). The single exception, a research study examining the performance of a group of cardiac nurses when removing an arterial femoral sheath, did not have the primary aim of measuring individual nurse performance (Schiks, Schoonhoven, Verheugt, Aengevaeren, & van Achterberg, 2007). Rather, the researchers analyzed performance at the individual level only to ensure that variability in mean group scores was not impacted by extreme individual scores (Schiks et al., 2007).

Nurse Metric Variability

We also identified wide variation in both the type of performance measured and in the nurse work environments (Burnie & Vining, 2021; Castille & Robinson, 2011; Chambers et al., 2019; Dexter, Ledolter, & Hindman, 2017; Kapu & Kleinpell, 2013; Schiks et al., 2007; Yakusheva et al., 2014; Yakusheva, Needleman, et al., 2020). The types of nurse performance ranged from discrete, technical tasks, such as compliance with a protocol for arterial sheath removal (Schiks et al., 2007) or blood culture collection (Burnie & Vining, 2021) to more global measures, such as value calculations that incorporated multiple patient outcomes (Yakusheva et al., 2014) and calculations that demonstrated individual variation in performance among nurses

(Yakusheva, Needleman, et al., 2020). The development of the metrics relied on a range of data including survey data from co-workers and patients, (Chambers et al., 2019; Dexter et al., 2017; Kapu & Kleinpell, 2013) retrospective review of the electronic medical record, (Burnie & Vining, 2021; Yakusheva et al., 2014; Yakusheva, Needleman, et al., 2020) and direct observation (Schiks et al., 2007).

The included papers also reflected a diverse range of clinical settings, including the emergency department, (Burnie & Vining, 2021; Chang et al., 2018) cardiac catheterization laboratory, (Schiks et al., 2007) inpatient mental health unit, (Chambers et al., 2019) and medical-surgical floors (Yakusheva et al., 2014). Three of the articles focused on advanced practice nurses, such as nurse practitioners in the intensive care unit, (Kapu & Kleinpell, 2013) certified nurse anesthetists in the perioperative department, (Dexter et al., 2017) and nurse midwives (Castille & Robinson, 2011). In these varied clinical environments, the performance metrics reflected the skills and priorities of those specific settings. For example, in the mental health setting, individual nurses were measured on the basis of therapeutic engagement, (Chambers et al., 2019) a quality that is not a priority for nurses in the cardiac catheterization laboratory where performance can be evaluated on the basis of technical skills (Schiks et al., 2007).

Performance Implications

The third theme describes how these data could improve nurse performance and, subsequently, patient care quality. Half of the included articles suggested direct education designed to adjust the performance of the individual nurse (Burnie & Vining, 2021; Castille & Robinson, 2011; Chambers et al., 2019; Chang et al., 2018; Schiks et al., 2007). We again noted variability in how that education would be structured depending on the clinical setting, and the

varied suggestions included delivering specific time-based metrics to nurses to improve length-of-stay in the emergency department (Chang et al., 2018) as well as reviewing how senior nurses spend their clinical and non-clinical time to improve organizational efficiency (Castille & Robinson, 2011). Two articles focused on advanced-practice nurses and made specific recommendations to include the individual performance metrics as part of the clinician's ongoing professional practice evaluation (OPPE), mirroring the physician model for OPPE (Dexter et al., 2017; Kapu & Kleinpell, 2013).

Three articles proposed using the metrics to create new models of staffing and to reconsider compensation for the work of nurses (Welton, 2016b; Welton & Harper, 2016; Yakusheva et al., 2014). These proposals focused on better matching individual nurses to the acuity of their patients as well as staffing based on individual nurse performance rather than the traditional method of nurse ratios (Welton & Harper, 2016). The application of these suggested metrics calls for a reexamination of the current status quo in hospital staffing and consideration of a new framework for understanding nurse work and its effect on patient outcomes (Yakusheva et al., 2014).

Discussion

This scoping review is the first to document the emerging field of individual nurse performance metrics. The search criteria yielded 12 appropriate studies for inclusion, with a majority published since 2013. The articles represent a variety of metrics used for specific clinical settings and initiatives. This growing body of research represents an opportunity for targeted education to improve clinical outcomes, as well as reevaluation of the traditional staffing approaches and reimbursement strategies currently used in hospitals. New, innovative data that captures the impact that an individual nurse on patient outcomes provides the

framework for nurse leaders to improve their organizations by reconsidering how nursing care is measured.

There already exists a call for the development of individual nurse performance metrics, and this review demonstrates that efforts are already underway to derive them (Yakusheva, Rambur, & Buerhaus, 2022). Identifying individual variability and seeking a better understanding of why that variability exists, nurse leaders can create improved organization efficiency, workforce productivity, and improved quality of care (Yakusheva, Needleman, et al., 2020). The nursing literature contains numerous studies in multiple clinical settings that demonstrate the work of nurses and its impact on patient outcomes (Aiken et al., 2002; Cho et al., 2015; Shindul-Rothschild et al., 2017). However, these studies measure nurses in aggregate, overlooking the individual qualities and characteristics each unique provider brings to patient care that could represent the next stage in quality improvement efforts (Welton, 2016a). The traditional approach of following the Donabedian model, with nurses included as a group as part of the structure and process, has not identified a way for nurse researchers to move the field forward. The paucity of literature in this area, as revealed by this review, suggests that the conceptual development of individual nurse performance metrics may need to look beyond nursing science and into economic theory.

Human Capital Theory

Human capital is an economic variable that refers to an individual's acquired skill, inclusive of that person's education and experience (Becker, 1962). The theory of human capital assumes that, as one acquires more experience, their productivity increases, as does their added value toward an organization (Becker, 1993). By acknowledging that individual variation exists among nurses, nurse researchers can develop and refine metrics that capture that value to

improve both individual and organizational productivity and efficiency (Yakusheva et al., 2014). Rather than adding new staff to meet previously considered ratios or staffing guidelines, hospitals and departments can focus on investing in their existing nurses, delivering targeted education based on individual performance metrics and creating the conditions to accumulate experience to enhance their human capital (Hayes et al., 2012). By considering an approach outside of the field of nursing science, nurse leaders have an opportunity to improve patient care delivery while also creating an environment that will retain nursing staff and possibly save costs.

Unintended Consequences

As with any innovation, using individual nurse performance metrics may undermine potential benefits. Two articles made specific mention of the potential of performance metrics to either exacerbate underlying inefficiencies within the healthcare system, or to be misused by those motivated by financial targets without a fundamental understanding of the value of nurses (Bliss et al., 2020; Welton, 2016b). These authors noted the proliferation of electronic medical record-generated data and the likelihood of performance metrics becoming ubiquitous in nursing, including those that capture individual-level effects (Bliss et al., 2020; Welton, 2016b). The future in application of individual nurse performance metrics requires focus to avoid exploiting these data to serve primarily financial purposes rather than clinical ones (Bliss et al., 2020). One author compared the advent of individual-level nurse performance metrics with “Pandora’s box,” but noted that if nursing were central to development and application, the patients would benefit most (Welton, 2016b).

Limitations

There are several limitations to this scoping review. First, although we made efforts to create a comprehensive search strategy, it is possible that our search terms did not capture eligible articles. Given the nascent nature of this body of research, there could be terms that describe this phenomenon that were not identified. The authors of this particular review were interested in whether individual nurse performance metrics were described and not whether they were featured as a part of a research study, and some articles may have been missed because of the lack of description of the metrics in the abstracts (Peters et al., 2020). Additionally, we performed the review during a specific date range, from 2004 to 2022, when it was thought that the development of these metrics would most likely appear in the literature. Because of the limited timeframe, any efforts to derive these metrics prior to then were not included. We made an additional attempt to capture these efforts by reviewing the reference lists for applicable materials, but it is still possible valid articles were excluded.

Conclusion

The purpose of this scoping review was to identify and characterize the study and application of individual nurse performance metrics. Twelve relevant articles were included, and three themes were identified: (1) this body of research is emerging, (2) there is variability in how metrics are derived and interpreted, and (3) these metrics can be used to improve nurse performance. The findings of this study demonstrate the need for further efforts for nurse researchers to work with nurse leaders and staff nurses to create metrics that capture the impact of individual nurses on patient outcomes.

Table 2.1

Data Extraction of Included Articles

Reference	Year	Type of Publication [a]	Type of Nurse	Setting	Described or Proposed Metric [b]	Name of Metric	Description of Metric	Proposed Use(s)
Schiks I, Schoonhoven L, Verheugt F, Aengevaeren W, van Achterberg T. Performance evaluation of arterial femoral sheath removal by registered nurses after PCI. *Eur J Cardiovasc Nurs*. 2007;6:172-177.	2007	Empirical Report	Cardiovascular staff nurses	Cardiac catherization laboratory	Described	Sheath removal performance	Individual nurse compliance with a cardiac catheter sheath removal protocol was assessed as a sensitivity measure in a study reporting aggregate nurse compliance with a protocol	Individual nurse metric uses not described; focused education proposed for aggregate data
Kapu AN, Kleinpell R. Developing nurse practitioner associated metrics for outcomes assessment. *J Am Assoc Nurse Pract*. 2013;25:289-296.	2013	Commentary	Nurse Practitioners (NPs)	Intensive care units (ICUs)	Described	Multiple; "NP-associated metrics for outcomes assessment"	Development of data dashboards that capture multiple NP-associated performance metrics in the ICU with the ability to view individual NP performance	Inclusion as part of the NP ongoing professional practice evaluation (OPPE)

Yakusheva O, Lindrooth R, Weiss M. Nurse value-added and patient outcomes in acute care. *Health Serv Res*. 2014;49(6):1767-1786.	2014	Empirical Report	Staff nurse	Inpatient, Medical-Surgical	Described	Nurse Valued-Added (NVA)	Individual NVA was calculated using nurse-linked data to patient outcomes using a composite score called the Rothman Index (RI) that measured changes in the patient's clinical condition. Additionally, patient length of stay, re-admission, and hospital costs were also linked to individual nurses.	Individual nurse performance evaluation and compensation models
Welton JM, Harper EM. Measuring nursing care value. *Nurs Econ*. 2016;34:7-14.	2016	Commentary	Staff nurse	Multiple	Proposed	Nurse Value Data Model	Multiple description of individual-level metrics for nurse productivity	New model for staffing that accounts for nurse performance and individual patient-level factors.
Welton JM. Nurses and the ethics of big data. *Nurs Econ*. 2016;34:257-259.	2016	Commentary	Staff nurse	Not specified	Proposed	Multiple	Individual nurse performance, efficiency, clinical effectiveness, and/productivity	Identify best practices as well as potential mismatches of workload and patient care needs

Dexter F, Ledolter J, Hindman BJ. Validity of using a work habits scale for the daily evaluation of nurse anesthetists' clinical performance while controlling for the leniencies of the rating anesthesiologists. *J Clin Anesth*. 2017;42:63-68.	2017	Quality Improvement	Certified registered nurse anesthetists (CRNAs)	Perioperative department	Described	CRNA work habits	Daily peer evaluation of CRNA work habits by their anesthesiologist co-workers	Inclusion as part of the CRNA OPPE
Chang AM, Cohen DJ, Lin A, et al. Hospital strategies for reducing emergency department crowding: A mixed-methods study. *Ann Emerg Med*. 2018;71:497-505.e4.	2018	Empirical Report	Staff nurse	Emergency Department	Proposed	Multiple	Time-related metrics are described with feedback reported to given at the individual nurse level	Individual nurse accountability in multidisciplinary efforts to improve Emergency Department crowding
Chambers M, McAndrew S, Nolan F, et al. The Therapeutic Engagement Questionnaire (TEQ): A service user-focused mental health	2019	Empirical Report	Registered mental health nurses	Acute in-patient mental health	Described	Therapeutic Engagement	Level of therapeutic engagement of an individual nurse is measured with a questionnaire completed by both the nurse	Monitoring individual nurse activity and add to an organization's performance indicators and outcome measures

nursing outcome metric. *BMC Psychiatry*. 2019;19:1-7.							and their patients	
Bliss K, Chambers M, Rambur B. Building a culture of safety and quality: The paradox of measurement. *Nurs Econ*. 2020;38:178-184.	2020	Empirical Report	Staff nurse	Multiple	Proposed	Multiple	Multiple metrics are described, including time-to-treatment metrics, that could be used in the evaluation of individual nurse performance	Individual nurse metric uses not explicitly described; however, preparation and education of nursing staff for the potential of individual metrics is proposed
Yakusheva O, Needleman J, Bettencourt AP, Buerhaus PI. Is it time to peek under the hood of system-level approaches to quality and safety? *Nurs Outlook*. 2020;68:141-144	2020	Commentary	Staff nurse	Inpatient	Described	Individual/Clinician-level Performance Variability	Calculation based on the outcome of the patient acuity score at discharge and the individual nurse assigned	To be the basis of further efforts to improve quality and outcomes through qualitative inquiry
Castille K, Robinson J. Balancing quality with productivity. *Nurs Manage*. 2011;18(2):14-20.	2021	Quality Improvement	Senior nurses and midwives	Multiple	Described	Senior nurse activity	Description of how the time of senior nurses and midwives is spent on both clinical and non-clinical activities to	Disaggregated data were shared with leadership to adjust the clinical and non-clinical responsibilities

							understand productivity in this cohort	of senior nurses to increase the value to patient care
Burnie J, Vining S. Clinical nurse specialist practice: Impact on emergency department blood culture contamination. *Clin Nurse Spec*. 2021;35:314-317.	2021	Quality Improvement	Staff nurse	Emergency Department	Described	Blood culture contamination	Incidence of contaminated blood cultures associated with individual emergency nurses	Targeted education by clinical nurse specialist to emergency nurses to increase compliance with blood culture policy

[a] *Empirical Report:* inclusive of quantitative or qualitative research studies; *Quality Improvement*: inclusive of performance or quality improvement initiatives that include quantitative data; *Commentary*: inclusive of non-research data reports and opinion articles

[b] *Described*: the metric has been created and is used in the study; *Proposed*: the metric is explained, but is not calculated.

Figure 2.1

Selection of Sources of Evidence [Adapted from: Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. Ann Intern Med. 2018;169(7):467-473. doi:10.7326/M18-0850.]

