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Investigating The Relationship Between Nurse Burnout And Self-Reported Medication Administration Errors In Alabama Hospitals

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INVESTIGATING THE RELATIONSHIP BETWEEN NURSE BURNOUT AND SELF-REPORTED MEDICATION ADMINISTRATION ERRORS IN ALABAMA HOSPITALS

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ABSTRACT

Background: Approximately 30% to 60% of nurses report high levels of burnout worldwide. Nurse burnout may impact vigilance and job performance. Nursing job performance may decrease due to lowered alertness if nurses have high levels of burnout, and this issue may be related to the act of committing a medication error. Of the very few studies exploring the relationship between nurse burnout and medication errors, the findings are conflicting. The purpose of this study is to examine the relationship between nurse work environment characteristics, burnout levels and self-reported medication administration errors as well as patient safety grades among nursing staff in Alabama acute care hospitals.

Methods: A cross-sectional, population-based study using electronic surveys included personal characteristics, the Practice Environment Scale of the Nursing Work Index (PES-NWI), the Copenhagen Burnout Inventory (CBI), and medication error and patient safety grade items from The Hospital Survey on Patient Safety Culture. Nurses received a postcard with a weblink to access and complete the survey. Staff registered nurses in Alabama acute care hospitals (N=928) were included in this study. Descriptive statistics, correlation, and multilevel mixed-modeling analyses were applied.

Results: A majority of Alabama nurses reported high Personal Burnout (60%), high Work-related Burnout (54%), and low to medium Client-related Burnout (72%). All burnout dimensions were significantly correlated to age, years in nursing, years in hospital, and practice environment ($p<0.05$). The average number of self-reported medication administration errors occurring in participating units during last three months was 2.13. Most participants rated positive perceptions (70%) of patient safety grade. Each burnout dimension was a statistically significant predictor of medication administration errors and patient safety grade after controlling for gender, age, years in hospital, race, and marital status.

Implications: This study provides important baseline data for actionable interventions to improve nursing care delivery and ultimately health care for Alabamians. It has the capability to inform Alabama health care systems that hospital level attributes are important to nurses, patients, policy makers, and the public.

Keywords: nurse, burnout, medication administration error, patient safety grade

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CBI	Copenhagen Burnout Inventory
CFA	Confirmatory Factor Analysis
COR	Conservation of Resources
DP	Depersonalization
EE	Emotional Exhaustion
FDR	False Discovery Rates
GVIF	Generalized Variance Inflation Factor
ICC	Intraclass Correlation Coefficient
IOM	Institute of Medicine
MBI	Maslach Burnout Inventory
NAM	National Academy of Medicine
OLBI	Oldenburg Burnout Inventory
PA	Personal Accomplishment
PCA	Principal Component Analysis
PES-NWI	Practice Environment Scale of the Nursing Work Index
RN-MD	Registered Nurse-Physician
UAB	University of Alabama at Birmingham
UK	United Kingdom
U.S.	United States

CHAPTER 1

INTRODUCTION

Burnout is a serious problem in nursing. Worldwide studies have reported that 30-60% of hospital staff nurses have moderate to high levels of burnout. The studies that explored burnout among nursing staff in the United States (U.S.) found that nurses reported the highest burnout scores in their second year after graduation (Browning, Ryan, Thomas, Greenberg, & Rolniak, 2007; Rudman & Gustavsson, 2011). Burnout is a state of physical and emotional exhaustion caused by long-term exposure to situations that are emotionally demanding, especially in people-oriented occupations such as human services, health care, and education (Maslach & Goldberg, 1998; Pins & Aronson, 1988). Nurse burnout is a concern for healthcare executives because of its negative impact on nurse turnover, job satisfaction, job performance, and its possible impact on patient safety (Halbesleben & Buckley, 2004; Rodgers, 2008).

Many indicators of quality nursing care and nurses' job performance fall within the broad category of patient safety, which is often measured by the frequency of several types of negative patient outcomes, including falls, nosocomial infections, and medication administration errors (Leiter & Laschinger, 2006). Medication administration errors are defined as the administration of a dose of medication that deviates from the prescription, as written on the patient medication chart, or from standard hospital policy and procedures. This includes errors in the preparation and administration of intravenous medicine on the unit (Ghaleb, Barber, Franklin, & Wong, 2010; Keers, Williams, Cooke,

& Ashcroft, 2013). There are several types of medication administration errors that nurses could be involved in, including wrong dose, wrong drug, known allergy, wrong time, wrong technique, drug-drug interaction, wrong route, inadequate monitoring, preparation error, and others. The Institute of Medicine (2000) reported that an estimated 44,000-98,000 deaths occur in the U.S. each year due to medical errors, which include medication administration errors. The rate of medication errors varies between two and fourteen percent of patients admitted to hospitals, with one to two percent of patients being harmed as a result (Williams, 2007). Also, almost two decades that the Institute of Medicine estimated that medical errors in hospitals were a major cause of mortality. Reducing patient harm and improving the culture of patient safety have been national healthcare priorities since then. However, little is known about the relationship between nurse burnout and nurse-attributed medication administration errors and patient safety grade. The purpose of Chapter one is to 1) introduce the problem, 2) provide a brief background and significance of the problem, 3) clarify study purpose and study aims, 4) introduce the conceptual framework that guides the study, and 4) clarify definitions of variables.

Statement of the Problem

Approximately 30% to 60% of nurses reported high levels of burnout worldwide. Nurse burnout may impact vigilance due to lowered alertness and consequently poor job performance (Barker & Nussbaum 2011; Schalk et al., 2010; Wakefield, Uden-Holman, & Wakefield, 2005). Poor job performance may be associated with committing a medication error (DeLucia et al., 2015).

Of the very few studies exploring the relationship between nurse burnout and medication errors, the findings are conflicting. This could be explained by different study methods and definitions used. Some studies combined medication administration errors with all other adverse events and did not analyze them as a separate category of adverse events. When Lieter and Lashinger (2006) examined the relationship between nurse burnout and patient safety outcomes, they found that two out of three components of burnout—emotional exhaustion and depersonalization—were correlated with adverse events, including medication errors. On the other hand, Halbesleben et al. (2008) found that burnout was not associated with adverse event reports in a Midwestern Veteran's Administration hospital. Halbesleben et al. (2008) described two explanations for the unexpected results. First, adverse event reports were extremely rare. Second, participants may not have reported all the adverse events because of respondent burden or a punitive culture. As the literature review below indicates, burnout among nursing staff may play a significant role in patient safety, especially with medication administration errors (Leape, Bates, & Cullen, 1995). Consequently, the divergent results of studies examining the relationship between burnout and patient safety should be confirmed by future studies.