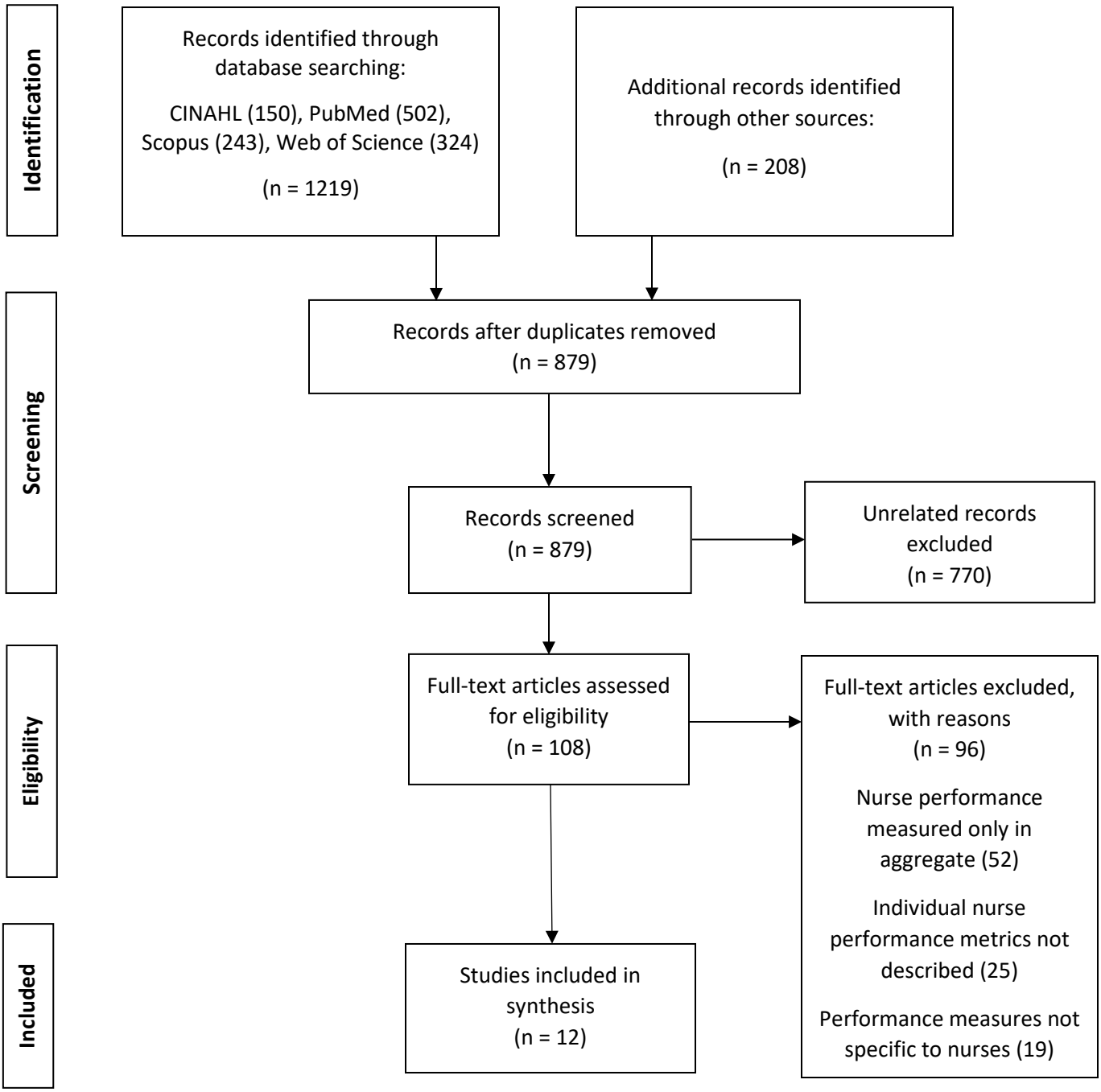
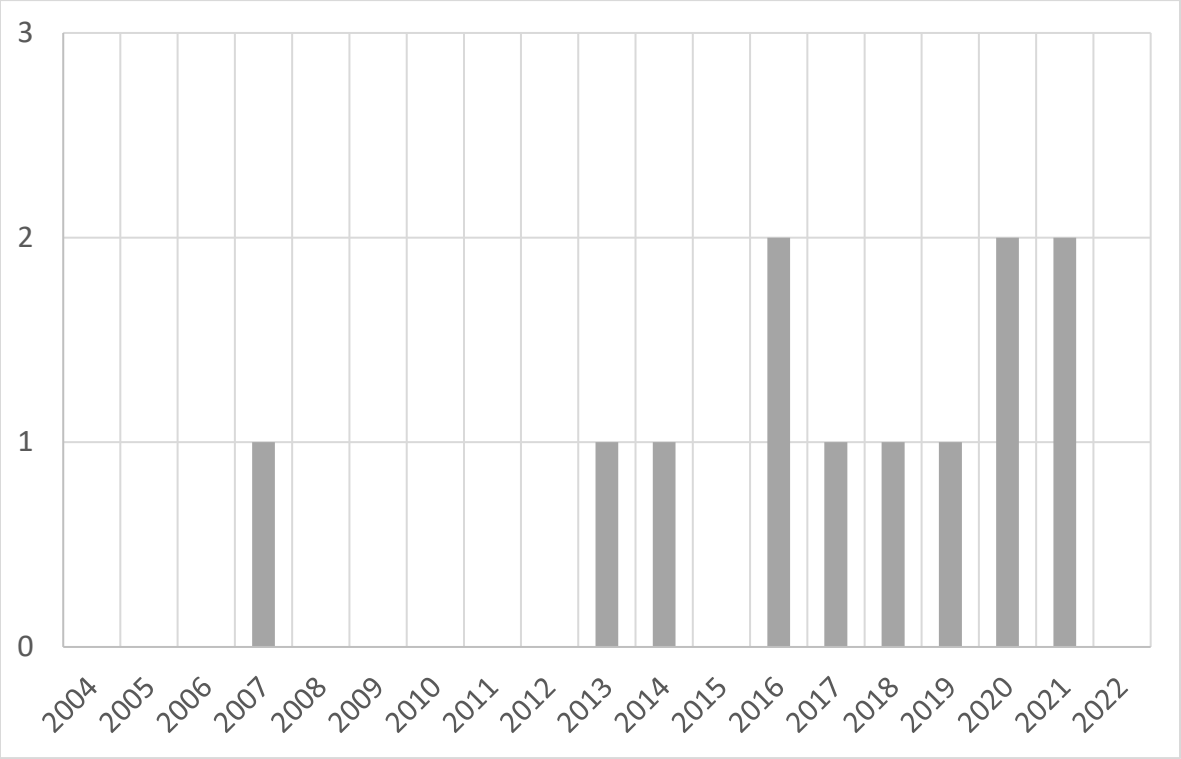


Figure 2.2

Number of Included Articles by Year of Publication



Appendix A

Search Terms	Limiters - Published Date: 1/2004-5/2022; English Language
nurse AND measur* OR metrics OR evaluat* AND patient outcomes AND performance	Results (54,916)
nurse AND measur* OR metrics AND patient outcomes AND performance	Results (31,486)
individual nurse AND measur* OR metrics AND patient outcomes AND performance	Results (716)
individual nurse AND measur* AND patient outcomes AND performance	Results (7)
individual nurse performance AND measur* AND patient outcomes	Results (1)
nurse performance AND measur* AND patient outcomes	Results (42)
nurse AND performance AND measur* AND patient outcomes	Results (282)
nurse AND performance AND measur*	Results (2,559)
nurse AND performance AND metrics	Results (150)

References for Chapter II

Refer to Cumulative Reference List

Chapter III

Emergency Nurse Efficiency: A Concept Analysis

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This manuscript replaces the review of the conceptual/theoretical framework section and measures section of the traditional dissertation. Mr. DePesa was the primary author on this paper; Dr. Jurgens was the second author; Dr. Lee was the third author; and Dr. O'Reilly-Jacob was the senior author on this paper. This paper was submitted to the Journal of Emergency Nursing, which is an indexed and peer-reviewed journal with an impact factor of 1.43. The readership for this journal includes emergency nurses, emergency/trauma departments, and emergency department managers.

Abstract

Objective: The evaluation of emergency nurse performance lacks evidence-based metrics that can be tracked over time. Measuring nurse efficiency, which incorporates the shared goal of minimizing patient length of stay (LOS) is one way to evaluate nurses, especially in the emergency department (ED). High-value nursing care in the ED involves high-quality patient care, while also decreasing ED LOS. The purpose of this paper is to introduce the concept of *emergency nurse efficiency* (ENE) as a measure to evaluate the performance of emergency nurses.

Method: Rodgers's evolutionary approach for concept analysis was performed.

Results: The concept of ENE is developed as a characteristic of emergency nurses that can be quantifiably measured. The evolving concept of ENE has close conceptual linkages to Benner's *Novice to Expert* theory of skill acquisition. ENE is a measurable attribute of emergency nurses that incorporates the positive impact of an individual nurse during a given time while subtracting the negative that grows as experience is obtained.

Conclusion: The introduction of the ENE concept has multiple applications in staff development, nurse education, and performance improvement.

Introduction

Nursing practice has been described as a team sport in hospital settings where nurses coordinate with multiple providers, including other nurses, physicians, and healthcare providers from additional disciplines (Breitbach, Reeves, & Fletcher, 2017). Nurses in these practice areas, like emergency care, work with a group of providers toward a common practice goal, including optimal care of trauma patients, decreased critical care mortality rates, and holistic care of cancer patients (Campbell, 2011; Civil, 2007; Dalia et al., 2019; Harkins, 2009). However, nurse evaluation rarely includes data that measures an individual provider's contribution toward those shared targeted outcomes (Welton, 2016a). Instead, the contribution of nursing is commonly measured in aggregate, with staffing ratios or nurse dose that do not actually measure the effects of individual nurses (Butler et al., 2011; Cho et al., 2015; Manojlovich, Sidani, Covell, & Antonakos, 2011). Recent studies that calculate a nurse's added value have created an economic framework for an individual nurse to be evaluated that incorporates the financial budget of a healthcare organization (Yakusheva et al., 2014, 2019). Evaluating the contribution of an individual nurse on a targeted patient outcome by using strategies successfully implemented from other team sports is an opportunity for nurse managers to quantify their unique impact (Abukhader, 2012).

A History Performance Evaluation in Nursing

The evaluation of nurse performance is integral to both staff development and quality assurance. Nurse scientists have extensively examined the process of performance evaluation and its value for the past 50 years (Bernhardt & Schuette, 1975; Finer, 1956; McCloskey & McCain, 1988; Schwirian, 1976; Tate, 1962). Despite efforts to standardize performance evaluation, there is variability in both the evaluation components and how evaluation data are used by nurses and

their supervisors (Brooks et al., 1995; Smith, 1989; South, 1978; Stalker, Kornblith, Lewis, & Parker, 1986; Stull, 1986; Sudela & Landureth, 1987; Thomas, 1987). The evaluation of nurse performance has evolved to include direct supervisor feedback (Stull, 1986), peer review (Brooks et al., 1995), and, most recently, the integration of technology (Greenslade & Jimmieson, 2007). The clinical ladder program, an attempt to link individual nurse performance with financial incentives, added the promise of standardization to the process of performance evaluation by integrating professional and national standards (Merian-Tresch, 1997). Although the structure of the performance evaluation has grown to include more variables, those variables generally remain the subjective opinions of supervisors, peers, and self-appraisals and lack robust evidence of the effect of an individual nurse. By looking at how other team activities measure the contribution of an individual within those teams, nursing can create a new approach to evaluation that accounts for patient outcomes.

Performance Evaluation in Professional Team Sports

The assessment of the impact of an individual on a collective outcome is the primary focus of sports analytics and a priority for general managers of professional sports organizations. Traditionally, this evaluation enlists the advice of experts, including scouts and sports executives (Lewis, 2003). However, in the last 40 years, new approaches to player evaluation, including the use of increasingly intricate data, called *advanced metrics*, has emerged as a new paradigm of player and team evaluation (Grabiner, 2011). *Advanced metrics* refers to the use of available statistics to evaluate an athlete's performance (Cook, 1964). The organization that most thoroughly explored the use of *advanced metrics* is the Society for American Baseball Research (SABR), which was created to better understand the game of baseball through research ("Society for American Baseball Research," n.d.). In 1977, a member of SABR published a prospectus on

the use of *advanced metrics* in baseball (James, 1977). Over time, teams began to implement these data, most notably the 2002 Oakland A's, whose success as a low-budget baseball team has been chronicled in the nonfiction book *Moneyball* (Lewis, 2003). *Moneyball* described how the team was able to re-evaluate baseball players based on their contribution to team wins, an approach without comparison to any previously held model of performance evaluation.

Player Efficiency Rating

In creating a technique to measure the value of an individual player in the context of a team's accomplishments, John Hollinger (Hollinger, 2002) built on the existing knowledge in sports analytics and offered a new way to view player performance. Obviously, healthcare is not the recreational activity that professional sports are, and nurses, physicians, and other healthcare professionals are not mere "players" that "win" or "lose" games each day. However, as healthcare evolves to meet the human needs of its patient population, new solutions are needed to explore how individuals perform in complex teams to contribute to positive patient outcomes. By applying a similar approach to the evaluation of nurses in environments that require a team approach to care, an evaluator can measure the impact of an individual nurse on a collective outcome in a method that has not been previously described in the literature.

Emergency Nursing and Patient Throughput

Emergency nursing is a unique practice discipline in which nurses acquire and apply a specialized set of skills that enhance their practice, including collaboration with multidisciplinary providers, situational awareness, and a deep and broad knowledge of the pathophysiology of acute illness (Sheehy, 2020). Studies focused on the environment, culture, and characteristics of emergency nursing have found that the profession is physically, mentally, and psychologically

complex, strenuous, and exhausting (Weigl & Schneider, 2017). Emergency nurses self-report that the characteristics required for success include being a team player, multitasker and timely in their interventions (Person, Spiva, & Hart, 2013). Additional studies have reiterated the trait of being able to prioritize tasks in a distracting environment is a core characteristic of the emergency nurse (Forsberg, Athlin, & von Thiele Schwarz, 2015; Fry, 2012). Working within a multidisciplinary team while delivering appropriate and timely interventions to emergency patients is the primary job of the emergency nurse.

Studies focused on patient outcomes in the emergency department (ED) have identified higher staffing levels as being associated with lower ED length of stay (LOS) as well as other quality metrics, such as patient satisfaction and the number of patients leaving without completing treatment (Henneman et al., 2015; Hwang & Chang, 2007; Recio-Saucedo et al., 2015; Shindul-Rothschild et al., 2017). Solutions proposed to improve ED throughput while maintaining quality care are ultimately dependent on a combination of the number of emergency nurses assigned to a shift, the physical design of the ED, and the structure of the processes in place to expedite the patient through the department (Bruno, 2017; Forbes et al., 2014; S. O. Murphy et al., 2014; Pati et al., 2014; Wolf et al., 2017). However, these ideas do not account for the performance characteristics of the individual nurse, which has been previously described in the literature as being included as part of *nursing care value* (Welton & Harper, 2016). The mark of an efficient emergency nurse is to influence the outcome of their patients in an expedient way while maintaining a high quality of care delivered.

Methods

This analysis surveys a broad body of multi-disciplinary literature to identify a measurable characteristic of emergency nurses that captures the impact of individual providers

on patient flow in the ED. Rodgers's evolutionary approach is an ideal method for this concept analysis because the concept is continuously evolving (Rodgers, 1989). This method includes 7 steps (Table 3.1) and proceeds in phases rather than linearly (Rodgers, 1989).

Identify and Name the Concept of Interest

Building on previous efforts to measure the contribution of an individual performer in a team endeavor, (Hollinger, 2002; James, 1977; Lewis, 2003) the concept of *Emergency Nurse Efficiency* (ENE) was conceived and selected for further analysis. The use of the term *efficiency* is intended to mirror its use in *advanced metrics*, specifically from its usage in team performance analytics (Piette, Anand, & Zhang, 2010).

Aim of the Analysis

The purpose of this concept analysis is to introduce *Emergency Nurse Efficiency* as a novel approach to measuring the contribution of emergency nurses on the outcome of ED patients.

Results

Uses of Efficiency in the Literature

The term *efficiency* was searched in multiple databases, including CINAHL, PubMed, EMBASE, and Google Scholar. As it is a common term, these searches returned a prohibitively high number of search results to be included in this analysis. Thus, using Rodgers's evolutionary approach (Rodgers & Knafl, 2000), the research team examined the search results, selected representative materials from multiple disciplines, and summarized their findings before moving

into the next phase of analysis. We then divided these materials into three categories: uses outside of healthcare, uses within healthcare, and uses in professional team sports.

Uses Outside of Healthcare

Merriam-Webster defines *efficiency* as "the ability to do something or produce something without wasting materials, time, or energy" and "the quality or degree of being efficient" (Merriam-Webster, n.d.). It is derived from the Latin *efficientia*, which means "producing or giving rise to something, immediate (of a cause)"(Merriam-Webster, n.d.).

Energy efficiency is a topic that appears in both the economic and organizational behavior literature and describes how industrial sectors can increase productivity while mitigating costs and energy expenses (Kang & Lee, 2016). In economics, efficiency is a concept with multiple uses, depending on the theory to which it is applied, but is generally used to described how an institution uses a resource when compared to its desired outcome (Klein & Miller, 1996). In psychology, efficiency has a long history of use as a descriptor of human behavior, including applications in the study of work patterns and employee selection for employment (Jarrett, 1948; E. S. Robinson, 1926). Organizational efficiency is a term that is used when focusing on the economic performance of a specific industry in which the desired outcome is measured as a function of the resources utilized as input (Couto & Graham, 2009). In cases where the measurement of performance of individuals in a specific job role is described, the terms *productivity* (Gandy, Coberley, Pope, & Rula, 2016) and *performance* (Rubino et al., 2014) are generally used instead of *efficiency*. When the term is used in describing individual performance, it refers to the minimization of extraneous movement in accomplishing a physical task, such as hand movement while playing the piano (Goebl & Palmer, 2013). Consistently, when the term *efficiency* is used to describe any phenomenon described in the literature, the

definition always retained similar traits, specifically the maximum utilization of a resource (i.e. energy, money, time, production) with minimal waste when producing a targeted outcome.

Uses Within Healthcare

Similar to other organizations that measure output as a function of resources used, healthcare institutions use *efficiency* to measure the output of departments and units within a hospital (Kaushal et al., 2014; Melon et al., 2013). When measuring the human aspect of a unit's or department's *efficiency*, again the term *productivity* appears (Nicholson et al., 2006; von Thiele Schwarz et al., 2014). For individual providers, *efficiency* is used as a financial calculation that incorporates reimbursement in advanced practice nurse roles (Liu, Finkelstein, & Poghosyan, 2014).

In ED settings, the related term *productivity* is found in the nurse management literature and is defined as the ratio between goods and services produced to the resources required, and the term *efficiency* is used in the context of managing a budget that produces appropriate staff productivity (Cardello, 1995). In a concept analysis about nursing productivity, the authors write about the relationship between *productivity* and *efficiency*, describing the terms as being used synonymously, and cited sources that included *efficiency* as part of the definition for *productivity* (Holcomb et al., 2002). When *efficiency* is used in the description of ED throughput, it incorporates the measurement of ED LOS as a metric for patient throughput (Subash, Dunn, McNicholl, & Marlow, 2004). Again, when *efficiency* is used to describe either clinical departments or clinical providers, it describes the ratio of a specific output to the amount of a resource being used.

Uses in Professional Team Sports

Emergency nursing requires the concurrent, and seemingly contradictory, qualities of being both autonomous and a team member while delivering care to a patient (Sheehy, 2020). Analogously, professional basketball players have similar characteristics, and their individual achievements are recorded as measured statistics, such as points scored, assists recorded, and rebounds attained, but they must be able to seamlessly work with other players in order for their team to be successful. This presents a challenge in trying to measure the impact of an individual player on the success or failure of his team, as well as the success or failure of his teammates. Hollinger attempted to tackle this exact challenge (Hollinger, 2002) He describes his concept of *Player Efficiency Rating (PER)*, which he defines as summarizing an individual player's positive impact on the team's outcome minus their negative actions to gain new insight into performance. He then uses this rating in evaluation of the players as a method to evaluate the individual effect that a player has on the outcomes of their team and their teammates (Hollinger, 2002). In this context, the term *efficiency* is used to describe the quality of how well a player utilizes his time on the court performing actions that contribute to wins for their team while avoiding actions that do not, or that may contribute to team losses. An efficient professional basketball player makes autonomous decisions that improve their team's chances of winning more games than an inefficient player.

Surrogate Terms

As noted above, the term *efficiency* was found to often be used interchangeably with other terms, namely *productivity*, *performance*, *efficacy*, and *effective* (or *effectiveness*). These terms are also represented in a summarized form in Table 3.2.

Productivity

Productivity, both in the nursing literature and in economic literature, commonly creates a defining equation that measures an output variable against an input variable, often the monetary cost associated with obtaining the output (Bukata, Murray, & Atkinson, 2018; Holcomb et al., 2002; Hollingsworth, 2008; Nicholson et al., 2006). In articles specific to nursing, productivity is defined as "hours per patient day and dollars per patient day,"(North & Hughes, 2012, p. 197) reinforcing the use of the term *productivity* as specific to input/output calculations involving financial data.

Performance

A broader term than either nurse *productivity* or nurse *efficiency*, nurse *performance* has multiple interpretations in the literature all of which include the ability for measurement (Edmonds et al., 2017; Ericsson et al., 2007; Robb, Valerie, & Dietert, 2002; Rubino et al., 2014). A review of clinical nursing *performance* demonstrated that, although there was no clear consensus method for measuring *performance*, the use of the term *performance* was done in the context of measurement (Robb et al., 2002). Further, the authors note that performance was often used as a proxy for clinical competence, which was in need for further clarification based on practice settings and current standards (Robb et al., 2002). *Performance* is additionally portrayed as an umbrella term for measurement that can be interpreted to capture multiple aspects of nursing practice, depending on the aim of individual or organization performing the evaluation (Needleman, Kurtzman, & Kizer, 2007).

Efficacy and Effective

Both *efficacy* and *effective* also are used as surrogate terms for *efficiency* and are used interchangeably for each other. The definition for *efficacy* is "the power to produce an effect,"

whereas the definition for *effective* is "producing a decided, decisive, or desired effect." (Merriam-Webster, n.d.) Since these terms share a common Latin root with *efficiency*, it is not uncommon to see all three terms used as surrogates for each other (Merriam-Webster, n.d.). In the nursing literature, *efficacy* tends to appear in the form of *self-efficacy*, which is a nurse's appraisal of themselves in the context of a specific task or intervention (Galiana-Camacho et al., 2021; Jønsson, Bahat, & Barattucci, 2021; Labrague, Al Sabei, Al Rawajfah, AbuAlRub, & Burney, 2021). Additionally, *efficacy* is also used when referring to the effectiveness of a specific intervention or initiative, including nursing education (Shin, Kang, Hwang, & Kim, 2021). *Effective* or *effectiveness* is more broadly applied as a term denoting whether an intervention, a program, or other action had its intended effect.(Gabbard et al., 2021; Hou, Lu, Lee, & Chang, 2019) *Cost-effective* is a common representation of the term in the literature, and it primarily pertains to the value of the outcome of an intervention given its financial cost (Bryant-Lukosius et al., 2015; Wang, Zou, Cong, & Liu, 2018).

Attributes of the Concept

In identifying the essential attributes of *Emergency Nurse Efficiency*, the attributes of both emergency nurses and of *efficiency* must be considered. First, an emergency nurse is a nurse who works in an emergency practice setting, namely a hospital ED. Nurses can also be considered emergency nurses while working in other practice settings similar to the ED (Sheehy, 2020), but for this concept application, it is essential that they work in a hospital ED. Second, nurses must exercise the unique characteristics that define emergency nursing. Specifically, the attributes are teamwork with other healthcare professionals, a broad and deep knowledge of emergency disease pathology, and situational awareness in which the nurse is able to consider their actions in the context of a busy department (Person et al., 2013) (Figure 3.1). Third,

consistent with its dictionary definition, its uses in the social science literature, and Hollinger's use in *PER*, *efficiency* is a function of how an individual spends their time. Specifically, *efficiency* is prioritizing tasks and interactions that make a positive impact on a desired outcome while minimizing time spent doing things that either do not contribute to that outcome or that influence it negatively. Efficient emergency nurses can use their acquired technical skill and clinical knowledge in coordination with other nurses, physicians, and other interdisciplinary members of the care team to achieve the best possible outcomes for their patients, including minimizing ED LOS. In order to develop into efficient practitioners, emergency nurses must reflect on how they delivered care in different circumstances over time and consider the results. As this reflection occurs, and as their practice develops, the nurse will eliminate practices or interventions that result in poor outcomes and will accumulate an ability to leverage teamwork and their clinical knowledge base to make the best decisions in a specific circumstance to create the best result. Thus, *Emergency Nurse Efficiency* is a measurable attribute of emergency nurses that incorporates that positive impact of an individual nurse during a given time while subtracting the negative.

Relationship to Benner's **Novice to Expert** ***Model***

The three defining attributes of *Emergency Nurse Efficiency* are all are acquired over time, with teamwork (Colman, Patera, & Hebbar, 2019), situational awareness (Cooper et al., 2010; Fore & Sculli, 2013), and ED-specific knowledge (Considine, Botti, & Thomas, 2007) influenced by experience and accumulated as expertise. The nature of acquisition of these defining attributes closely mirrors the way nursing expertise is acquired, and thus *Emergency Nurse Efficiency* implicates Benner's *Novice to Expert* model in how nurse performance changes over time (Benner, 1984). Similar to Benner's model *Emergency Nurse Efficiency* should

improve as the emergency nurse gains expertise through work experience and reflection on their practice (Benner et al., 1997) (Figure 3.2).

A Model Case

It is a busy day in the ED, and an experienced emergency nurse is managing an assignment of 5 patients when an ambulance calls the department to expect a new patient with a suspected stroke in 15 minutes. The nurse knows that, once the patient arrives, there are time-sensitive interventions that need to be done to ensure the best possible outcome for the arriving patient. The nurse also knows that members of their care team will have to divert their attention to the new arrival, and their existing patients may have to wait for the next steps in their ED course. So, before the new patient arrives, they consider the needs of their existing patients and the needs of the department, which is nearly out of available space. Before the new patient arrives, the nurse calls the floor to give report on her admitted patient, prepares another patient to go to radiology when transport arrives, and coordinates with the attending physician to order a rapid swab to send to the lab on a third patient who is being ruled out for strep throat. When the new patient with a suspected stroke arrives, the nurse is then free to assist in obtaining IV access, sending urgent blood work to the lab, and providing comfort to the new patient and their family while their assigned patients continue to progress along their expected ED course. This nurse understood the current state in the ED, leveraged their knowledge base, and worked with the ED team to address their patients' needs in a way that expedited the patients through their ED course efficiently.

Related Concepts

The two concepts that are most related to *Emergency Nurse Efficiency* are *nurse dose* and *nurse value-added*, both of which are attempts to conceptualize the impact an individual nurse has on a collective outcome. *Nurse dose* is a concept composed of the amount of time a nurse provides direct care to a patient, the characteristics of the nurse (including experience, training, and education), and the patient response to the interaction (Brooten & Youngblut, 2006). *Nurse dose* has been used to examine the effect of exposure to skilled nursing care results on rates of adverse events (Manojlovich et al., 2011). However, *nurse dose* remains an aggregated measurement of nursing care, similar to studies on nurse staffing ratios and their relationship to patient-related outcomes (Cho et al., 2015; Shindul-Rothschild et al., 2017). *Nurse dose* and *Emergency Nurse Efficiency* differ in that *Emergency Nurse Efficiency* is specific to emergency nurses and reflects the effect of an individual on an outcome.

Nurse value-added is a measurement of the relative effectiveness of a nurse and nursing care (Welton, 2016a; Welton & Harper, 2016; Yakusheva et al., 2014). This approach can be used to measure nurses individually, including each nurse's influence on adverse patient outcomes, such as readmission rates (Yakusheva et al., 2019). Similar to the advanced metrics utilized in professional team sports and to *Emergency Nurse Efficiency*, *nurse-valued added* is a metric that can be applied to nurses individually, and these measurements can be used to direct efforts to improve patient care by better understanding how these individual nurses work.

Antecedents and Consequences

Because *Emergency Nurse Efficiency* is a characteristic of emergency nurses that is a measurable manifestation of emergency nurse expertise, the primary antecedents are what Benner describes as the requirements for skill acquisition and progression along the novice to expert continuum (Benner, 1984). Accordingly, the two primary antecedents for *Emergency*

Nurse Efficiency are clinical experience and the ability to actively reflect on that experience to refine a nurse's clinical knowledge (Benner, 1982; Benner et al., 1997).

The consequences of *Emergency Nurse Efficiency* are also related to Benner theory of skill acquisition, and these include technical skill acquisition and refinement of clinical judgement (Benner, 1984). Just as for the jet pilots and chess players that Benner references (Dreyfus & Dreyfus, 1980), emergency nurses develop *Emergency Nurse Efficiency* through repetition of clinical experiences and their understanding of their influence on patient ED length of stay. With active reflection, they will develop specialized technical skills, including the ability to obtain IV access with facility even in challenging patients or circumstances, the physical capacity for spending a 12-hour shift on their feet, and physical affectations that create a safe and comfortable space for their patients and their families (Figure 3.3). These are physical skills that follow the development of *Emergency Nurse Efficiency* over time. Further, as *Emergency Nurse Efficiency* grows, so does a nurse's clinical judgement, as they gain a deeper understanding of the conditions and situations that could lead to a complicated ED course, and, subsequently, a longer ED length of stay.

Empirical Referents

Emergency nursing is about quickly assessing patients, prioritizing tasks, and coordinating team care to expedite the evaluation, stabilization, and disposition of ED patients. In a hospital ED, there is always another patient who needs a nurse's attention, and the departmental goal is to expedite patients without sacrificing quality of care. The essence of *Emergency Nurse Efficiency* is maximizing the use of time that contributes to positive patient outcomes while minimizing actions and tasks that either contribute to negative patient outcomes or are redundant. *Emergency Nurse Efficiency*, then, can be measured, in part, as a combination

of patient ED LOS and patient-level adverse events, accounting for other factors that may affect ED LOS. The timing of nurse-specific interventions, such as medication administration or lab specimen collection, play a role in ED LOS. Thus, *Emergency Nurse Efficiency* will manifest in these time intervals which then influence ED LOS.

Discussion

This concept analysis utilized Rodgers's evolutionary approach to develop the novel concept of *Emergency Nurse Efficiency* by incorporating literature and ideas from multiple and varied sources. Per the Rodgers approach, as the sources and definitions used in this analysis evolve, so will the concept of *Emergency Nurse Efficiency*. *Emergency Nurse Efficiency* is an attribute of emergency nurses that allows those nurses to facilitate the appropriate outcome for emergency patients that grows as experience is gained. The future of healthcare will include data-driven analyses, initiatives, and metrics that nurses will be forced to confront, and it is crucial that there are nurses at the forefront to interpret and contextualize these data (P. F. Brennan & Bakken, 2015).

The process of explicating the concept of *Emergency Nurse Efficiency* created an opportunity to better understand how emergency nurses work and the impact that they are able to make on both a single patient's experience and on the healthcare system in general. Emergency nurses are in a unique position at the frontlines of healthcare system, and they feel the pressures of their patients looking to them for help and of their organizations, who are asking them to fill the gaps of a system that is either reaching its capacity or already overloaded (McKenna et al., 2019). The concept of *Emergency Nurse Efficiency* is by no means meant to capture all of the work that an emergency nurse does. Rather, it is a single proposed metric that aims to identify ways in which nurses can make an impact in an environment filled with unknown variables.

There are expert emergency nurses working today who have learned to provide exemplary care within the context of these unknowns, and *Emergency Nurse Efficiency* is our proposal to capture that.

Implications for Emergency Clinical Care

The value of nurses on positive patient outcomes has already been attributed to the ratio of nurses to patients (Cho et al., 2015), the skill mix and education of those nurses (Aiken et al., 2003), and the overall time of exposure to skilled nursing practice (Manojlovich et al., 2011). The ED has different priorities than other units in the hospital, and ED LOS is an outcome measure that can be influenced by quality nursing care (Shindul-Rothschild et al., 2017). The introduction of *Emergency Nurse Efficiency* as an attribute of emergency nurse performance creates an opportunity for nurse scientists to further analyze the characteristics of an individual nurse that contribute to positive patient outcomes and can be obtained with additional experience. Additionally, identifying, and, ultimately, quantifying *Emergency Nurse Efficiency* affords ED nurse leadership the ability to direct education and staff development efforts toward an individual nurse's opportunities for improvement. Further, ED nurse leaders consider alternatives to the current staffing strategies, including *nurse dose* or staffing ratios, in favor of using a specific mix of nurses to create department-level efficiency based on a combination of individual emergency nurse efficiencies. A possible negative consequence would be if hospital organizations begin to connect nurse compensation to efficiency data, which would likely leave behind those nurses that could benefit from additional counselling and education to support skill acquisition.

Conclusion

The preceding analysis is the introduction of *Emergency Nurse Efficiency*, a novel performance trait that describes the contribution of an individual nurse on ED patients' outcomes that is informed by Benner's *Novice to Expert* model of skill acquisition. The current standard of increasing nurse staffing ratios with the expectation of decreasing poor patient outcomes does not allow for a comprehensive evaluation of individual nurse performance. The introduction of ENE as a concept addresses this deficiency in the nurse staffing literature and may lead to a streamlined staff education process, innovation is nurse performance evaluation, and new advances in ED staffing strategies.

Table 3.1

Steps of the Rodgers's Evolutionary Method of Concept Analysis [from Rodgers, B. L. (1989)]

1.	Identify and name the concept of interest.
2.	Identify surrogate terms and relevant uses of the concept.
3.	Identify and select an appropriate realm (sample) for data collection.
4.	Identify the attributes of the concept.
5.	Identify the references, antecedents, and consequences of the concept, if possible.
6.	Identify concepts that are related to the concept of interest.
7.	Identify a model case of the concept.