Background and Significance of the Problem

Burnout has become so prominent among healthcare providers, that the National Academy of Medicine (NAM) launched the Action Collaborative on Clinician Well-Being and Resilience in 2017. More than half of U.S. physicians experience burnout and nurses are also experiencing high rate of burnout, putting an unsustainable strain on the health system (National Academy of Sciences, 2018). Enhancing patient experience,

improving population health, and reducing costs were included in the Triple Aim (which is a framework developed by the Institute for Healthcare Improvement that explains an approach to optimizing health system performance) for health care quality; however, members of healthcare workforce experience burnout, which is associated lower patient satisfaction, reduced health outcomes, and it may increase costs. Because provider mental health imperils the Triple Aim, the Quadruple Aim (which is the expanded Triple Aim) was recommended by adding the goal of improving the work life of healthcare providers including physicians and nurses (Bodenheimer & Sinsky, 2014).

Nursing care is a key to improving quality of patient care by reducing adverse outcomes (Mitchell, 2008). An ideal nurse is expected to be knowledgeable, yet patient and kind at all times. Having to project a positive attitude in all circumstances could lead to cognitive dissonance for nurses, often creating internal turmoil (Gandi, Wai, Karick, & Dagona, 2011). Additional nursing challenges include time pressures, the needs of family members, and the demands of other staff members. There is evidence that patient acuity in hospitals is increasing, along with nurse workload, work-related stress, and consequent burnout (Gandi et al., 2011). Also, possible causes of burnout could be daily confrontation, heavy workload, working overtime, high pressure to complete nursing tasks, poor work environment, and stress from keeping up with new technologies in procedures and equipment (Moss, 1989).

Approximately 40 percent of hospital nurses have higher burnout levels than other healthcare workers, and hospital nurses have a rate of job dissatisfaction 4 times greater than that of average workers in the U.S. (Aiken et al., 2002). A study of 68,724 registered nurses (RNs) in California, Pennsylvania, New Jersey, and Florida between 2006-2007

reported that higher burnout levels were found in nurses with direct patient care responsibilities (35%), compared with nurses who did not provide direct patient care (28%) (McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, 2011). Approximately 30% to 60% of nurses reported experiencing burnout in eight of nine countries, including the U.S., China, South Korea, Thailand, Japan, New Zealand, the United Kingdom (UK), and Canada (Aiken et al., 2011).

In 2017, Kronos Incorporated surveyed 257 RNs who were working in U.S. hospitals, and found that 98% of those hospital staff nurses said their jobs were physically and mentally demanding, 63% of hospital staff nurses reported that their jobs have caused burnout, 44% said they were worried their patients would suffer because they were so tired, and 41% have considered changing jobs and/or hospitals during the past year due to burnout (Larson, 2017). These findings are congruent with another study by the Hospital Review, which reported that 70% of nurses reported experiencing burnout in their current roles (Zimmerman, 2017). Nurse burnout is also implicated in fatigue, sleep deprivation, and errors; 13% of nurses attributed patient care mistakes to their burnout (Chin, Guo, Hung, Yang, & Shiao, 2015; Kenyon, Glusing, White, Dunkel, & Burlingame, 2007). Burnout in healthcare professions, including both physicians and nurses, could affect dimensions of care quality, including teamwork, patient satisfaction, productivity, and patient safety, including errors (McMahon, 2018).

Patient safety has become a core value within contemporary health care institutions and is based on data demonstrating that poor patient safety outcomes such as medical errors, falls, health care-associated infection, and unsafe blood products are associated with poor health care quality (Mathews & Pronovost, 2012; World Health

Organization, 2009). Defining the value of patient safety as quality over cost, it appears that if poor quality care was provided, substantial cost needs to be added to the healthcare system to keep value constant. Warburton (2009) categorized the cost associated with preventable adverse events as "the lost quality-adjusted life years of patients harmed by health care, the lifetime productivity lost by health professionals who have been involved with the error, and the value and resources used trying to reverse harm, analyze the error, and order compensation" (p. 224-225). Examples of these measures include additional treatment and legal and court costs. Ehsani, Jackson, and Duckett (2006) determined that on average, patients with adverse events extended their hospital stays 10 days longer and were at seven times the risk of death than patients without these complications. As a result, the adverse event added $6,826 to the cost of each patient stay. Although this study was conducted between 2003 and 2004, the total cost of adverse events in one year was $460,311,000. These findings are congruent with a longitudinal study conducted in Australia (Twigg, Geelhoed, Bremner, & Duffield, 2013); researchers found that the cost per patient with an adverse event between 2000 and 2004 increased from $8,488.43 (AUD$8,907) to $9,235.51 (AUD$9,690.926).

A study further suggested that medical errors are now the third leading cause of death in the U.S. (Makary & Daniel, 2016). Medication administration errors comprises one of the components of medical errors. In 2004, there were approximately 1.25 million annual medication errors in the U.S. (DataRay, 2018). At least 1.5 million Americans are injured every year by medication errors (Johns Hopkins, 2006). The number of medication errors have been increasing over time and have impacted more than seven million patients in the U.S. in 2012, contributed to 7000 deaths, and cost almost $21

billion in direct medical costs (Lahue et al., 2012). A study conducted by John Hopkins Medical Center calculated medication errors over an eight-year period (from 2000 to 2008) and concluded that 9.5 percent of all deaths each year stemmed from medical errors.

An increased emphasis on how nurses contribute to patient safety, or more specifically, to medication errors, led to explorations into the hazards of shift work and excessive work hours and workloads (Rogers, Hwang, & Scott, 2003). The most critical contribution of nursing to patient safety, in any setting, is the ability to coordinate and integrate the multiple aspects of quality within the care directly provided by nursing, and across the care delivered by others in the setting (Hughes, 2008). Clearly, the responsibility for correct medication administration on patient units rest with nurses, who are the last line of defense between medications and patients in the hospital settings (O'Shea, 1999).

Decreasing nurse burnout levels and improving patient safety are priorities for both the American Nurses Association (2018) and the Joint Commission (2011). Although the nursing workforce is predicted to increase by seven percent from 2017 to 2021 (from 3.6 million positions to 3.9 million positions), improving nurse health by decreasing burnout is critical need. It is vital to support the nursing population, which is the backbone of U.S. healthcare, as nurses are often the last line of defense for patients primarily through accurate medication administration and vigilant surveillance and patient care. A better understanding of the relationship between nurse burnout and medication administration errors as one component of patient safety must be a priority.

Purpose of the Study

The purpose of the study is to examine the relationship between nurse burnout levels and self-reported medication administration errors and patient safety grade among nursing staff in Alabama acute care hospitals. Alabama and the southeastern U.S. are often left out of major survey research about nurses and nursing. The studies about the nursing work environment use data primarily from four states: California, Pennsylvania, New Jersey, and Florida (McHugh et al., 2011). In 2006, the Alabama Center for Nursing found that the hospital work environment, inadequate staffing, and excessive work hours all negatively impact not only overall nurse outcomes, including job satisfaction and turnover, but also affect nurse health, contributing to sleep deprivation and generally poor health (Terry, 2018). Since then, no study has been conducted among Alabama nurses to examine the contributions of nursing and their impact on patient outcomes, particularly medication administration errors.

Study Aims and Research Questions

The specific aims of the study are as follows:

Specific Aim 1: To describe burnout levels among Alabama hospital-based nurses overall and by hospital and region.