Table 3.2

Summary of Surrogate Terms for Efficiency and Their Definitions

Productivity	Measure of creating a desired output accounting for all input variables, often including cost.
Performance	Broad term representing either an assessment of activities performed by an individual or a group.
Efficacy	Ability to produce a desired effect, including self-appraisal (self-efficacy).
Effective(ness)	Measure of whether a person, action, or collective program created its/their desired effect. Often includes a calculation of value based on cost (cost-effective).
Efficiency	Ability to do something without wasting materials, time, or energy.

Figure 3.1

Conceptual Model of Emergency Nurse Efficiency (ENE) *and its Defining Attributes*

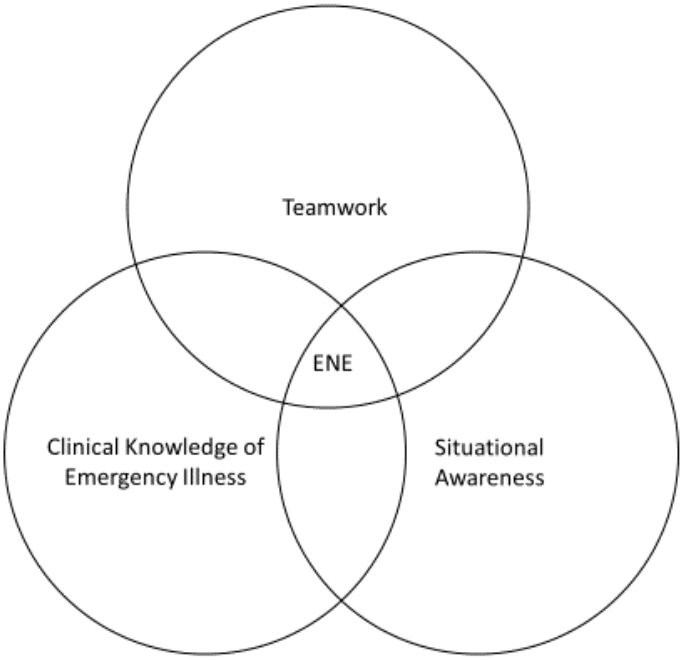


Figure 3.2

Visual Representation of Emergency Nurse Efficiency (ENE) *as a Function of Benner's* Novice to Expert *Model and Patient ED LOS*

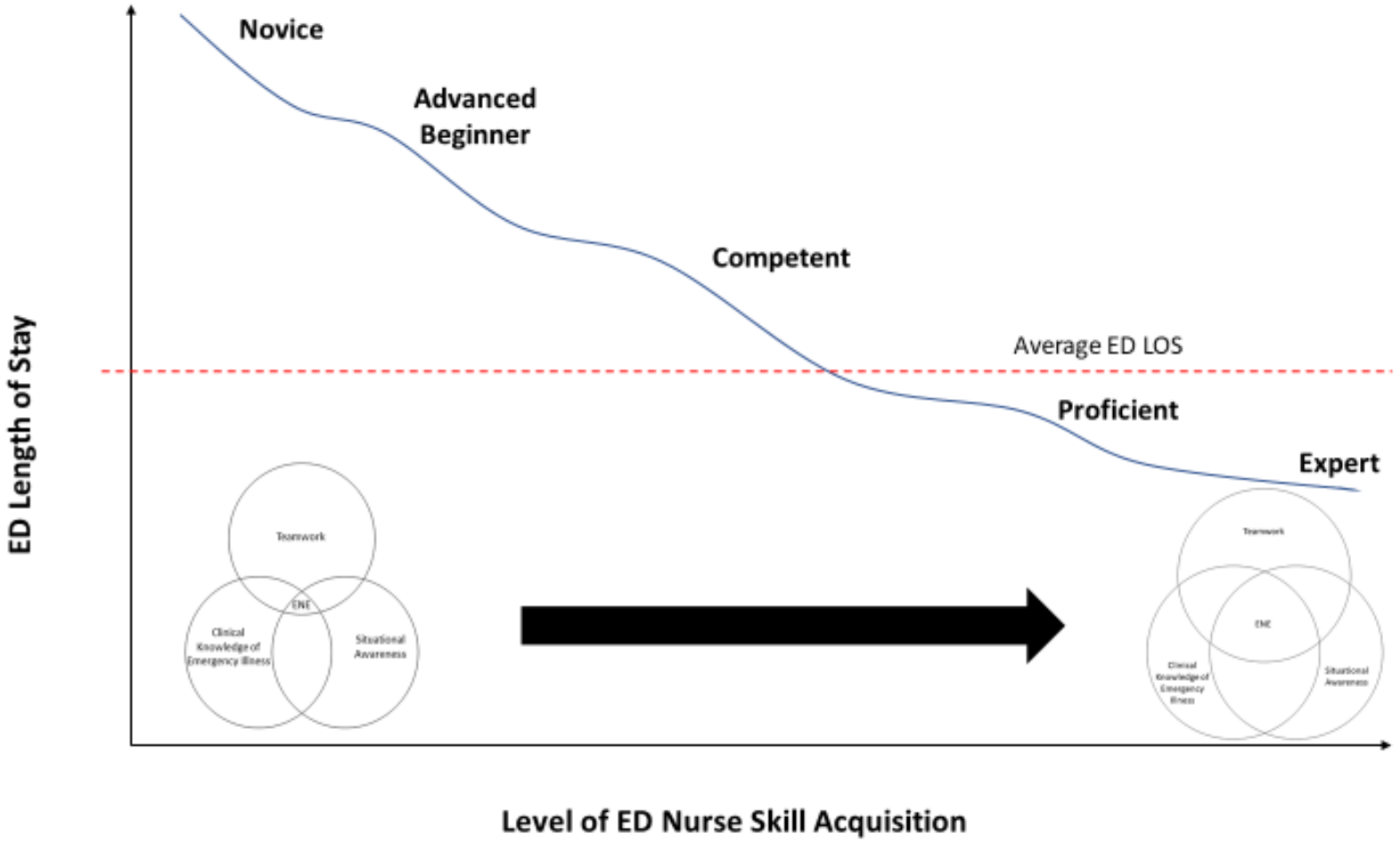
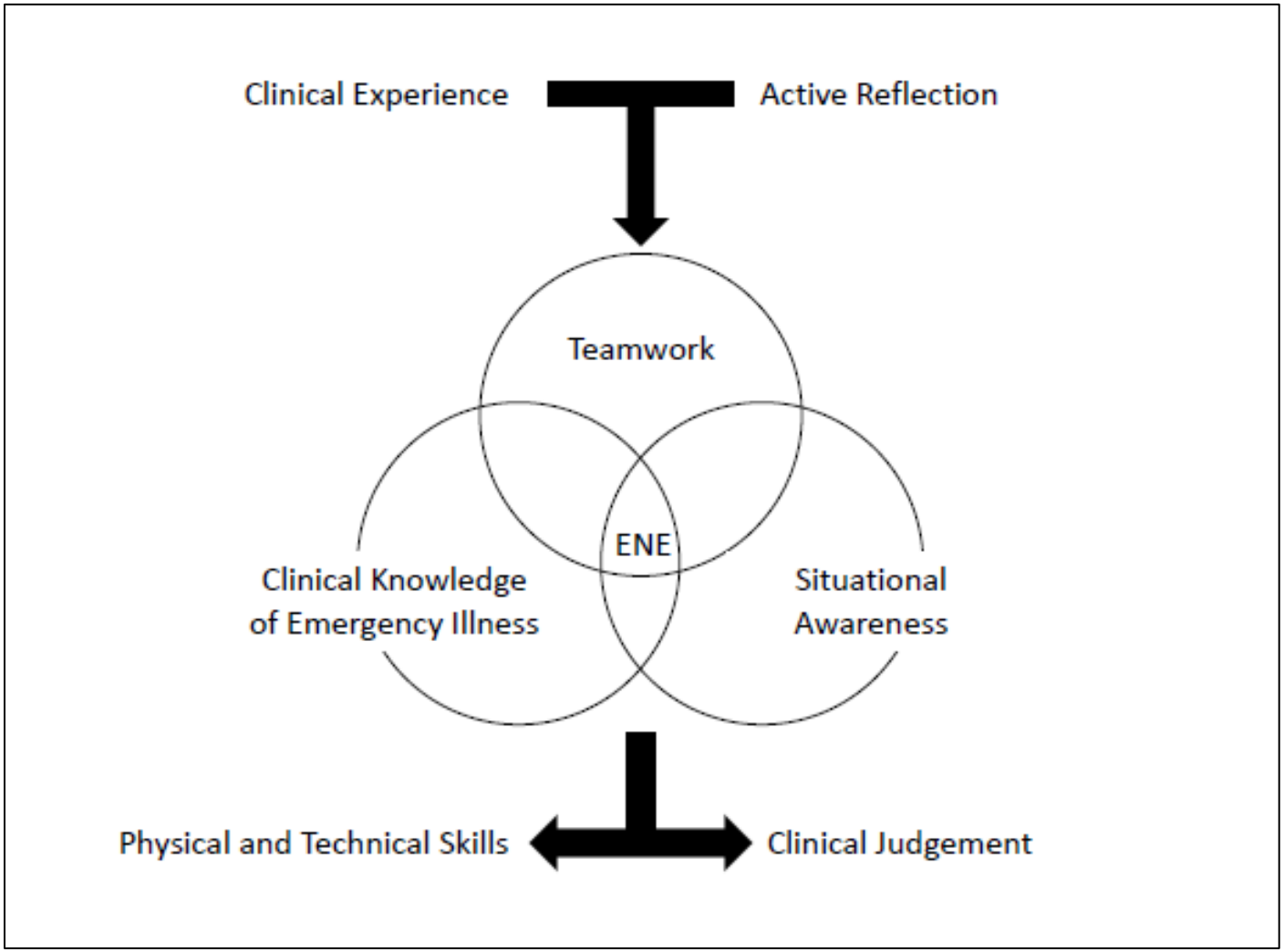


Figure 3.3

Conceptual Model of Emergency Nurse Efficiency (ENE)*, its Antecedents, and its Consequences*



References for Chapter III

Refer to Cumulative Reference List

Chapter IV

The Association Between Emergency Nurse Expertise and Emergency Department Length of Stay

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This manuscript replaces portions of the methods section and the results section of the traditional dissertation. Mr. DePesa will be the primary author on this paper; Dr. O'Reilly-Jacob will be the second author; Dr. Adkison will be the third author; Dr. Lee will be the fourth author; and Dr. Jurgens will be the senior author. This paper will be submitted Journal of Nursing Scholarship, which is an indexed and peer-reviewed journal with an impact factor of 3.928. The readership for this journal includes nurse scientists, nurse educators, and members of the honor society of nursing Sigma Theta Tau International.

Abstract

Introduction: Emergency department crowding (EDC) is a major problem for hospitals across the United States. However, little is known about the impact of individual emergency nurses, and their level of clinical expertise, on ED patient length of stay (ED LOS). By measuring individual nurse performance, and the influence of their level of expertise, nurse leaders can use these data to decrease ED LOS.

Design: This study was a multimethod, descriptive analysis that merged retrospective ED visit patient data with cross-sectional nurse survey data.

Methods: Patient and nurse data were collected from a single site from August 2021 to January 2022. Data was obtained from both the electronic medical record (for patient-level variables) and from an electronic survey (for nurse-level variables). Data analysis was done in three stages and performed on four groups of patients based on the post-ED disposition (all ED patients, inpatient floor admissions, inpatient intensive care unit admissions, and discharges). First, patient data was investigated using binomial regression, and a model was constructed using ED LOS as the outcome. Second, nurse survey data was explored using Chi-square analysis and ANOVA, and a nurse expertise variable was created. Finally, the nurse expertise variable was added to a multivariate model and analyzed using mixed-effect binomial regression with ED LOS as the outcome.

Results: The individual emergency nurse is a statistically significant predictor of ED LOS for all dispositions, except for patients admitted to the inpatient floors, after accounting for nurse expertise. Although not reaching statistical significance, a higher level of nurse expertise could be a contributing variable to a shorter patient ED LOS.

Conclusion: Individual emergency nurses are a significant predictor of ED LOS, and their level of development along Benner's *Novice to Expert* continuum of skill acquisition may help explain their effectiveness.

Clinical Relevance: The development of clinical expertise among emergency nurses could decrease patient ED LOS and help to reduce EDC. Nurse leaders should use these data to better guide development of their nursing staff and improve clinical outcomes without adding extra nursing resources.

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Introduction

Emergency department crowding affects hospitals across the United States and contributes to poor patient outcomes (Woodworth, 2020). Among the causes of EDC is an insufficient level of nurse staffing needed to address the increasing volume of patients (Clopton & Hyrkäs, 2020; Shindul-Rothschild et al., 2017). Expediting patients through the department, and improving ED throughput, can improve ED crowding by decreasing patient length of stay (DeAnda, 2018). While nurses are key players in the ED, little is known about the effect of individual nurses on patient care, including their influence on ED length of stay (LOS) (DePesa, Jurgens, Lee, & O'Reilly-Jacob, 2023; Schumaker, 2020). By measuring the influence of an individual emergency nurse on their patients' ED LOS, nurse leaders have an opportunity to improve patient outcomes by leveraging existing resources.

Emergency Department Crowding

Emergency department crowding (EDC) leads to increases in incomplete patient treatments, medication errors, and hospital mortality rates (Carter et al., 2014; Rasouli et al., 2019; Woodworth, 2020). Factors that contribute to EDC include an increased volume of patients presenting for nonurgent care, inadequate nurse and physician staffing, and an insufficient number of hospital beds for patients requiring admission (Hoot & Aronsky, 2008; Johnson & Winkelman, 2011; Trzeciak & Rivers, 2003). Nursing resources, specifically poor staffing ratios, is an important factor associated with increased patient ED LOS, as it increases the amount of time a patient needs to spend in the ED (Ramsey et al., 2018). Internal approaches undertaken by ED clinicians focus on ED throughput, or the amount of time needed to complete patient evaluations, which is the only aspect of EDC under the control of ED providers (Asplin et al., 2003; DeAnda, 2018; Ramsey et al., 2018). A missing component of this is consideration of

the effect of the individual emergency nurse, where variation may exist and may be contributing to increased ED throughput (Sensmeier et al., 2019; Yakusheva et al., 2014; Yakusheva, Rambur, & Buerhaus, 2022). By measuring the influence of individual emergency nurses on ED LOS, ED nurse leaders could use these data to build a more efficient clinical team.

The Role of Emergency Nursing in Reducing ED Crowding

Evaluating the work of emergency nurses means factoring in the unique challenges of the ED environment, including fluctuations in patient volume, a lack of homogeneity in patient acuity, and the skill mix of the healthcare providers (Anderson et al., 2016; Considine et al., 2012; Elder et al., 2015; Otegbeye et al., 2015; Weigl et al., 2016). High-performing emergency nurses possess characteristics that differentiate them from nurses in other settings, including adaptability to work with any member of the multidisciplinary team, situational awareness of clinical trajectories and a practice autonomy that relies on a deep knowledge of emergency illness (Cone & Murray, 2002; Schriver et al., 2003). In assessing the performance of emergency nurses, care efficiency must be consideration.

The most efficient emergency nurses can be described as having *intuition* (Lyneham, Parkinson, & Denholm, 2008), a term consistent with the *expert* level of skill acquisition described by Benner in her *Novice to Expert* theory (Benner, 1982). To obtain expertise, a nurse must gain experience, which is an active process in which the individual nurse compares an event being experienced to what they were taught as well as any similar past events (Benner, 1984). Notably, years working as a nurse does not necessarily translate into experience if the nurse did not actively reflect on their actions (Benner et al., 1997). Nurses who have progressed further professionally should demonstrate a more efficient workflow, and their patients should benefit from that expertise (Benner, 1984). Evidence that emergency nurse skill level is a

predictor of ED LOS could inform future staffing decisions. Additionally, by identifying nurses whose performance results in a lower ED LOS for their patients, nurse leaders and educators will have evidence to guide performance improvement initiatives based on individual nurse data.

Purpose Statement

There are two purposes to this research study. First, it will evaluate the effect of an individual emergency nurse on patient ED LOS. Second, it will examine the effect of nursing expertise, as described in Benner's *Novice to Expert* model, on ED LOS.

Design

This study was a multimethod, descriptive analysis that merged ED visit data derived from the electronic medical record (EMR) with survey data from the ED nurses in a single ED. To best capture the contemporaneous experience level of the nurses, data collection occurred simultaneously.

Materials and Methods

Study Period and Setting

Data collection occurred from August 2021 to January 2022. The Redcap survey was disseminated via email to all emergency nurses on the active roster in December 2021 and January 2022. The study site was a suburban, community ED with an annual volume of more than 60,000 patients per year, staffed by its own physician group that includes ED attendings, physician assistants, and nurse practitioners. During the study period, 34,258 patients presented to the study site ED.

Study Sample

Figure 4.1 depicts how the inclusion and exclusion criteria for both patients and nurses were applied.

Patients

The medical records of all adult patients who presented to the hospital's emergency department during the study period were reviewed. Patient data was included in the analysis if the patient was at least 18 years old, presented to the hospital by private vehicle or ambulance, and was either admitted to the hospital after their ED course or discharged from the ED. Patient data was excluded from the analysis if the patient was (1) transferred to the ED from another facility, (2) admitted from the ED to a unit within the hospital to undergo interventions (including the labor and delivery unit and procedural areas, such as the operating room, interventional radiology, or endoscopy), and (3) admitted to the psychiatric unit. To minimize bias and to isolate the influence of individual nurses, patients with more than one nurse assigned during their ED stay were also excluded from analysis. Additionally, incomplete records, including those missing timestamps for ED arrival, ED departure, and ED attending names, were excluded.

Nurses

To capture nurse expertise, previously published questions about nurse expertise (McHugh & Lake, 2010) were incorporated into a cross-sectional survey that also captured work experience variables. All nurses with a patient assignment during the study period were included in the descriptive analysis and were sent an invitation to complete the survey. Any nurse with less than 10 patients were excluded from the study, including their patients' data, from further

statistical analysis. Nurses who did not complete the survey were included in the initial descriptive analysis but were excluded from further analysis related to expertise.

Variables and Measures

Patient-level

Variables extracted from the EMR included patient visit data, patient demographics, the names of the emergency department clinical team, and the Emergency Severity Index (ESI) score (range 1-5, assigned at triage with a lower number indicating most severe illness).

Time Intervals. Dates and times of ED arrival, ED room assignment, in-patient admission request, inpatient bed availability, and ED dismissal were used to create specific time intervals to be used as both outcome variable and covariates in the analysis. We calculated, in minutes, the following time intervals: the time between ED arrival to ED departure ("ED LOS"), the time between bed request and bed availability ("Inpatient Wait"), and time between ED rooming and departure ("ED Evaluation").

Nurse-level

The survey questions (Appendix B) were designed to capture specific nurse demographic and work history elements, including years working in their current role and total years worked as an emergency nurse. It was comprised of five brief sections, with a total of 20 questions. Because the survey included a field for the name of the nurse, there was no risk for multiple participation. It also included questions based on previous published survey questions that represent nurses' professional development of expertise along the Benner's *Novice to Expert* trajectory (McHugh & Lake, 2010).

Data Analysis

Data analysis was performed in three stages. First, we identified predictors of patient ED LOS using bivariate analysis with binomial regression for four groups of patients: (1) all patients regardless of ED disposition, (2) patients who were evaluated and discharged from the ED, (3) patients admitted to the hospital on a medical or surgical floor, and (4) patients admitted to an intensive care unit (ICU). Patients were separated by disposition (e.g. discharge versus admission) to account for both illness severity and for specific variables associated with those destinations. We also used the "Inpatient Wait" time for patients admitted to inpatient units to account for any delays related to hospital capacity. A sensitivity analysis, using the "ED Evaluation" time interval, was also performed to confirm the relationship between the predictor variables and ED LOS. We built a multivariate model by first exploring how individual variables were associated with ED LOS with bivariate analysis and then by incorporating all of those variables into a multivariate equation and removing any variable found to not be statistically significant in a backward stepwise approach.

Second, using the survey responses, we divided the nurses in two categories of nurse expertise compared to other respondents. Based on the McHugh and Lake (2010) survey questions, nurses who reported lower frequencies of being selected as a preceptor and being consulted for their clinical judgement were assigned a low-expertise variable (representing Benner's earlier stages of professional development) level of professional development, and nurses who reported higher frequencies on those items were assigned a high-expertise variable (representing Benner's later stages of professional development). We then used Chi-square tests to determine which factors were associated with the high-expertise variable. Additionally, we used one-way analysis of variance (ANOVA) to examine relationships between factors known to

be associated with years working (e.g., age). Using the assigned alphanumeric nurse identifier, these data were then merged with the EMR data to analyze the effect of nurse expertise on patient ED LOS for all four groups of patients.

Lastly, because patient data were nested under each ED attending, we used mixed-effects negative binomial regression to account for both between-physician (i.e., individual work patterns), and within-physician (i.e., some patients with short and others with long LOS) variation. The primary outcome was ED LOS in minutes among all patients in the final analytic sample (alpha set at 0.05). The final model was again constructed using a stepwise approach, however, we forced the experimental variables of the individual nurse variable and nurse expertise into the model. All analyses were performed using Stata v18SE (StataCorp LLC, 2023).

Ethical Considerations

The study was reviewed and approved by the MassGeneral Brigham Institutional Review Board. The research team removed all patient identifiers and replaced all nurse and provider identifiers with unique alphanumeric codes prior to analysis. Additionally, the survey included an informed consent to include nurses for the purpose of data merging. A five-dollar gift card was offered to nurses as an incentive to complete the survey. No identifying performance data was given to the nurse administration at the study site.

Results

Patient Data

After application of the inclusion and exclusion criteria (Figure 4.1), there were 12,709 of a possible 34,258 (37.1%) patients available for analysis. Among these patients, there were 32

ED attendings, 20 midlevel providers (19 physician assistants and 1 nurse practitioner), and 117 emergency nurses caring for them during the study period. As depicted in Table 4.1, the patient sample had average age of 51.2 years, with a median of 51 years, and a majority of the sample was female (56.3%). Most patients were White (76.8%), not Hispanic (85.5%) and spoke English as their primary language (91.4%). Most patients were discharged from the ED (representing 80.7% of all included patients) while 18.9% were admitted to an inpatient floor and 0.46% were admitted to the ICU. On presentation, 0.50% of patients were assigned an ESI score of 1, 28.6% were assigned 2, 53.0% were assigned 3, 17.8% were assigned 4, and 0.58% were assigned 5.

Unadjusted Analysis of Length of Stay

Female sex, higher severity of illness (i.e. lower ESI), older age, non-White race, and post-ED disposition were significant predictors of longer ED LOS in unadjusted models, as were the individual ED attending and advanced practice provider (Table 4.2). When examining only patients discharged from the ED, female sex, higher severity of illness (i.e. lower ESI), older age, non-English primary language, and non-White race were significant predictors of a higher ED LOS. For patients admitted to the inpatient floors, higher severity of illness, older age, Hispanic ethnicity, ED attending, and a longer Inpatient Wait interval were significant individual predictors of a longer ED LOS. For patients admitted to the ICU, only higher severity of illness, older age, and a greater time between bed request and bed ready were significantly associated with ED LOS.

After accounting for variation in individual physician work patterns, similar variables remained predictive of ED LOS for patients admitted or discharged in the multivariate model. As seen in Table 4.3, for all patients, female sex, higher severity of illness, older age, non-English primary language, ED attending, and post-ED disposition remain predictors of ED LOS in the

multivariate model. For discharged patients, female sex, higher severity of illness, older age, non-English primary language, and the ED attending are significant predictors for longer ED LOS. For patients admitted to the inpatient floors and the ICU, higher severity of illness, older age, and more time between bed request and bed ready are significant predictors for a longer ED LOS. ED attending is only significant for inpatient floor admissions. A sensitivity analysis using the "ED Evaluation" time interval in the place of the ED LOS interval confirmed the results of the multivariate models.

Nurse Survey Data

Twenty-seven of a possible 145 emergency nurses completed the voluntary survey, a response rate of 18.6%. Table 4.4 describes attributes of the sample of RNs. Most (81.5%) had a Bachelor's degree as their highest level of education. A majority of respondents (29.6%) are scheduled between 31-36 hours per week but actually work more than 36 hours per week (44.4%). Respondent age ranges from under 25 to over 65 years, with more than a third of the nurses (37.0%) between 41 and 50 years old. In terms of length of employment at the study site, most nurses (66.7%) worked there less than 5 years. Additionally, most (66.7%) were assigned a "High" level of expertise.

Table 4.5 describes the nurse survey responses. There is no statistical relationship between years working, either as a nurse, as an emergency nurse, or as an emergency nurse at the study site, and level of expertise. There was also no statistical relationship between the highest degree obtained and level of expertise. Greater years working as a registered nurse, as an emergency nurse, and as an emergency nurse at the study site was significantly associated with being assigned the charge nurse role. Years working as a registered nurse and as an emergency nurse was significantly associated with being consulted for clinical judgement.

Nurse Expertise and Patient ED LOS

After combining the patient EMR data and the nurse survey, there were a total of 2,777 patients and 18 nurses matched in the dataset. Table 4.6 depicts the relationship between the EMR-derived and nurse survey-derived predictors on patient ED LOS, reported in minutes. After accounting for nurse expertise and nesting the influence of the ED attending, the individual emergency nurse is a small, but statistically significant predictor of ED LOS for all dispositions except for patients admitted to the inpatient floors in the multivariate models. Although not reaching statistical significance, the regression coefficients of the nurse expertise variable were negative in all analyses, indicating that a higher level of nurse expertise could be a contributing variable to a shorter patient ED LOS.

Figure 4.2 is a visualization of influence individual emergency nurses and is inclusive all of the variables from the final model. It depicts the of individual nurses on their patients' ED LOS, as well as the average impact of an individual nurse, and further identifies 4 nurses whose patients' ED LOS are statistically longer when compared to their colleagues (EDRN01, EDRN02, EDRN15, and EDRN16).

Discussion

The purpose of this study was to evaluate the effect of an emergency nurse and examine the effect of nurse expertise on patient ED LOS. By identifying variables that individually predict ED LOS and then creating a multivariate model, we demonstrate that individual emergency nurses influence patient ED LOS. Further, while not statistically significant in the final model, a higher level of nurse expertise could be a factor in lowering patient ED LOS. To

our knowledge, this is the first study to quantitatively describe the performance of individual emergency nurses within the context of a complex, team environment.

In the bivariate analysis, there are several factors that were associated with ED LOS that were unanticipated, including female sex, race, and ethnicity (Table 4.2). In regards to sex, female patients had a significantly longer ED LOS compared to males. Our findings correspond to other research on this phenomenon by identifying an increased ED LOS for female patients being discharged home (Gardner, Sarkar, Maselli, & Gonzales, 2007), although the underlying mechanisms are unclear. Patients identifying with a race of non-White and a Hispanic ethnicity were also both independent predictors of longer ED LOS in the bivariate analysis, but the effect of these variables was not present in the multivariate model. In further examining the ethnicity variable, we found that patients who declined to give an answer or those unable to specify an answer appeared to be a contributor of increased ED LOS. It is likely that these variables were colinear with other factors, such as language and disposition, in the multivariate model that better account for their variance.

We expected a stronger relationship between nurse experience and the frequency of being asked to be a preceptor (Table 4.5) based on previously published research (McHugh & Lake, 2010). The study site was experiencing a higher rate of nurse turnover in the wake of the COVID-19 pandemic when the research team administered the survey, and there was an increased reliance on travel nurses to ensure safe staffing (Holtz et al., 2023). Because of this turnover, newer nurses were assigned precepting roles earlier than historically expected, and this is likely reflected in the responses to this survey question.

Our study demonstrates that emergency nurses have an influence on ED LOS, and it is possibly related to their level of accrued clinical expertise and professional development.

However, the precise nursing practice patterns that reduce patient ED LOS is unclear. Previously studies identified nurse-attributed interventions or actions that can lower a patient's ED LOS, including decreasing time to intervention and initiating diagnostic tests for specific diagnoses (Clark & Normile, 2007; Stauber, 2013). Better understanding the work of emergency nurses, and what resources are needed to administer high quality care, is critical to build and develop a robust ED nursing staff (Wundavalli, Kumar, & Dutta, 2019). As our study establishes, the professional development of individual nurses can decrease patient ED LOS. Nurse leaders should look to better ways of measuring the value of their nurses to improve the quality of care delivered in their institutions.

Nurse Value

Calculations developed to calculate the *value-added care*, and, more recently, *value-informed nursing practice*, are now available in the literature that allow nurse leaders to better characterize the care delivered by individual nurses (Upenieks et al., 2007; Yakusheva et al., 2014). *Value-informed nursing practice* encourages nurse leaders to focus on the actions performed by nurses that lead to improved patient outcomes (Yakusheva, Rambur, et al., 2020; Yakusheva, Rambur, O'Reilly-Jacob, & Buerhaus, 2022). Further development of individual nurse performance metrics that include value-added calculations have potential to change institutional approaches to nurse staffing (DePesa et al., 2023; Welton, 2016a). The adequacy of patient care may no longer be based on the number of nurses on a given unit, but rather based on the composition of nursing skill mix or nurse expertise on the unit (Welton & Harper, 2016). Prioritizing the development of nurses along the Benner *Novice to Expert* pathway represents an efficient way for nurse leaders to create additional value within their staff while also improving patient outcomes.

Limitations

There are several limitations in this study. First, the lower survey response rate could bias the results if the non-respondents have different characteristics than respondents (Groves & Peytcheva, 2008). For this analysis, our identification of nurse outliers (Figure 4.2) may have been influenced by those nurses that completed the survey and may not be an appropriate representation of nurse performance when compared to the entirety of the nursing staff. Additionally, because of the relatively low survey response rate, there are fewer data to interpret in the final model, and there may be additional relationships that are associated with ED LOS we could not identify. Second, the study was limited to a single site, with its own work culture and well-established team roles. This is likely demonstrated by the strong relationship between years of experience and frequency of working in the charge nurse role (Table 4.5), as there is a permanent charge nurse position that limits the number of nurses able to assume that responsibility. A third limitation to the study is the study site was dealing with the same ongoing challenge of increased hospital capacity, ED boarding, and ED crowding facing other EDs across the country, all of which was exacerbated by the COVID-19 pandemic. Increased hospital bed capacity drives up ED LOS, which reduced the sample size available for analysis after application of the exclusion criteria. Finally, attribution of nurse influence was a challenging piece of the study that we simplified by only selecting patients with a single nurse assigned to them during their ED course. However, in a collaborative environment like the ED, nurses are routinely assisting their colleagues in care of their patients without assigning themselves in the EMR to identify the work they performed. Thus, we are limited only to data available in the EMR to interpret the influence of a particular nurse, though we are certain other nurses contributed to outcomes of these patients.

Conclusion

Emergency department crowding is a critical problem facing hospitals that leads to devastating patient outcomes. This research study demonstrates that individual nurses can influence patient ED LOS, and their level of progression from *Novice to Expert* may an provide explanation of their effect. Nurse leaders should seek to further develop their existing nursing staff to improve patient outcomes without requiring additional nursing resources.