Research Question 1: What are burnout levels among Alabama hospital-based nurses overall and by hospital and region?

Specific Aim 2: To examine whether self-reports personal and work characteristics are related to nurse burnout.

Research Question 2: Are any self-reports personal and work characteristics related to nurse burnout levels?

Specific Aim 2A: To examine whether either work or personal characteristics are related to nurse burnout.

Research Question 2A: Are either work or personal characteristics related to nurse burnout?

Specific Aim 2B: To examine whether both work and personal characteristics are related to nurse burnout.

Research Question 2B: Are both work and personal characteristics related to nurse burnout?

Specific Aim 3 (Main Aim): To examine whether there are relationships between nurse burnout and self-reported medication administration errors and patient safety grade among Alabama hospital-based nurses.

Research Question 3: Are there relationships between nurse burnout and self-reported medication administration errors and patient safety among Alabama hospital-based nurses?

Specific Aim 3A: To examine whether there is a relationship between nurse burnout and self-reported medication administration errors among Alabama hospital-based nurses.

Research Question 3A: Is there a relationship between nurse burnout and self-reported medication administration errors among Alabama hospital-based nurses?

Specific Aim 3B: To examine whether there is a relationship between nurse burnout and patient safety grade among Alabama hospital-based nurses.

Research Question 3B: Is there a relationship between nurse burnout and patient safety grade among Alabama hospital-based nurses?

Introduction of the Theoretical Framework

This section introduces the Conservation of Resources theory, which is the theoretical framework that guides this study. Application of the Conservation of Resources theory to the concept of burnout means that burnout will occur as a result of perceived or actual loss of these four resources: objects, conditions, personal characteristics, and energy resources (Freudenberger 1974, Hobfoll & Freedy 1993, Maslach & Goldberg, 1998). Hobfoll and Freedy (1993) explained burnout as physical exhaustion from an excessive workload that is likely to make workers feel overwhelmed and unable to meet their work-related goals. This is because a heavy workload decreases time to consider how to mobilize resources, and the complexity of these problems can be beyond cognitive and organizational resources.

Alvaro et al. (2010) suggested that the Conservation of Resources theory links personal resources to performance in health systems. The physical and mental health of nurses, including the presence of burnout, may affect work performance, which in turn may lead to a decrease in both alertness and overall quality of care (Schalk et al. 2010, Barker & Nussbaum 2011). DeLucia et al. (2015) noted that reduced nurse alertness may precede serious medication errors and lower perception of patient safety grade.

Definitions of Terms

The terms listed below will be used throughout this dissertation:

General Terms.

Burnout is defined as a syndrome of physical and emotional exhaustion caused by long-term experience in situations that are emotionally demanding, especially in people-oriented occupations such as human services, health care, and education (Maslach & Goldberg, 1998; Pins & Aronson, 1988).

Personal burnout is defined as "the degree of physical and psychological fatigue and exhaustion experienced by the person" (Kristensen et al., 2005, p. 197).

Work-related burnout is defined as "the degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work" (Kristensen et al., 2005, p. 197).

Client-related burnout is defined as "the degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work with clients" (Kristensen et al., 2005, p. 197).

Predictor Variables.

Personal characteristics.

Age is defined as the length of time that a person has lived (Merriam-Webster, 2019).

Gender is defined as the behavioral, cultural, or psychological traits typically associated with one sex or the state of being male or female (Merriam-Webster, 2019).

Marital Status is the state of being married or not married (Merriam-Webster, 2019).

Race refers to a class or kind of people unified by shared interests, habits, or characteristics or the state of belonging to a social group that has a common national or cultural tradition (Merriam-Webster, 2019).

Years of Nursing Experience is defined as the length of time that a nurse has worked or experienced in a nursing area when they responded to the survey (Feleke et al., 2015)

Years in Current Hospital is defined as the length of time that a nurse has worked in the current hospital when they responded to the survey (Queiros et. al., 2013)

Hospital characteristics.

Hospital Size is defined by the number of short-term acute beds which a hospital has been designed and constructed to contain (National Center for Biotechnology Information, 2019). Hospital size was defined as small (< 100 beds), medium (100-250 beds), and large (>250 beds) (Neff, Cimiotti, Sloane, & Aiken, 2013).

Location is classified to two categorical; rural versus urban. Rural hospitals aid smaller communities and often have limited access to advanced equipment or specialized procedures and techniques. Urban hospitals serve larger metropolitan areas and must often offer a wide degree of versality when it comes to treatment options and patient experience (Gallgher, 2018).

Regions is defined by an area or division, especially part of a country having definable characteristics but not always fixed boundaries (Merriam-Webster, 2019). Alabama regions in this study were followed Alabama Statewide Area Health Education Centers (AHEC) Program which divided Alabama into five regions including, North,

West Central, Southern, East Central, and Southeast Alabama (UAB School of Medicine, 2019).

Work characteristics.

Nursing Practice Environment is described as factors that contribute to or detract from a nurse's ability to conduct professional nursing in a setting and to provide high quality of care (Aiken & Patrician, 2000; Lake, 2002; McClure & Hinshaw, 2002; Swiger, Patrician, Miltner, Raju, Breckenridge-Sproat, & Loan, 2017); however, work environment and nursing practice environment will be using interchangeably in this study.

Nurse Participation in Hospital Affairs is defined as nurse involvement in forming the hospital-wide care environment (Lake, 2002).

Nursing Foundations for Quality of Care is defined as the hospital-wide structural support of nursing including a preceptor program for newly hired RNs (Lake, 2002).

Nurse Manager Ability, Leadership, and Support of Nurses is defined as the ability of the nurse manager to lead the unit, manage, and support nursing staff (Lake, 2002).

Staffing and Resource Adequacy is defined as enough staff and resources to support the services to do the job (Lake, 2002).

Collegial Nurse-Physician Relations is defined as good working relationships between nurses and physicians on the unit (Lake, 2002).

The composite score is the mathematically derived average of the PES-NWI subscales. Using an average of the subscales rather than the items themselves prevents the weighting of subscales that contain more items than others (Lake, 2013).

Outcome Variables.

Medication administration errors are defined as any difference between the medication that the patient received and what the prescriber intended in the original medication order (Keers et al., 2013).

Patient safety is defined as the avoidance, prevention, and amelioration of adverse outcomes or injuries from the process of health care (Alotaibi & Federico, 2017).

Patient safety grade is defined as perception on the level of the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery (Sorra et al., 2016).

Summary

Chapter one of the proposed dissertation study introduced the problem of nurse burnout and medication administration errors, the background and significance of this problem, the study purpose, study aims, theoretical framework that guides the study, and definitions that are used throughout the proposed dissertation. This study addresses the knowledge gap about the relationship between nurse burnout and medication administration errors among acute care hospital nurses in Alabama. This study has an incredible potential to inform hospitals about the level of burnout among their nurses and about possible organizational factors that are contributing to this phenomenon in Alabama. Furthermore, the findings may provide baseline data for actionable interventions to improve the effectiveness of nursing care delivery at the worksite. These actionable interventions could also improve patient safety, particularly with regard to medication administration errors, and ultimately the quality of health care as a whole. In

chapter two, an integrative review of the literature will be presented to provide what is known in this area and what support is available for the inclusion of each construct.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this chapter is to provide a comprehensive, integrative review of literature by presenting the research relevant to the central concept, which is nurse burnout and practice work environment, as well as the related concept of medication administration errors and patient safety grade. Furthermore, this chapter will provide support for this study, including the epidemiology, theoretical framework, and ethical issues.

Concepts of Interest

Approximately 30% to 60% of nurses reported high levels of burnout worldwide. Nurse burnout could impact vigilance and job performance (Wakefield, Uden-Holman, & Wakefield, 2005). High levels of burnout among nurses may be associated with decreased alertness and subsequent decline in nursing job performance (Schalk, Bijl, Halfens, Hollands, & Cummings, 2010; Barker & Nussbaum 2011), and this issue may precede the commission of medication errors (DeLucia, Ott, & Palmieri, 2009). The review of the epidemiology of medication errors showed a high incidence of medication administration errors, and that nurses are the last line of defense between medications and patients.

Nurse Burnout.

Worldwide studies have reported burnout among nurses. It should be noted that most of the prior research has used the Maslach Burnout Inventory (MBI) as the instrument to measure three components of burnout including Emotional Exhaustion (EE), Depersonalization (DP), and Personal Accomplishment (PA). The studies that explored burnout among nursing staff in the U.S. found that nurses reported high levels of burnout (i.e., high EE, high DP, and low PA), and these studies reported that these high burnout scores were stable for three consecutive years after graduation (Aiken et al., 2002; Browning, Ryan, Thomas, Greenberg, & Rolniak, 2007; Rudman & Gustavsson, 2011; Vahey, Aiken, Sloane, Clarke, & Vargas,2004). In China, nurses reported burnout concurrent with less personal accomplishment; nearly 40% of nurses reported high EE levels, 25% of nurses reported high DP levels, and 49% of nurses reported low PA levels (Zhang et al., 2014). Approximately 30% to 60% of nurses reported burnout in eight of nine countries, including the U.S., China, South Korea, Thailand, Japan, New Zealand, the U.K., and Canada (Aiken et al., 2011). Likewise, a study of nurses in Thailand (Nantsupawat et al., 2011), found that 41% of nurses had high burnout scores.

A high percentage of nurses in U.S. hospitals (70%) reported experiencing high burnout levels. Hospitals in U.S. had the highest percentage of nurses with high burnout scores and high levels of nursing job dissatisfaction when compared to four other countries, including Canada, Columbia, England, and Scotland (Aiken, Clarke, & Sloane, 2002). These same U.S. hospitals were also more likely to rate the quality of care during their last shift as fair or poor. Additionally, nurse-reported quality of care in U.S. hospitals had deteriorated over the past years compared to reports in the four other

counties (Aiken et al., 2002). Aiken et al. (2002) hypothesized that these issues might arise from a variety of factors: nurse-patient ratios, staffing and skill mix, surveillance and early detection of decompensation, organizational support for nursing care, and processes of care. In the hospital settings, nurses constitute an around the clock surveillance system for early detection and prompt interventions when patients' conditions deteriorate. The effectiveness of nurses surveillance is impacted by number of nurses available to access patients. As we know, the patient-nurse ratio is a significant predictor of nurse burnout. Nurse burnout is also implicated in fatigue and sleep deprivation; 13% of nurses attributed patient care mistakes to their fatigue (Chin, Guo, Hung, Yang, & Shiao, 2015; Kenyon, Glusing, White, Dunkel, & Burlingame, 2007).

Medication Administration Errors.

Patient safety has become a core value within contemporary health care institutions (Alotaibi & Federico, 2017; Mathews & Pronovost, 2012; You et al., 2013). Bates (2010) estimated that for every ten patients in developed countries, one patient is harmed while receiving hospital care. In the very first report on adverse drug events in 1984, of a total of 2,671,863 patients discharged from New York hospitals, approximately 98,600 patients (3.69%) experienced adverse events, including medication errors. (Brennan et al., 1991; IOM, 1999). In a later report, the IOM (2006) found that medication errors injure at least 1.5 million people per year and that the cost of treating medication error-related injuries was 3.5 billion dollars per year (IOM, 2006). The IOM (1999) suggested a four-tier strategy for a safer healthcare system; one strategy was to identify and learn from errors by developing a nationwide public mandatory reporting system and by encouraging health care organizations and practitioners to develop and

participate in voluntary reporting systems. Even though healthcare organizations have paid attention to these incidents and are involved in medication error prevention programs at international, national, and local levels, adverse events including medication errors are still occurring at alarming rates.

Fathi et al. (2017) found the prevalence of medication administration errors was 17%, and the most common types of medication errors were administering medications at the wrong time (24%), dosage errors (17%), and administering medication to the wrong patient (14%). However, it should be noted that medication error report rates may be lower than the actual medication error rates because many errors are not reported and may not even be recognized due to the following reasons: 1) perceptions that the administration focuses on the individual and not on the system; 2) nurses are blamed when something "bad" happens to patients; 3) nurses fear adverse consequences for reporting errors; 4) nurses believe that their peers will think them incompetent; and 5) nurses do not think the error was important enough to report (Patrician & Brosch, 2009).

The best method of collecting medication administration error data is via direct observation. In 2003, two studies were conducted using direct observation and found that the error rate for intravenous medications was 26% to 49% (Taxis, & Barber, 2003; Wirtz, Taxis, & Barber, 2003). Medication errors not only negatively affect patients, but also impact nurses and organizations and reduce healthcare efficiency. The healthcare professionals who are involved in the incident including medication errors, the so-called second victims, can also suffer distress such as guilt, anger, frustration, and fear (Lee, Pyo, Jang, Choi, & Ock, 2019).

Analysis of the Literature Relative to Concepts

Professional Nursing Burnout.

The defining characteristics of burnout that appear consistently in the literature are fatigue and emotional exhaustion or insufficient emotional energy to provide services, negative or neutral feelings and attitudes toward the recipients of services (once defined as depersonalization and now called cynicism), and a feeling of low accomplishment and professional failure (Dubois, Bentein, Mansour, Gilbert, & Bedard, 2014; Leiter & Laschinger, 2006; Nayeri, Negarandeh, Vaismoradi, Ahmadi, & Faghihzadeh, 2009; Maslach & Goldberg, 1998; Queiros, Carlotto, Kaiseler, Dias, & Pereira, 2013; Tartakovsky, Gafter-Shor, & Perelman-Hayim, 2013; Wlodarczyk & Lazarewicz, 2011). Kristensen, Borritz, Villadsen, and Christensen (2005) also emphasize that burnout is not just fatigue or exhaustion, but it is adding the additional key feature of the attribution of fatigue and exhaustion. One attribution is work and a more specific domain is client work which elaborate further on the three domains of the Copenhagen Burnout Inventory (CBI).