Table 4.1

Patient Descriptive Statistics

Age		
Mean	51.22	
Median	51	
Sex	**Count**	**Percent**
Female	7,152	56.3%
Male	5,557	43.7%
Disposition		
Discharge	10,250	80.7%
Inpatient Admission	2,401	18.9%
ICU Admission	58	0.46%
ESI*		
1	64	0.50%
2	3,630	28.6%
3	6,720	53.0%
4	2,190	17.3%
5	73	0.58%
Primary Language, English		
Yes	11,614	91.4%
No	1,095	8.6%
Race		
White	9,747	76.8%
Asian	699	5.5%
Black/African American	667	5.3%
Unavailable/Declined	331	2.6%
Other	1,255	9.9%
Ethnicity		
Not Hispanic	10,858	85.5%
Hispanic	1,270	10.0%
Unavailable/Declined	570	4.5%

*ESI = Emergency Severity Index score

Table 4.2

Unadjusted Negative Binomial Regression with ED LOS in Minutes as the Dependent Variable

All Patients				
Independent Variable	**Coefficient**	**Standard Error**	**z-score**	**p-value***
Sex, Female	0.059	0.0085	6.95	**<0.001**
Emergency Severity Index (ESI) score	-0.224	0.0064	-34.99	**<0.001**
Age	0.005	0.0002	24.35	**<0.001**
Primary Language, English	-0.011	0.0151	-0.70	0.483
Race, Non-White	0.002	0.0004	5.53	**<0.001**
Ethnicity, Hispanic	-0.005	0.0085	-0.56	0.573
ED Attending	-0.001	0.0005	-1.99	**0.047**
ED Midlevel	-0.003	0.0013	-2.15	**0.031**
ED Nurse	0.000	0.0001	0.38	0.707
Disposition	-0.411	0.0103	-39.88	**<0.001**
Discharged Patients				
Sex, Female	0.096	0.0093	10.36	**<0.001**
ESI score	-0.201	0.0070	-28.60	**<0.001**
Age	0.003	0.0002	12.19	**<0.001**
Primary Language, English	-0.048	0.0160	-3.02	**0.003**
Race, Non-White	0.001	0.0004	2.75	**0.006**
Ethnicity, Hispanic	-0.008	0.0087	-0.96	0.338
ED Attending	0.000	0.0006	-0.02	0.988
ED Midlevel	-0.002	0.0014	-1.48	0.140
ED Nurse	0.000	0.0001	0.51	0.607
Inpatient Floor Admissions				
Sex, Female	0.013	0.0131	0.99	0.324
ESI score	0.064	0.0117	5.52	**<0.001**
Age	-0.001	0.0003	-2.08	**0.038**

Primary Language, English	0.011	0.0265	0.41	0.684
Race, Non-White	-0.001	0.0006	-1.04	0.298
Ethnicity, Hispanic	-0.050	0.0156	-3.23	**0.001**
ED Attending	0.003	0.0009	3.13	**0.002**
ED Midlevel	0.001	0.0021	0.65	0.516
ED Nurse	0.000	0.0002	0.15	0.882
Inpatient Wait Interval	0.002	0.0001	19.86	**<0.001**
Admitting Unit	0.001	0.0033	0.20	0.842
ICU Admissions				
Sex, Female	0.033	0.1096	0.30	0.764
ESI score	0.229	0.0871	2.63	**0.009**
Age	0.007	0.0029	2.46	**0.014**
Primary Language, English	-0.164	0.2150	-0.76	0.446
Race, Non-White	0.006	0.0046	1.33	0.184
Ethnicity, Hispanic	-0.063	0.1061	-0.60	0.552
ED Attending	-0.003	0.0076	-0.37	0.713
ED Midlevel	0.024	0.0173	1.38	0.168
ED Nurse	-0.002	0.0018	-1.08	0.279
Inpatient Wait Interval	0.002	0.0008	2.87	**0.004**

*$\alpha < 0.05$

Table 4.3

Multivariate Mixed-Effects Negative Binomial Regression Model Predicting ED LOS

	Independent Variable	Coefficient	Standard Error	z-score	p-value*
All Patients	Sex, Female	0.075	0.009	8.77	**<0.001**
	Emergency Severity Index (ESI) Score	-0.163	0.007	-24.79	**<0.001**
	Age	0.002	0.000	10.55	**<0.001**
	Primary Language, English	-0.056	0.015	-3.68	**<0.001**
	ED Attending	0.002	0.001	3.72	**<0.001**
	Disposition	-0.329	0.011	-29.61	**<0.001**
Discharged Patients	Sex, Female	0.088	0.009	9.45	**<0.001**
	ESI Score	-0.194	0.007	-27.57	**<0.001**
	Age	0.002	0.000	10.80	**<0.001**
	Primary Language, English	-0.074	0.016	-4.61	**<0.001**
	ED Attending	0.002	0.001	3.19	**0.001**
Inpatient Floor Admissions	ESI	0.070	0.012	5.80	**<0.001**
	Age	-0.001	0.000	-3.13	**0.002**
	ED Attending	0.002	0.001	2.02	**0.043**
	Inpatient Wait Interval	0.002	0.000	19.99	**<0.001**
ICU Admissions	ESI	0.200	0.085	2.35	**0.019**
	Age	0.007	0.003	2.57	**0.010**
	Inpatient Wait Interval	0.002	0.001	2.81	**0.005**

*$\alpha = 0.05$

Table 4.4

Nurse Survey Data Descriptive Statistics

Highest level of education	**Count (%)**			
Associate's	2 (7.4)			
Bachelor's	22 (81.5)			
Master's	2 (7.4)			
Other	1 (3.7)			
Previous LPN				
Yes	1 (3.7)			
No	26 (96.3)			
Scheduled Hours				
<16	4 (14.8)			
16-24	6 (22.2)			
25-30	1 (3.7)			
31-36	8 (29.6)			
37-40	3 (11.1)			
>40	5 (18.5)			
Actual Worked Hours				
<16	4 (14.8)			
16-24	4 (14.8)			
25-30	2 (7.4)			
31-36	5 (18.5)			
37-40	6 (22.2)			
>40	6 (22.2)			
Age				
<25	1 (3.7)			
26-30	6 (22.2)			
31-35	1 (3.7)			
36-40	2 (7.4)			
41-45	5 (18.5)			
46-50	5 (18.5)			
51-55	2 (7.4)			
56-60	3 (11.1)			
61-65	1 (3.70)			
>65	1 (3.7)			
Years Working	***0 to 5***	***6 to 10***	***11 to 25***	***>25***
As a nurse	7 (25.9)	7 (25.9)	7 (25.9)	6 (22.2)
As an ED nurse	12 (44.4)	6 (22.2)	4 (14.8)	5 (18.5)
As an ED nurse at this hospital	18 (66.7)	2 (7.4)	4 (14.8)	3 (11.1)

Nurse Expertise Questions	***Never***	***Rarely***	***Occasionally***	***Frequently***
How often are you assigned the role of triage nurse?	3 (11.1)	4 (14.8)	10 (37.0)	10 (37.0)
How often are you assigned the role of charge nurse?	18 (66.7)	5 (18.5)	1 (3.7)	1 (3.7)
How often are you selected as a preceptor?	5 (18.5)	10 (37.0)	7 (25.9)	5 (18.5)
How often are you consulted by other nurses for your clinical judgment?	0 (0.0)	1 (3.7)	11 (40.7)	15 (55.6)
Nurse Expertise	**Count (%)**			
Low	9 (33.3)			
High	18 (66.7)			

Table 4.5

Statistical Analysis of Nurse Survey Data

Frequency of Responses	***Never***	***Rarely***	***Occasionally***	***Frequently***	**p-value***
How often are you assigned the role of triage nurse?	3	4	10	10	0.199
Low	1	2	4	1	
High	2	2	6	9	
How often are you assigned the role of charge nurse?	18	5	3	1	0.503
Low	7	2	0	0	
High	11	3	3	1	
How often are you selected as a preceptor?	5	10	7	5	**0.001**
Low	5	4	0	0	
High	0	6	7	5	
How often are you consulted by other nurses for your clinical judgment?	0	1	11	15	**0.031**
Low	0	1	6	2	
High	0	0	5	13	
Years Working	***0 to 5***	***6 to 10***	***11 to 25***	***>25***	
As a nurse	7	7	7	6	0.634
Low	3	3	1	2	
High	4	4	6	4	
As an ED nurse	12	6	4	5	0.973
Low	4	2	1	2	
High	8	4	3	3	
As an ED nurse at this hospital	18	2	4	3	0.453
Low	6	0	1	2	
High	12	2	3	1	
Highest Degree Obtained	***Associate's***	***Bachelor's***	***Master's***	***Other***	

Low Expertise	0	8	1	0	0.606	
High Expertise	2	14	1	1		
	Never	***Rarely***	***Occasionally***	***Frequently***	**p-value***	**F**
How often are you assigned the role of triage nurse?	3	4	10	10		
Average years working as a(n) …Nurse	9.3	15.5	12.5	20.4	0.423	0.97
…ED Nurse	1.3	13.5	10.5	14.7	0.406	1.01
…Site ED Nurse	1	11.3	5.4	10	0.332	1.2
How often are you assigned the role of charge nurse?	18	5	3	1		
Average years working as a(n) …Nurse	10.7	27.6	19	31	**0.015**	4.3
…ED Nurse	7.4	25.6	7.3	26	**0.006**	5.38
…Site ED Nurse	4.06	18.4	4.33	24	**0.001**	8.27
How often are you selected as a preceptor?	5	10	7	5		
Average years working as a(n) …Nurse	16.2	15.1	16.6	14.2	0.989	0.04
…ED Nurse	12.8	12.5	12.7	6.4	0.798	0.34
…Site ED Nurse	10.4	7.1	8.4	4	0.741	0.42
How often are you consulted by other nurses for your clinical judgment?	0	1	11	15		
Average years working as a(n) …Nurse	0	10	9	20.7	**0.046**	3.52
…ED Nurse	0	1	5.5	16.6	**0.037**	3.78
…Site ED Nurse	0	0	3.7	10.7	0.103	2.51

*$\alpha = 0.05$

Table 4.6

Nurse Expertise Variable in the Multivariate Model

	Independent Variable	Coefficient	Standard Error	z-score	p-value*	95% Confidence Interval [Lower Limit, Upper Limit]
All Patients	Sex, Female	17.333	4.249	4.08	**<0.001**	[9.006, 25.660]
	ESI	-40.496	3.075	-13.17	**<0.001**	[-46.522, -34.470]
	Age	0.460	0.106	4.34	**<0.001**	[0.252, 0.668]
	Primary Language, English	-4.148	7.348	-0.56	0.572	[-18.549, 10.254]
	Disposition	-106.574	5.899	-18.07	**<0.001**	[-118.136, -95.011]
	ED Nurse	0.188	0.074	2.54	**0.011**	[0.043, 0.333]
	High Nurse Expertise	-8.875	5.003	-1.77	0.076	[-18.682, 0.931]
Discharged Patients	Sex, Female	19.873	4.446	4.47	**<0.001**	[11.160, 588.045]
	ESI	-48.318	3.127	-15.45	**<0.001**	[-54.446, -42.190]
	Age	0.540	0.109	4.95	**<0.001**	[0.326, 0.754]
	Primary Language, English	-12.626	7.549	-1.67	0.094	[-27.421, 2.169]
	ED Nurse	0.162	0.076	2.12	**0.034**	[0.012, 0.312]
	High Nurse Expertise	-9.640	5.112	-1.89	0.059	[-19.659, 0.379]
Inpatient Floor Admissions	ESI	30.762	8.281	3.71	**<0.001**	[14.533, 46.992]
	Age	-0.437	0.235	-1.86	0.063	[-0.897, 0.024]
	Inpatient Wait Interval	0.785	0.055	14.32	**<0.001**	[0.678, 0.893]
	ED Nurse	0.244	0.157	1.56	0.119	[-0.063, 0.551]
	High Nurse Expertise	-15.916	11.276	-1.41	0.158	[-38.016, 6.184]
ICU Admissions	ESI	157.688	39.639	3.98	**<0.001**	[79.997, 235.379]
	Age	-0.697	1.036	-0.67	0.501	[-2.727, 1.333]

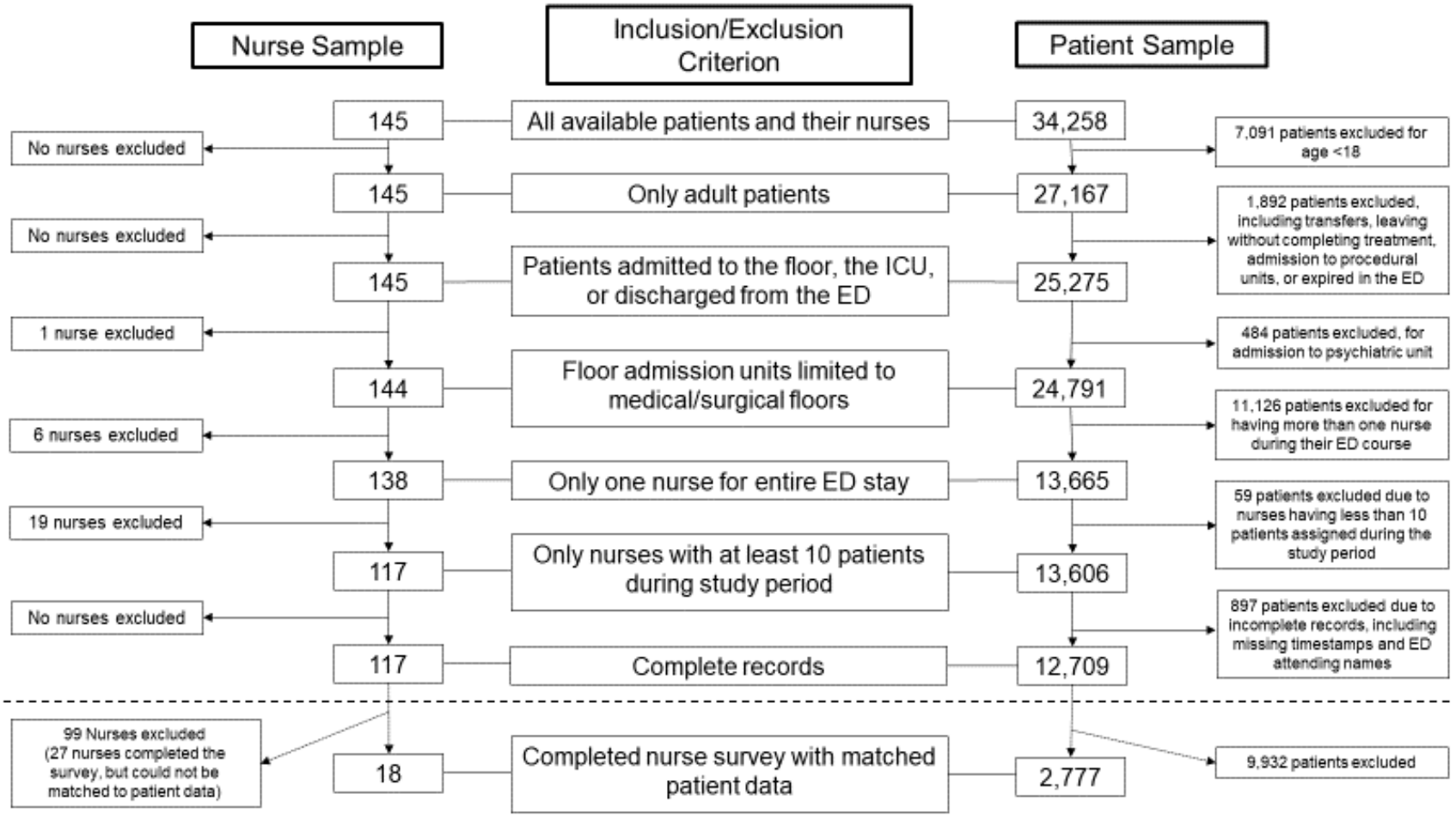
	Inpatient Wait Interval	1.809	0.627	2.89	**0.004**	[0.581, 3.038]
	ED Nurse	4.804	1.577	3.05	**0.002**	[1.713, 7.895]
	High Nurse Expertise	-314.655	59.456	-5.29	**<0.001**	[-431.187, -198.124]