Burnout in nursing has been an issue for decades. In 1989, burnout was found to be costly to the nurses who experienced it, their employers, and their patients (Moss, 1989). Moss (1989) also stated that burnout has three major symptoms: physical, emotional, and mental exhaustion. The factors contributing to nurse burnout were related to work, such as daily confrontation with death, and heavy workload (Moss, 1989). However, the pressure to keep up with rapidly changing technological advances in procedures and equipment could cause nurse burnout as well (Moss, 1989). Technology has changed nursing care since 1980s. Some examples include electronic smart

intravenous pumps, information management systems, drug management technologies, and electronic health records. Technical skill is a necessary competency in nursing (Courtney, Demiris, & Alexander, 2005). Furthermore, the National Academy of Medicine (NAM) Reports stated that the consensus recommendations from experts have been changed over time to improve healthcare quality and safety including measuring disparities in access to the quality of health care as well as reducing medication errors based on estimates of the incidence and cost of such errors and evidence on the efficacy of various prevention strategies (Agency for Healthcare Research and Quality, 2019). This review presents possible factors related to nurse burnout and its consequences focused within the last twelve years (2007-2019).

Possible factors related to nurse burnout. The factors that precede burnout among nurses are personal characteristics (i.e., age, gender, marital status, work experience, and coping skills), and work environment factors/job characteristics (i.e., patient-nurse ratio, time pressure, work overload, shift length, income, social support, social relationships, and ethical conflicts).

Personal characteristics. Personal characteristics which showed statistically significant differences in professional nursing burnout levels were age, gender, race, marital status, and children in the home (Cañadas-De la Fuente et al., 2015; Henriksen, & Lukasse, 2016; Karakoc et al., 2016; Padilla Fortunatti, & Palmeiro-Silva, 2017). These studies demonstrated a connection between emotional exhaustion and nurses' personal characteristics, i.e., age and marital status. A higher level of depersonalization was found in men than women. The male nurses were at almost three-fold higher risk for developing burnout compare to female nurses ($OR = 2.76$, $p = .017$) (Alqahtani, Awadalla, Alsaleem,

Alsamghan, & Alsaleem, 2019). A study in a pediatric health care system reported that Black participants reported higher Personal Burnout, whereas white participants reported higher Work-related Burnout, and Asian nurses reported higher Client-related Burnout (Jacobs, Nawaz, Hood, & Bae, 2012). A nursing staff study in a private hospital found that non-white nurses reported higher emotional exhaustion compared to white nurses (Duan-Porter et al., 2018). Also, a lower level of personal accomplishment was found in single individuals than in married individuals. Likewise, nurses with children reported a greater sense of personal accomplishment than those who had no children (Cañadas-De la Fuente et al., 2015; Henriksen & Lukasse, 2016; Karakoc et al., 2016; Ntantana et al., 2017). However, single parents reported higher burnout levels (high EE, high DP, low PA, and high overall burnout) than those who lived with partners (Rizo-Baeza et al., 2017). Padilla Fortunatti et al. (2017) reported that younger nurses had higher emotional exhaustion scores. These results are congruent with other studies that predicted burnout by nurse gender, age, and years of experience (Queiros et al., 2013; Shoorideh, Ashktorab, Yaghmaei, and Alavi Majd (2015). They reported that male gender and younger age were significantly correlated with cynicism and a statistically significant relationship existed between work experience and depersonalization (Queiros et al., 2013). Work experience accounted for a small proportion of variance in nurses' burnout and also indicated that nurses with younger age experienced higher overall burnout (Ezenwaji et al., 2019). In sum, younger age and less nursing experience seems to have higher burnout.

In contrast, some studies report opposite findings on the relationship between personal characteristics and nurse burnout. For example, Mudallal, Othman, and Al Hassan (2017) found that older age was positively correlated to some dimensions of burnout, including high Emotional Exhaustion and Personal Accomplishment. Also, men have lower scores on Emotional Exhaustion and Depersonalization, and higher scores on Personal Accomplishment than women (Lahana et al., 2017; Mudallal et al., 2017). This study also reported that nurses who had longer nursing experience seem to have higher burnout levels (Mudallal et al., 2017). It should be noted that only a few studies have been conducted on how race related to nurse burnout (Pradas-Hernández, Ariza, Gómez-Urquiza, Albendín-García, De la Fuente, & Cañadas-De la Fuente, 2018).

Nurses who have routinely used coping techniques have been found to have lower burnout levels (Duarte & Pinto-Gouveia, 2016; Magtibay, Chesak, Coughlin, & Sood, 2017). Specific coping techniques that have been experimented with among nurses and work well are Stress Management and Resiliency Training (Magtibay et al., 2017), and Mindfulness-based Interventions (Duarte & Pinto-Gouveia, 2016). These studies tested coping skills using longitudinal studies and found that nurses who used coping skills routinely had much lower burnout levels compared to those at baseline (Duarte & Pinto-Gouveia, 2016; Magtibay et al., 2017). On the other hand, Yu, Jiang, and Shen (2016) reported that high burnout levels were found in nurses who had a passive coping style. Passive coping style refers to a feeling of relying on others to resolve stressful events or situations (Carroll, 2013).

Work environment factors and job characteristics. A better nursing practice environment (e.g., Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, better Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, and better Collegial Nurse-Physician Relations) was associated with better patient outcomes and better nurse outcomes, including low nurse burnout levels in nine countries around the world (Aiken et al., 2011; Hanrahan, Aiken, McClaine, & Hanlon, 2010; Zhou et al., 2015). In a study among Nigeria nurses, better work environments were correlated with lower nurses' overall burnout (using Oldenburg Burnout Inventory) after controlling for sex, age, and nursing experience (Ezenwaji et al., 2019). This finding is congruent with a study that examined the relationship between nursing work environment (using the Practice Environment Scale of Nursing Work Index (PES-NWI)) and nurse burnout (using Maslach Burnout Inventory (MBI)). The Practice Environment Scale of Nursing Work Index composite score had negative correlations with Emotional Exhaustion and Depersonalization and positive correlations with Personal Accomplishment (Aiken et al., 2011; Liu et al., 2012; Ogata et al., 2018).

Nursing workload is defined as the amount of work that nurses perform, both direct and indirect care, which also includes unit and organization activities (Needham, 1997). Work overload is one of factors that contributes to professional nursing burnout (Galletta et al., 2016; McMillan et al., 2016; Tawfik et al., 2017; Wu, Zhu, Wang, Wang, & Lan, 2007). Also, higher daily patient admissions and higher nursing care hours per patient day resulted in the highest burnout prevalence among nurses who worked in intensive care units (ICU) (Tawfik et al., 2017). Galletta et al. (2016) supported the fact that higher emotional exhaustion levels among nurses was correlated with cynicism in the

presence of high work demands. The work conditions associated with moderate to high burnout levels are high workload and limited resources (human and time) (Galletta et al., 2016; Russell, 2016). Among Emergency Department nurses, time pressures decreased their feelings of control and increased their experiences of burnout as compared to nurse practitioners, who reported the most control and the least burnout (Browning et al., 2007).