*α = 0.05

“ESI” = Emergency Severity Index score

Figure 4.1

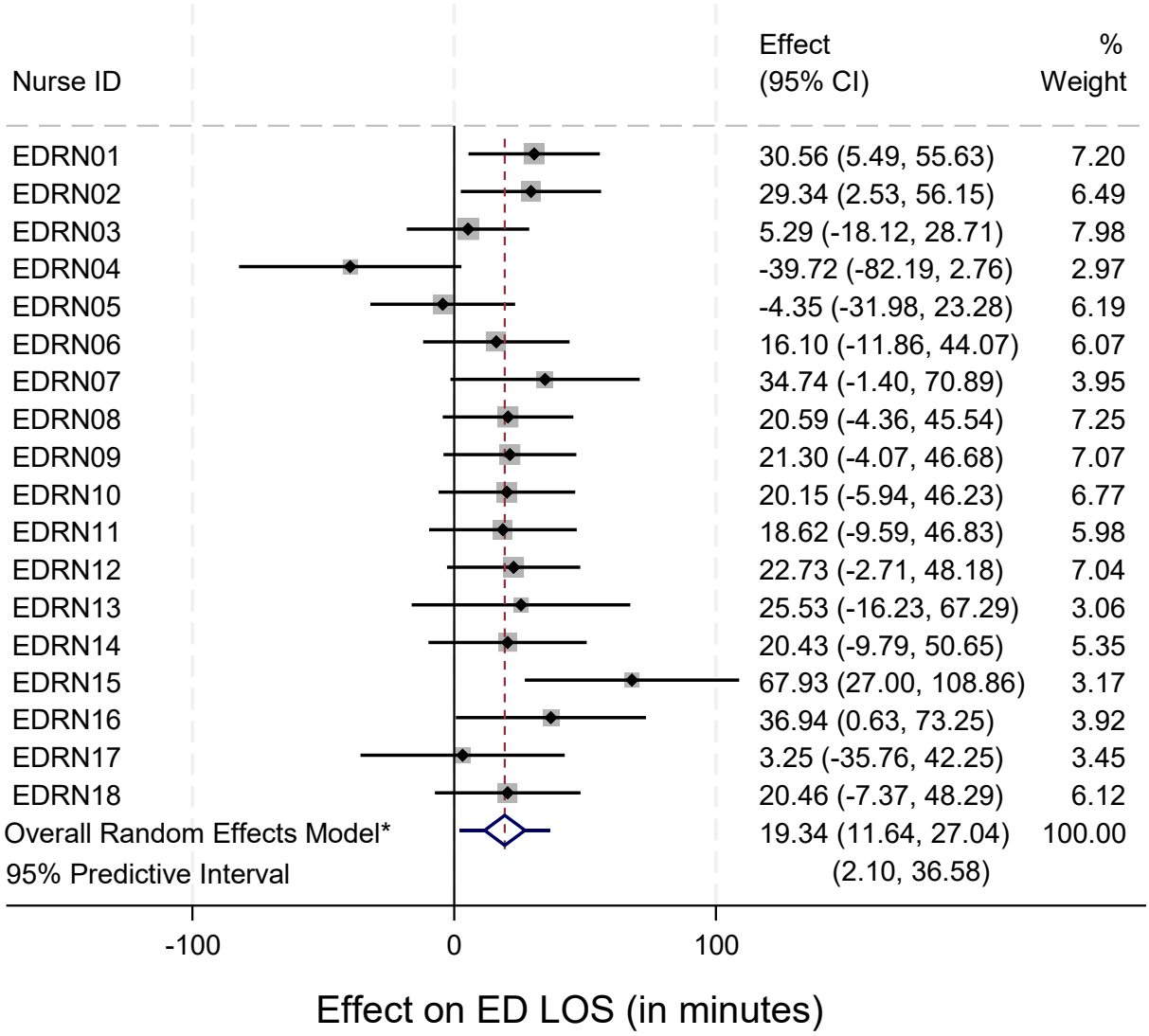
Application of Inclusion and Exclusion Criteria for Both Patients and Nurses



*All patients and nurses that met criteria above the hatched line were included in the retrospective data analysis. Patients and nurses included below the hatched line were included in the merged data analysis that included survey results.

Figure 4.2

Forest Plot of the Effect of Individual Emergency Nurses on their Patients' ED LOS in Minutes



Hatched line = Average effect of an individual ED RN on ED LOS

*Heterogeneity: I^2 = 18.5%, p = 0.233

Appendix B

Emergency Nurse Expertise Survey
Are you willing to participate in this survey? *(Yes/No)*
For the following questions, please write in your answers in the blank space provided or select the appropriate answer among the choices provided.
In what year were you issued your first U.S. RN license? *(Please use 4 digits; e.g. YYYY)*
Which type of nursing degree qualified you for your first U.S. RN license? *(1=Diploma, 2=Associate, 3=Bachelor's, 4=Master's, 5=Doctorate, 6=Other)*
In what year did you graduate from this RN program? *(Please use 4 digits; e.g. YYYY)*
If you obtained a non-nursing degree before your first nursing degree, what was it? Mark all that apply *(1=Diploma, 2=Associate, 3=Bachelor's, 4=Master's, 5=Doctorate, 6=Other, 7=None)*
Have you ever been licensed as a Licensed Practical Nurse (LPN) or Licenses Vocational Nurse (LVN) in the U.S.? *(Yes/No)*
Did you earn any additional academic degrees after acquiring your first nursing degree? *(Yes/No)*
If yes, what type of additional degree is it? *(1=Associate in nursing, 2= Bachelor's in nursing, 3=Master's in nursing, 4=Doctorate in nursing, 5=Associate in non-nursing field, 6=Bachelor's in non-nursing field, 7=Master's in non-nursing field, 8=Doctorate in non-nursing field)*
In what year did you receive this additional degree? *(Please use 4 digits; e.g. YYYY)*
In what year did you begin working as a registered nurse? *(Please use 4 digits; e.g. YYYY)*
In what year did you begin working as an EMERGENCY nurse? *(Please use 4 digits; e.g. YYYY)*
In what year did you begin working as an EMERGENCY nurse at this hospital? *(Please use 4 digits; e.g. YYYY)*
How many hours are you scheduled to work in a typical week as an EMERGENCY nurse at this hospital? *(1=less than 16, 2=16-24, 3=25-30, 4=31-36, 5=37-40, 6=greater than 40)*
How many hours do you actually work in a typical week as an EMERGENCY nurse at this hospital? *(1=less than 16, 2=16-24, 3=25-30, 4=31-36, 5=37-40, 6=greater than 40)*
What is your age? *(1=less than 25, 2=26-30, 3=31-35, 4=36-40, 5=41-45, 6=46-50, 7=51-55, 8=56-60, 9=61-65, 10=greater than 65)*
For the following 4 questions, please pick from the following choices: "Never", "Rarely", "Occasionally", and "Frequently" The answers are your best description.
How often are you assigned the role of triage nurse?
How often are you assigned the role of charge nurse?
How often are you selected as a preceptor?
How often are you consulted by other nurses for your clinical judgment?
What is your first name?
What is your last name?
Thank you for answering these questions. The survey is complete. **Are you interested in receiving a $5 gift card? *(Yes/No)***

References for Chapter IV

Refer to Cumulative Reference List

Chapter V:

Summary of the Dissertation

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Hospitals across the United States continue to face the pervasive crisis of emergency department crowding (EDC) and are forced to deal with its consequences to both patients and staff (McKenna et al., 2019; Muir et al., 2022; Rasouli et al., 2019). Traditional approaches to alleviate EDC remain insufficient, and nursing leadership overseeing these emergency departments (EDs) possess an opportunity to reconsider how their staff is evaluated and deployed (Carlson, 2016). By evaluating their nursing staff based on their individual performance characteristics, rather than as an interchangeable group of professionals, nurse leaders can better understand how a nurse influences their patients' ED length of stay (LOS). Additionally, the prioritization of the accumulation of nursing expertise within the ED could represent a valid approach in decreasing patient ED LOS and a possible solution to the pernicious problem of EDC.

The purpose of this program of research was to identify, articulate, and demonstrate a novel approach that leveraged the evaluation of individual emergency nurse performance to better understand the relationship between ED LOS and nurse expertise. In its totality, this program of research is a significant contribution to the nursing science literature by identifying the opportunity to evaluate nurses based on individual performance, by introducing an innovative conceptual model to understand how individual emergency nurse performance can be viewed, and, finally, by demonstrating how individual nurse performance can be measured and how it is related to nurse expertise.

Discussion

This discussion presents a summary of the findings of the dissertation, using previous research to provide context, focused on three areas: (1) the evaluation of individual nurse performance, (2) understanding individual emergency nurse performance within the unique

setting of the ED, and (3) the relationships among an individual emergency nurse, their patients' ED LOS, and the nurse's level of expertise as defined in Benner's *Novice to Expert* framework. Following this discussion, the methodological, theoretical, and clinical importance of this dissertation are summarized. Finally, in the summary of this dissertation, areas for future research are also recommended based on these three main themes.

Evaluation of Individual Nurse Performance

To better understand how individual nurse performance is measured and the prevalence of that measurement, a scoping review was performed to identify the varied documented uses of nurse performance metrics in Chapter II. Using the scoping review framework provided by the Joanna Briggs Institute, we identified 12 articles published between January 2004 and May 2022 (DePesa et al., 2023). Within the included articles, three themes were further identified: (1) the emerging nature of these metrics in the literature, (2) variability in their applications, and (3) performance implications. We recommended that further efforts be taken by nurse researchers, working with nursing leadership and nurses at the bedside, to establish metrics that best represent the impact of individual nurses on patient outcomes within their own specific practice settings.

The metrics identified in Chapter II represent a departure from traditional approaches of nurse performance, and its relationship to patient outcomes, that evaluate nurses as a group, usually as a unit or a floor (Lake et al., 2019; McHugh et al., 2021). By using patient-level data to measure the work of an individual nurse, these metrics begin to resemble efforts being described in the literature as calculations of *nurse value* and are rooted in Human Capital theory (Becker, 1993; Yakusheva et al., 2019, 2022). Nurse value, where individual nurses are measured based on a calculation of their positive and negative impacts on patient care and institutional priorities, represents a developing field within the nursing literature (Sensmeier et

al., 2019; Welton & Harper, 2016; Yakusheva et al., 2014). The further development of these data to characterize and quantify the impact that nurse work has on patient outcomes requires insight from nurses not only to inform these metrics, but also to ensure that their application is appropriate to the practice setting (Brennan & Bakken, 2015; Welton, 2016).

While Chapter II is a broad depiction of the current state of individual nurse performance measurement in the literature, the creation of appropriate individual nurse performance metrics that are informed by the unique practice environment of the ED is the main focus of Chapters III and IV, and, therefore, this entire dissertation. Chapter III proposes that, in order to ground these metrics in the ED setting, a new concept that encapsulates the work of emergency nurses and their specific impact on ED patients must be introduced. Chapter IV applies that conceptual framework to collected data to demonstrate one possible way to measure the impact of individual emergency nurses. The most significant impact this the body of research makes is that, even in a complex and dynamic environment like the ED, there is a method of isolating and evaluating the impact of each individual nurse on patient care.

Understanding Emergency Nurse Performance

Emergency nursing has specific characteristics that make it a unique practice discipline when compared to nursing in other clinical settings (Sheehy, 2020). For emergency nurses to be successful, they must be able to work with an interdisciplinary team, prioritize time-sensitive tasks, and have deep understanding of the pathophysiology of emergency illness (Person et al., 2013; Weigl & Schneider, 2017). In Chapter III, we identified the similarities between evaluating individual performance in the ED and another high-intensity team activity in professional sports. Drawing on previous efforts developed in the evaluation of professional basketball players, we proposed the novel concept of *Emergency Nurse Efficiency* (Hollinger, 2002). We defined

Emergency Nurse Efficiency as the measurable attribute that incorporates the positive impact of an individual nurse on patient care during a given time while subtracting the negative. The concept is hypothesized to consist of three major components, teamwork, situational awareness, and clinical knowledge of emergency illness. Because *Emergency Nurse Efficiency* is based on Benner's *Novice to Expert* model, it changes as nurse experience is gained (Benner, 1984). We recommended that nurse leaders and nurse researchers should consider this conceptual framework to better understand how emergency nurses work, how their performance changes over their career, and how to best evaluate that performance.

Emergency Nurse Efficiency draws on a body of research called sports analytics, which is the use of data and statistics to improve individual and team performance among athletes (Baumer et al., 2023). The emergence of this field of research coincided with the availability of large data sets, a resource now pervasive in almost every field and discipline (Morgulev et al., 2018). However, applications of the statistical and theoretical concepts developed in sports analytics to a healthcare setting remain limited (McParland et al., 2020). By introducing *Emergency Nurse Efficiency* as a conceptual framework in evaluating individual emergency nurse performance, we are among the first to apply sports analytics in nursing science.

The concept proposed in Chapter III represents the first attempt to establish a measure of individual nurse performance that is developed for, and informed by, the unique challenges present in the ED. The role of the emergency nurse is to, first, recognize the signs and symptoms of life-threatening disease processes, then administer interventions to stop these active processes, and, finally, guide their patients to a safe disposition. Additionally, it is to the benefit of their patients, and to the department's other patients, if the nurse completes this process as fast as possible (Burgess et al., 2022). The most expert emergency nurses can synthesize complex

information subconsciously, using "intuition" to grasp complex clinical scenarios and guide their actions, while using a fraction of the time that less experienced nurses would require to do the same work (Johansen & O'Brien, 2016; Lyneham et al., 2008). Because of the time-sensitive nature of emergency nursing, we hypothesized in Chapter III that ED LOS would be the appropriate data point in assessing emergency nurse performance. In Chapter IV, we demonstrated how individual emergency nurses could be not only be measured, but also how their professional development could be contextualized within the *Novice to Expert* model.

Individual Emergency Nurses, ED LOS, and Nurse Expertise

In Chapter IV, we applied the concept of *Emergency Nurse Efficiency* to clinical data, showcasing one method of evaluating individual emergency nurse performance. Combining retrospective data collection with a cross-sectional survey design, we collected both patient-level and nurse-level data that were then merged to perform statistical analyses that isolated the effect of an individual nurse on their patients' ED LOS. We found that the individual nurse was a statistically significant predictor of their patients' ED LOS, and higher nurse expertise could be associated with a lower ED LOS. Future application of these metrics could inform staffing decisions, guide specific nurse educational efforts, and represent a new paradigm in addressing crowding in the ED.

The findings presented in Chapter IV represents the first documented measurement of the effect an individual emergency nurse on the ED LOS of their patients, and it can be viewed as part of the broader research efforts to quantify nurse value (Moon et al., 2019; Yakusheva et al., 2022). This developing field of inquiry within nursing science represents a paradigm shift from considering nurse productivity as a collective to measuring the value of an individual nurse (Disch & Finis, 2022). As cited in Chapter II, the National Quality Forum previously identified

measuring nurse productivity as a priority (National Quality Forum, 2004), and we are addressing that charge for nurses working in the ED setting with the efforts documented in this dissertation. While previous attempts to measure the impact of an individual nurse are rooted in the field of economics (Chu, Wang, & Dai, 2009; Hollingsworth, 2008; Nicholson et al., 2006; North & Hughes, 2012; Welton, Zone-Smith, & Bandyopadhyay, 2009), the body of research represented by this dissertation is derived from a nursing science basis and is not primarily concerned with the financially-related, but rather with patient-associated outcomes by measuring individual nurse performance.

Further, Chapter IV identified a possible association between patient ED LOS and the level of expertise accrued by individual emergency nurses. This finding is consistent with the hypothesized change in nursing practice that occurs as nurses gain experience and expertise (Benner, 1984; Benner et al., 1997; Morrison & Symes, 2011). By demonstrating that accumulating nursing experience leads to improved outcomes in ED patients, our conclusions in Chapter IV support the model that we proposed in Chapter III regarding how emergency nurses can influence their patients' ED LOS. Of the nurse performance metrics identified in Chapter II, none provide a theoretical explanation for how individual nurses can be measured and how that measurement changes as nurses develop professionally. This dissertation represents the first documented attempt in explicating Benner's *Novice to Expert* model in emergency nurses using quantitative data on ED patients.

Theoretical Implications

This body of research builds on Benner's *Novice to Expert* theory of nurse professional development (Benner, 1984). In particular, it is Benner's assertion that nursing practice changes as nurses gain experience, and advance in their expertise, that led us to develop a specific

conceptual model for how it is operationalized among emergency nurses in Chapter III. Our findings are consistent with previous research describing how nurse expertise manifests in emergency nurses (Lyneham et al., 2008). Additionally, our introduction of the concept of *Emergency Nurse Efficiency*, an attribute of emergency nurses that changes as the nurse advances in their expertise and is measured in their patients' ED LOS, has its own theoretical implications. This attribute grows as the nurse develops professionally, and it manifests in the nurse's ability to facilitate their patients through their ED course, working within a multidisciplinary team, as quickly as possible (Figure 5.1). Future use of the concept by nurse researchers and ED leaders could lead to a more advanced understanding of the complex work done by emergency nurses, who must constantly integrate new and changing information while guiding their patients to their appropriate destination.

Practical Implications

There are multiple practical implications of the work presented in this dissertation. First, it represents a framework in which individual emergency nurse performance can be evaluated using patient-level data. When assessed over time, with repeated measurements, ED nursing leadership can track the clinical progression of the individual nurse as they develop professionally. In instances where the nurse's performance is less efficient than expected given their professional trajectory, ED nurse managers and educators can use these data to look further into why the performance is being affected, then can identify interventions that could subsequently be monitored for improvement. Second, because these data are based on patient ED LOS, they could be used to identify the highest performing emergency nurses on staff. When creating a schedule for a day that is anticipated to be busy, ED nurse leadership can preferentially place more efficient nurses in positions where their performance would best

benefit the department's throughput. Finally, using these data on a regular basis could help identify when, and if, a nurse's performance changes and would be an opportunity to look further into other contributing factors. For example, if a nurse becomes less efficient after working multiple shifts in a row, it could be recommended that their assignment be changed or that their scheduled shifts be re-arranged to avoid adverse impacts to their patients.