Heavy workloads are associated with inadequate staffing measured as nurse-to-patient ratio. The American Nurses Association (ANA) recommends minimum nurse-to-patient ratios to be maintained at all times. The recommends minimum nurse-to-patient ratios for emergency departments, step-down, and pediatrics units are 1:4 ratio, for medical/surgical and post-partum units, 1:6, for intensive care 1:2, and other specialty care (1:5) (Lippincott Nursing Education, 2016). Low nurse-to-patient ratios make it problematic for nurses to spend adequate amounts of time with patients, the time necessary for thorough assessment and surveillance functions. The U.S. oncology nurses reported that their experience of high burnout was because of increased nurse-patient ratios and skipped or shortened lunches or breaks (Russell, 2016). Shoorideh, Ashktorab, Yaghmaei, and Alavi Majd (2015) explored the relationship between work, individual factors, moral distress, and burnout in intensive care nurses. The results showed that the higher the patient-to-nurse ratio (i.e., the more patients per nurse), the greater the workload for nurses, and the more likelihood of nurse burnout. Welp, Rothen, Massarotto, and Manser (2019) also confirmed that workload was positively correlated with self-reported burnout among 1,148 nurses working in 55 ICUs.

Burnout among nurses has also been associated with hours worked per shift. Nurses regularly perform physically and mentally demanding duties and work for long shifts with little rest time between shifts. Shift length, shift schedules, and hours worked per week are related to levels of burnout (Seki &Yamazaki, 2006; Stimpfel et al., 2012). There has been a trend over the past few decades for nurses to work 12-hour shifts. Nurses prefer to work twelve-hour shifts because it gives nurses more days off (four days off per week) and nurses believe it provides a better work-life balance (Richardson, Turnock, Harris, Finley, & Carson, 2007). However, longer shifts affect both nurse outcomes and patient outcomes (Dall'Ora, Griffiths, Ball, Simon, & Aiken, 2015; Naz, Hashmi, & Asif, 2016; Stimpfel, Sloane, & Aiken, 2012; Zhou et al., 2015). Nurses who worked longer hours (≥ 12 hours) were more likely to experience higher levels of nurse burnout than those who worked shorter hours per shift (≤ 8 hours) (Dall'Ora et al., 2015; Zhou et al., 2015). Stimpfel et al. (2012) found that nurses who worked more than ten hours per workday were up to 1.7 times more likely to experience burnout compared with nurses who worked eight hours, and nurses who worked more than 13 hours were about three times more likely to experience burnout compared with those nurses who worked eight-hour workdays.

Income or salary has been a predictor of job satisfaction and burnout level in all careers. Economic well-being and income levels were significantly related to burnout among emergency staff, nurses, technicians, and health information technicians in same organizations in Western Turkey (Schooley, Hikmet, Tarcan, & Yorgancioglu, 2016). These results are congruent with a recent study among nurses in China (Guo et al., 2017). To investigate the prevalence and extent of burnout among nurses, and the relationship

between nurse burnout and personal resilience, nurses in six different hospitals were surveyed. The results showed that nurses had high burnout levels and a moderate level of resilience, and the important predictor of high nurse burnout level was a lower income per month (Guo et al., 2017). However, it should be noted that this was not a factor in the U.S. studies.

Furthermore, social support from the workplace, and ethical conflicts are important predictors of nurse burnout (Gunusen, Wilson, & Aksoy, 2017; Khamisa, Peltzer, Ilic, & Oldenburg, 2016; Orgambidez-Ramos, Borrego-Ales, Vazquez-Aguado, & March-Amegual, 2017; Vander Elst et al., 2016; Wu, Singh-Carlson, Odell, Reynolds, & Su, 2016). Social support can be emotional (e.g., the action of caring, listening sympathetically, and offering assistance toward solving the problem), which might help nurses to alleviate emotional exhaustion (Jenkins, & Elliott, 2004). Work colleagues can provide a greater range of support for dealing with work-related problems than external sources by helping each other in the completion of tasks (Jenkins, & Elliott, 2004). Nurses seem to have lower burnout levels in better work environments characterized by good social relationships with each other and with patients and physicians (Nantsupawat et al., 2017; Schwarzkopf et al., 2017; Viotti, Gilardi, Guglielmetti, & Converso, 2015).

Two studies have confirmed that both physical and verbal violence in the workplace by patients were significantly and positively related to nurse burnout levels (Bernaldo-De-Quiros et al., 2015; Viotti et al., 2015). Poor physician-nurse collaboration was related to high burnout levels in both physicians and nurses (Schwarzkopf et al., 2017). To explain the relationship between ethical conflicts and burnout among nurses, a correlation study was conducted in Poland. Four of fourteen ethical conflicts showed a

significantly strong relationship to professional burnout, including being a witness to an unfair critique by a colleague, being part of an inappropriate interpersonal relationship between nurses, being a witness to the discrediting of a nurse by another in the presence of a third party, and a lack of colleagues' understanding when enhancing professional qualifications. Wang, Liu, and Wang (2015), conducting a nursing study in 6 hospitals in China, found that work-environment factors, including nurse-physician relationships and the ability of the nurse manager to be a leader and supporter, are related to all three dimensions of burnout. However, Kalicińska, Chylińska, and Wilczek-Różyczka (2012) found that supervisor and peer support was significantly related only to emotional exhaustion, not to depersonalization or personal accomplishment. In sum, a better nursing practice environment in every dimension was associated with better nurse outcomes, including low nurse burnout levels.

The summary of possible predictors of nurse burnout is shown in Table 1. For categorical data, positive means there is a relationship between that level and nurse burnout. For example, male nurses had higher burnout levels than female nurses. The conflicting findings between at least two studies are indicated in the column labeled "conflicting." In sum, conflicting results have been reported and more studies are needed to investigate the relationship between personal characteristics (e.g., age, gender, marital status, and nurse experience), work characteristics, and nurse burnout levels.