Methodological Importance

This dissertation deployed a variety of methods to achieve its stated aims. In Chapter II, we performed the literature review using the scoping review approach described by the Joanna Briggs Institute (Peters et al., 2020). This approach allowed us to map out a disparate collection of metrics described in the literature representing an emerging field of nursing science. Chapter III drew on influences outside of nursing (and outside of traditional sources of research) to apply a concept developed in professional sports to the ED environment. In doing so, it acknowledged that measuring individual nurse performance on a dynamic team using only techniques described in the nursing literature were insufficient, and there was a need to draw on a commensurate high-intensity team environment for inspiration. Further, by approaching the analysis of nurse performance with a focus on the individual nurse, the conceptual model addressed some of the limitations of analyzing nurses in aggregate (Paulsen, 2018). In Chapter IV, we utilized previously validated survey questions to approximate nurse expertise (McHugh & Lake, 2010) and deployed that survey during the period of time when we knew that we would be collecting retrospective data. This allowed us to procure patient-level data that could be merged with nurse-level data representing their professional development stage at the same time that they were delivering patient care. As a cohesive body of research, the major importance to nursing science

of this dissertation is its novel method in measuring emergency nurse performance that is associated with patient ED LOS.

Theoretical Importance

This dissertation used the previous work on the professional development of nurses pioneered by Benner, integrated patient- and nurse-level data, and created a framework to understand how nurses work in the unique practice environment of the ED. The result of this work is the concept of *Emergency Nurse Efficiency*, which is a theoretical construct that can be used both as an instrument for managing a staff of emergency nurses and as a lens to better understand the role of the emergency nurse. Further, the integration of the use of advanced metrics derived from professional sport evaluation represents an opportunity for further elaboration of these data in the healthcare setting. However, the most important theoretical idea put forth by this body of work is that nurses are not interchangeable, and any evaluation of the work that nurses do should integrate individual practice characteristics. In the preceding chapters, we have demonstrated how, even in a complex work environment like the ED, the assessment of individual nurses is possible. The development of a theoretical basis for individual nurse performance within a team dynamic could be considered a model for future development of metrics that seek to identify and measure individual nurse value.

Clinical Importance

In this body of research, we have proposed that better measurement of nurse performance can result in a deeper understanding of both patient outcomes and individual nurse characteristics. The major clinical importance of this dissertation is that the more expert an emergency nurse is, the more efficiently they can deliver care and the faster they can navigate

their patients through the ED. This association can be interpreted by nurse leaders as a need to invest in their staff professionally to improve patient outcomes. Conversely, though, patient ED LOS can be used by nurse educators as a measure of emergency nurse professional development, and these data can be the foundation for targeted educational efforts to facilitate the advancement toward expertise.

Implications and Summary

The purpose of this body of research was to identify, describe, and then apply a new method of evaluating individual emergency nurse performance, and we have described how we achieved those aims in the preceding chapters. In the context of the broader crisis affecting emergency departments across the United States, every possible technique that can expedite patients through the ED needs to be considered and deployed. However, there is no single approach to improving EDC that will solve the crisis, and it will require a combination of efforts to improve the conditions in the ED. To date, solutions to improve EDC that include emergency nurses are primarily limited to improving nurse-to-patient ratios (Janhunen et al., 2020; Leary & Punshon, 2019; Shindul-Rothschild et al., 2017). The work that we presented in this dissertation offer an alternative strategy to addressing EDC that recognizes the individual characteristics of emergency nurses.

Implications for Nursing and Other Disciplines

There is a growing body of research that is dedicated to calculating the value of the work of individual nurses instead of viewing them only in aggregate, and this dissertation adds to it. By considering nurses individually, nursing science can propose better methods of measuring the work that each nurse does and, in turn, can better represent the contributions of nurses in all

areas of healthcare. To continue to develop and advance as a separate discipline, nursing must demonstrate how its work can impact patient outcomes, and the body of work represented in this document is one step forward in giving emergency nurses credit for their efforts. As healthcare evolves, and leaders seek to justify the costs associated with specific job roles, nurses should look to own their work and support it with data that demonstrates how crucial they are to patient care.

Disciplines outside of nursing that are seeking to better characterize their impact within their field could also find inspiration in this dissertation. Although there are individual performance metrics associated with many jobs, particularly within the business field, there is opportunity to apply a similar approach outside of nursing that follows the steps that we have demonstrated in this body of work. Just as Benner found inspiration in the research done with Air Force pilots, we drew on the work being done in sports analytics, and we hope that our work here represents future inspiration for innovation in another field outside of nursing.

Strengths

This body of work has several strengths. First, it is, thus far, the only documentation of the prevalence of individual nurse performance metrics in the nursing science literature. Second, we have created a new conceptual model that proposes how emergency nurses can influence their patients' ED LOS and how their performance can change as experience is gained. By drawing on the well-established *Novice to Expert* model, and integrating team activities outside of nursing, our concept of *Emergency Nurse Efficiency* has a robust foundation for further elaboration. Finally, this dissertation demonstrates a novel approach to measuring emergency nurse performance that is based on ED LOS, a critical datapoint in addressing the broader problem of EDC. Our description of a method of nurse performance evaluation that incorporates

the unique characteristics of the ED represents the most comprehensive measure of emergency nurses yet to be described in the literature.

Weaknesses

This dissertation also has several limitations. Primarily, there is an inherent challenge in isolating individual contributions within a team environment, with the appropriate attribution of individual nurse work being a complex calculation, and we may have excluded influential variables that could better illustrate the relationships in the ED. Additionally, this entire body of work presents one possible solution to EDC by measuring the impact of individual emergency nurses, and it may be an oversimplification of the multifaceted issue of EDC. Future research may demonstrate that, even when one adds expertise to their nursing staff by providing ongoing educational and professional support, other factors, such as hospital capacity, emergency medicine provider ordering patterns, and the increasing complexity of an aging patient population, may be too much to overcome by nursing interventions.

Furthermore, the result of our literature search in Chapter II are limited to the search terms, the timeframe, and the databases that we included in our approach. There may be additional resources documented regarding individual nurse performance that were not included because of this. Also, the conceptual model that we proposed in Chapter III, which is the basis for the work done in Chapter IV, is our initial attempt at describing how emergency nurses guide their patients to the appropriate destination while assimilating complex and changing information. We proposed using ED LOS as the outcome on which to measure emergency nurse performance, but we recognize that emergency nurses do much more than move patients from one place to another. Nursing is a holistic discipline, and patient care cannot be reduced a single datapoint. Efficiency is just one aspect of the emergency nurse role, and the findings presented in

this body of research are not intended to encapsulate the total job performance of emergency nurses. We acknowledge that there are additional confounders not identified in this dissertation that influence ED LOS, including patient-level, clinician-level, and hospital-level variables. Examples of patient-level factors would be behavioral issues or diagnoses, such as dementia or schizophrenia, that require additional time and attention, medically complex issues needing sequential diagnostic tests, and family members that need counselling or education that requires additional time for the nurse. Clinician-level variables that may contribute to a longer ED LOS could be sick calls, or staffing vacancies, that increase the workload on the nurses and physicians. Hospital-level confounders include bed closures due to infectious precautions or the availability of inpatient staff to receive ED patients. However, because this is a new idea, we chose an outcome that most appropriately captured the work of emergency nurses. Over time, and with the help of additional research on the model, we may find that there are additional variables that need to be considered. Third, the analysis that we performed in Chapter IV was done at a single site, and our interpretation of those data may not represent a similar relationship at other sites. The sample size that we used in the final analysis is comparatively small when contrasted with the trove of data available within the EMR, and it is possible that the relationships that we identified may change in subsequent studies based on our model.

Future Research

This program of research is the initial step in developing specific strategies to measure individual nurse performance in specific clinical settings. While there is a growing field documenting the measurement of individual nurse value, this area of nursing science offers opportunities for further exploration. Table 5.1 outlines possible future research topics based on the areas of focus presented in this dissertation.

Evaluation of Individual Nurse Performance

We documented in Chapter II that there was a paucity of available metrics that measured individual nurse performance and that their application was varied. Future research on the evaluation of individual nurse performance should focus on developing metrics that integrate the unique qualities of the settings in which these nurses work. Additionally, we suggest that patient-level data be incorporated into these metrics, so that the nurses better understand how their work contributes to patient outcomes. For example, the priorities of a nurse working in an ambulatory clinic are different than those working in the perioperative department, so reporting rates of surgical site infections associated with individual nurses would not be applicable to both settings. Each practice environment has specific patient-related goals, and nurses, as part of the treatment team, should be measured, in part, by how they contribute to those goals.

Understanding Emergency Nurse Performance

Future research on emergency nurses should focus on clarifying the conceptual model that we proposed in Chapter III. Because *Emergency Nurse Efficiency* is composed of three primary variables, namely clinical knowledge of emergency illness, teamwork, and situational awareness, future studies could examine the influence of each by either isolating or eliminating one variable with an intervention and measuring the effect. Additionally, further elaboration of the model, including new factors to be considered should be explored in future work. There is an opportunity to build a better understanding of how emergency nurses address all the challenges that they encounter daily, using either quantitative, qualitative, or mixed-methods, and the concept that we presented in Chapter III can be the starting place for those efforts.

Individual Emergency Nurses, ED LOS, and Nurse Expertise

The study that we conducted and presented in Chapter IV was done at a community hospital, where medical resident presence was minimal. Conducting the same analysis at an academic center, where residents, faculty, and the interactions between residents, faculty, and nurses will influence patient ED LOS, is an obvious suggestion for future work. Additionally, we have described in this dissertation only that individual emergency nurses influence ED LOS, but we have not explored how. Previous research in the ED has demonstrated that there are specific time-sensitive interventions, such as the time to first medication order, that are associated with a lower ED LOS in patients admitted to the intensive care unit (Clark & Normile, 2007). Future research examining whether there are specific tasks associated with a lower ED LOS, and whether those tasks change depending on level of expertise, should be explored. Third, future work that focuses on how an individual emergency nurse's practice evolves over time, and how that evolution manifests in their patients' ED LOS, could confirm the theoretical model that was proposed in Chapter III. Finally, in Chapter IV, we assigned nurses a binary level of expertise (ie high or low), but Benner's model describes five stages of professional development. With a large enough nursing staff, further analysis and assignment of the stage of progression along the Novice to Expert continuum could provide further researchers with a deeper understanding of how the practice of emergency nurses changes with each stage of development.

Conclusions

This dissertation has made meaningful and substantial contributions to the science individual nurse performance and, specifically, the impact that individual emergency nurses can have on their patients' outcomes. The body of research that we have presented here builds on previous research that measures the performance, and value, of individual nurses while integrating new perspectives in developing a novel metric of emergency nurse performance. By

understanding how nurse expertise is associated with ED LOS, future efforts by nurse educators and leadership can focus on the professional development of their nurses with the knowledge that it benefits both their patients and their staff. It demonstrates how, even in a complex, dynamic environment like the ED, clinically significant metrics can be developed so that nurse leaders can best utilize their existing nursing resources to address the complicated problem of EDC.

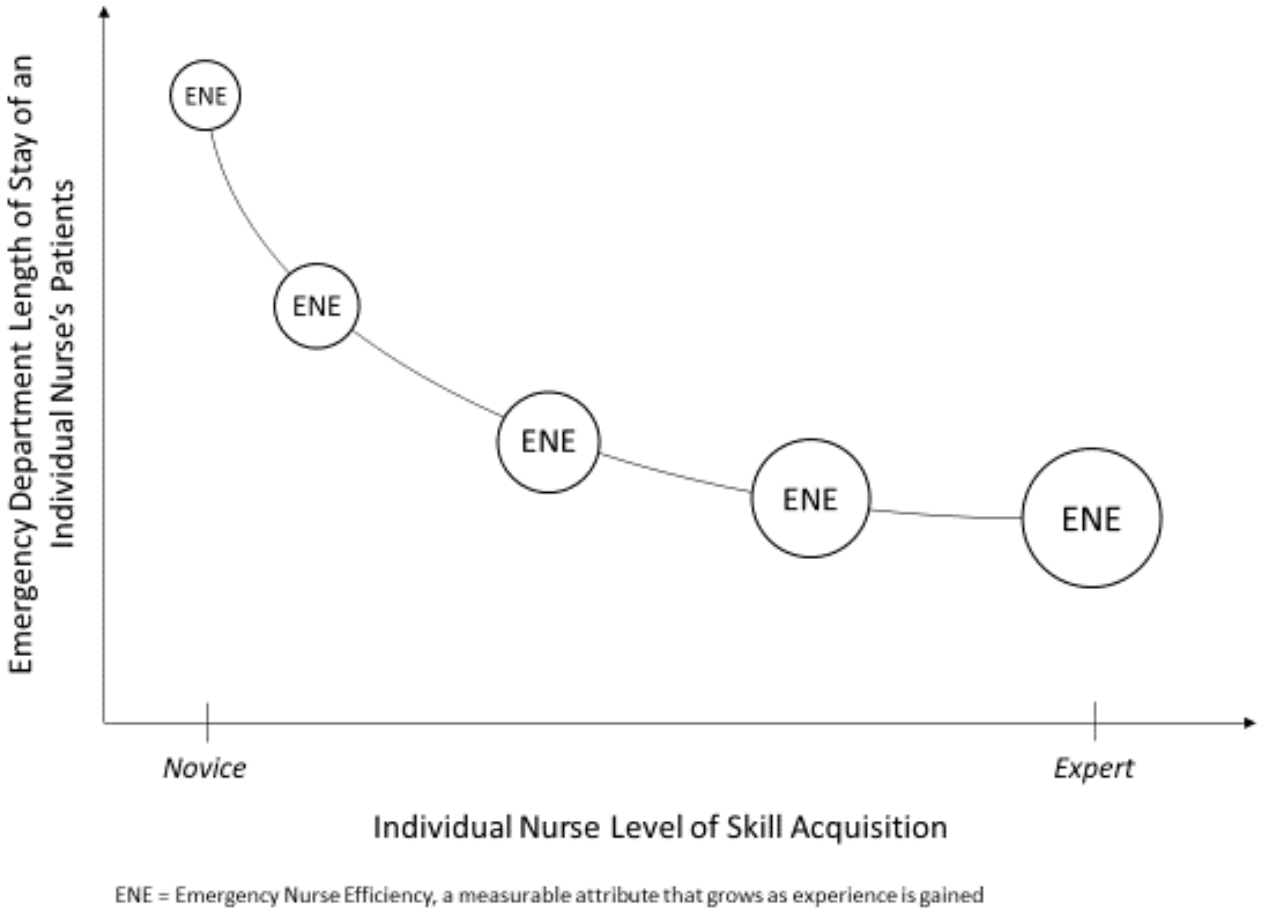
Table 5.1

Opportunities for Future Research

Area of Inquiry	Work Done in this Dissertation	Future Suggestions
Evaluation of individual nurse performance	Identification existing metrics for individual nurse performance (Chapter II)	Development of metrics specific to practice settings that capture the performance of individual nurses based on patient-level data
Understanding emergency nurse performance	Development of the concept of *Emergency Nurse Efficiency* (Chapter III)	Elaboration of the proposed concept that better represents and clarifies the performance of emergency nurses
Individual emergency nurses, emergency department length of stay (ED LOS), and nurse expertise	Demonstration of the relationship among emergency nurses, their patients' ED LOS, and their level of expertise (Chapter IV)	(1) Reproduction of the study at a medical center that includes the influence of medical residents and additional support staff (2) Further analysis of high-expertise nurses to understand the specific tasks that differentiate them from low-expertise nurses in the ED (3) Longitudinal studies that examine how ED LOS changes over time as individual emergency nurses accrue experience (4) Assignment of emergency nurses into the specific stages of development proposed by Benner's *Novice to Expert* model

Figure 5.1

Visualization of the Emergency Nurse Efficiency *Conceptual Model*



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Refer to Cumulative Reference List

Cumulative Reference List

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