Table 1

Summarize Possible Predictors of Nurse Burnout from the Literature

Factors	Relationship with Burnout	References
Personal Characteristics		
Age	×	Mudallal, Othman, & Al Hassan, 2017 **VS** Padilla Fortunatti et al., 2017
Gender		Alqahtani, Awadalla, Alsaleem, Alsamghan, & Alsaleem, 2019; Cañadas-De la Fuente et al., 2015; Henriksen, & Lukasse, 2016; Karakoc et al., 2016; Padilla Fortunatti, & Palmeiro-Silva, 2017
Female	×	
Male	×	**VS**
		Lahana et al., 2017; Mudallal et al., 2017
Race	-	Duan-Porter et al., 2018; Jacobs, Nawaz, Hood, & Bae, 2012
White	+	
Non-White		
Marital Status		Rizo-Baeza et al., 2017
Single	+	
Married	-	
Years of nursing experience	+	Queiros et al., 2013
Coping skills		Duarte & Pinto-Gouveia, 2016; Magtibay, Chesak, Coughlin, & Sood, 2017
Had skills	-	
Had no skills	+	
Work Characteristics		
Nursing practice environment	-	Aiken et al., 2011; Hanrahan, Aiken, McClaine, & Hanlon, 2010; Zhou et al., 2015
Patient- Nurse ratio	+	Shoorideh, Ashktorab, Yaghmaei, & Alavi Majd 2015; Russell, 2016
Time pressure	+	Browning et al., 2007; Galletta et al., 2016
Work Overload	+	Galletta et al., 2016; McMillan et al., 2016; Tawfik et al., 2017; Welp, Rothen, Massarotto, & Manser, 2019; Wu, Zhu, Wang, Wang, & Lan, 2007
Shift length	+	Dall'Ora, Griffiths, Ball, Simon, & Aiken, 2015; Naz, Hashmi, & Asif, 2016; Stimpfel, Sloane, & Aiken, 2012; Zhou et al., 2015
Income	-	Guo et al., 2017; Schooley, Hikmet, Tarcan, & Yorgancioglu, 2016
Social support at work		Gunusen, Wilson, & Aksoy, 2017; Khamisa, Peltzer, Ilic, & Oldenburg, 2016; Orgambidez-Ramos, Borrego-Ales, Vazquez-Aguado, & March-Amegual, 2017; Vander Elst et al., 2016; Wu, Singh-Carlson, Odell, Reynolds, & Su, 2016
Adequate support	-	
Inadequate support	+	
Social relationships at work		
Good relationships	-	Nantsupawat et al., 2017; Schwarzkopf et al., 2017; Viotti, Gilardi, Guglielmetti, & Converso, 2015
Poor relationships	+	
Ethical conflicts		Wang, Liu, & Wang, 2015
Had conflicts	+	
Had no/less conflict	-	

Note. - = Negatively Correlated, + = Positively Correlated, × = Conflicting Results

Consequences of nurse burnout. The consequences of burnout among nurses that have been found in the literature review are characterized as nurse outcomes (job dissatisfaction, intention to leave, and mental illness), organizational outcomes (diminished organizational commitment and turnover), and patient outcomes (quality of care and patient safety), which includes such factors as mortality and failure to rescue, medication administration errors, near-misses, and other adverse events.

Nurse outcomes. Nurses who had high levels of burnout, such as new graduate nurses and emergency nurses, reported more stressors, depressive symptoms, and hostility towards them (Browning et al., 2007; Rudman & Gustavsson, 2011). Newly-registered nurses who experienced burnout exhibited the following symptoms: low self-esteem, irritability, depression, emotional exhaustion, and disengagement (Rudman & Gustavsson, 2011). Rudman and Gustavsson (2011) reported that new graduate nurses with high burnout were more likely to have bad eating habits and higher consumption of alcohol. Nurses who reported a history of taking medications for sleep disorder also reported higher burnout opposed to those with no history of sleep disorder medication (Alqahtani et al., 2019)

Burnout affected not only nurses' health, but also dissatisfaction with job and intention to leave. Lower job satisfaction was another consequence of high burnout levels (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Holden et al., 2011; McHugh et al., 2011; Stimpfel et al., 2012). In better nursing work environments, where nurses tend to report lower burnout levels, they were more satisfied with their jobs (Aiken et al., 2008; Aiken et al., 2011; Holden et al., 2011; McHugh et al., 2011; Nantsupawat et al., 2011; Queiros et al., 2013; Stimpfel et al., 2012; You, Choe, Park, Kim, & Son, 2013; Zhang et al.,

2014). Moreover, numerous studies found that job dissatisfaction among nurses was significantly related to their intention to leave the job (Aiken et al., 2008; Rudman & Gustavsson, 2011; Stimpfel et al., 2012; Zhou et al., 2015). Therefore, consequences of nurse burnout on nurse outcomes include physical and mental illness, low job satisfaction, and increasing nurse intent to leave the profession.

Organizational outcomes. In studies of Chinese nurses, Zhou et al. (2014) and Cao, Chen, Tian, Diao, and Hu (2015), found negative correlations between the three dimensions of professional burnout (i.e., emotional exhaustion, depersonalization, and reduced personal accomplishment) and the three dimensions of organizational commitment (i.e., affective commitment, normative commitment, and cost commitment). These results are congruent with a study that examined the correlation between burnout and productivity among Iranian nurses (Nayeri et al., 2009). The findings of Nayeri et al. study showed that productivity had a significant negative correlation with emotional exhaustion and depersonalization. A significant positive correlation was found between productivity and personal accomplishment.

If high burnout among nurses is not addressed, it could lead to a serious cost issue in terms of nurse turnover, shortage, and productivity losses (Nayeri et al., 2009). Nurse burnout often precedes turnover and absenteeism (Zhang et al., 2014). A consistently heavy workload increases job tension, which turns into increase the likelihood of turnover (Hayes et al., 2006). Empirical study suggested that each additional patient served per nurse is associated with a 23% increase in the odds of burnout (Aiken et al., 2002). High rate of nursing staff leaving their jobs is a considerable problem in organizations, especially in countries that have nursing shortages (Nantsupawat et al.,

2011; Rochefort & Clarke, 2010; Stimpfel et al., 2012). A study on turnover and nurse burnout in Japan reported that nurses with low emotional exhaustion had significantly lower relative risk of the incidence of turnover than those with high emotional exhaustion (Shimizu, Feng, & Nagata, 2005). Nurses who had high levels of burnout, including new graduates, reported high rates of turnover intention (Aiken et al., 2008; Boamah, & Laschinger, 2016). This phenomenon was related to a poor nursing work environment, long shift hours, and excess busyness at work (Aiken et al., 2008; Stimpfel et al., 2012). Holdren, Paul III, and Coustasse (2015) also suggested that decreasing nurse burnout levels could potentially help to decrease the national nursing shortage and help organizations eliminate costly expenses in recruiting, training, and replacing nursing staff.

Patient outcomes. Strong evidence connects better nurse outcomes to better patient outcomes. Many studies reported that high burnout levels among nurses were significantly related to poor or fair quality of nursing care (Nantsupawat et al., 2011; Nayeri et al., 2009; Rochefort & Clarke, 2010; You et al., 2013). High quality of care on the unit and during the last shift were related to all three components of burnout: low EE, low DP, and high PA (Van Bogaert, Clarke, Roelant, Meulemans, & Van de Heyning, 2010; Van Bogaert, Kowalski, Weeks, Van Heusden, & Clarke, 2013; Van Bogaert, Meulemans, Clarke, Vermeyen, & Van de Heyning, 2009; Van Bogaert et al., 2014). However, all studies that examined the relationship between professional burnout among nurses and patient outcomes used a cross-sectional design, so researchers could not make causal links between lower levels of burnout and higher quality of care (Nantsupawat et

al., 2011; Nayeri et al., 2009; Rochefort & Clarke, 2010; You et al., 2013; Van Bogaert et al., 2010; Van Bogaert et al., 2013; Van Bogaert et al., 2009; Van Bogaert et al., 2014).

Adverse patient events may be a consequence of burnout, but this relationship has conflicting results in the literature. Nurses reported that a good work environment was related to higher patient safety, defined by lower frequency of adverse events and higher patient safety grades (Teng, Shyu, Chiou, Fan, & Lam, 2010; You et al., 2013). You et al., (2013) used the PES-NWI and the Agency for Healthcare Research and Quality (AHRQ) Hospital Survey on Patient Safety Culture to examine the relationship between those variables and found that higher hospital safety grades were given by nurses who had lower nurse burnout scores. Teng et al., (2010) also reported that for nurses with high burnout levels, time pressure affected patient safety, and the interaction of time pressure and burnout negatively and significantly affected patient safety.

Medication administration error is one measure of adverse events in organizations. A nurses' self-reported survey, such as the Medication Administration System-Nurses Assessment of Satisfaction Scale, was used to assess the occurrence of medication errors and near-miss medication error (Halbesleben, Rathert, & Williams, 2013; Halbesleben et al., 2008; Holden et al., 2011; Seki & Yamazaki, 2006; Van Bogaert et al., 2014). Some researchers reported that all three subscales of the Maslach Burnout Inventory, i.e., Holden et al., 2011; Van Bogaert et al., 2014, were related to medication administration errors by nurses, while other researchers reported that only emotional exhaustion and depersonalization were associated with medication errors (Halbesleben et al., 2013; Laschinger & Leiter, 2006). In addition, day and evening shift

nurses reported that higher rates of near-miss errors occurred when longer working hours were required because of busyness (Seki & Yamazaki, 2006).

Studies conducted in Canada and Belgium reported that burnout among nursing staff was associated with patient adverse patient events (patient falls, nosocomial infections, patient and family complaints, and medication errors) (Laschinger & Leiter, 2006; Van Bogaert et al., 2014). Laschinger & Leiter (2006) also found that burnout was a mediator in the relationship between work-life factors and adverse events.

A study conducted to investigate the relationship between nurse burnout and patient safety among 148 nurses from a Midwestern Veteran's Administration (VA) hospital found no significant relationship between nurse burnout and adverse event reports. Even though the researchers found a strong correlation between emotional exhaustion and depersonalization, neither was associated with adverse events (Halbesleben et al., 2008). Two explanations of this unexpected result were as follows: 1) reports of adverse events were extremely rare, and 2) participants may have felt that adverse event reports required too much effort. These findings conflict with a study by Spence, Lashinger, and Lieter (2006), who found a positive relationship between emotional exhaustion and adverse events. The lack of consistent findings regarding the relationship between nurse burnout and patient safety is a consequent gap in the literature. It also appears that nurse burnout has not been studied sufficiently as an antecedent of adverse events, especially with regard to medication administration errors.

The summary of the consequences of nurse burnout is shown in Table 2. The key gap of knowledge is that studies to reveal the connection between nurse burnout and medication administration errors still show mixed results.

Table 2

Summarize Outcomes of Nurse Burnout from the Literature

Factors	Relationship with Burnout	References
Nurse Outcomes		
Job satisfaction	-	Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Holden et al., 2011; McHugh et al., 2011; Stimpfel et al., 2012
Intention to leave	+	Aiken et al., 2008; Rudman &Gustavsson, 2011; Stimpfel et al., 2012; Zhou et al., 2015
Mental illness	+	Browning et al., 2007; Rudman & Gustavsson, 2011
Physical illness	+	Alqahtani, Awadalla, Alsaleem, Alsamghan, & Alsaleem, 2019; Rudman & Gustavsson, 2011
Organizational Outcome		
Dimensions of organizational commitment	-	Cao, Chen, Tian, Diao, & Hu, 2015
Turnover	+	Boamah, & Laschinger, 2016; Shimizu, Feng, & Nagata, 2005
Patient Outcomes		
Nurse related quality of care	-	Nantsupawat et al., 2011; Nayeri et al., 2009; Rochefort & Clarke, 2010; Van Bogaert, Clarke, Roelant, Meulemans, & Van de Heyning, 2010; Van Bogaert, Kowalski, Weeks, Van heusden, & Clarke, 2013; Van Bogaert, Meulemans, Clarke, Vermeyen, & Van de Heyning, 2009; Van Bogaert et al., 2014You et al., 2013
Patient safety/ adverse events	-	Aiken et al., 2008; You et al., 2013
Mortality rate/ failure to rescue	×	Aiken et al.,2008 **VS** Halm et al., 2005; Halbesleben, Rathert, & Williams, 2013;
Near-miss medical error	×	Halbesleben et al., 2008; Holden et al., 2011; Seki & Yamazaki, 2006; Van Bogaert et al., 2014
Medication Errors	×	Halbesleben et al., 2008 **VS** Lashinger, & Lieter, 2006

Note. - = negatively correlated, + = positively correlated, × = conflicting findings

Medication administration errors.

A medication administration error is defined as any difference between what the patient received and what the prescriber intended in the original order (Keers, Williams, Cooke, & Ashcroft, 2013). Currently, worldwide healthcare organizations have used two systems to keep records on medication administration, including paper and an electronic prescribing and medication administration system (ePA). These systems may impact the safety of medication administration in hospitals (Jheeta & Franklin, 2017). Jheeta and Franklin found that the prevalence of medication administration errors was higher with the paper system (4.2%) than with an ePA (3.4%). An example of these results is that the wrong dose could be caused by ambiguous provider handwriting (Gunes, Gurlek, & Sonmez, 2014; Keers et al., 2013; Topcu, Turkmen, Sahiner, Savaser, & Sen, 2017). Medication errors were reviewed in an 18-bed medial ICU of a university hospital and found that 464 out of 808 adverse events were medication errors (57.43%) (Chapuis, Tournegros, & Bedouch, 2019). Even though the majority of healthcare professionals, including nurses, were able to define medication errors correctly and acknowledged the implications of medication errors on patient safety, the greatest number of medication administration errors (64.6%) were made by nurses because nurses give the majority of medications in hospitals and are the last line of defense between medications and patients (Abdel-Latif, 2016; Cheragi, Manoocheri, Mohammadnejad, & Ehsani, 2013). This finding is congruent with reports of medication error incidence types; the most frequently reported errors were administration (68.1%), prescribing (39.5%), and adverse drug reaction (0.6%) (Esque Ruiz et al., 2016). This review presents possible causes of medication administration errors and its consequences that are related to nurses.

Possible factors related to medication administration errors. The factors that may contribute to medication administration errors in hospitals, including nurse personal characteristics and work environment, were examined in both qualitative and quantitative studies worldwide.

Personal characteristics of nurses. The findings on the relationship between nurse age and prevalence of medication administration errors were not consistent. One study found that the age of nurses is related to the frequency of medication administration errors (Bolandianbafghi, Salimi, Rassouli, Faraji, & Sarebanhassanabadi, 2017; Feleke, Mulatu, & Yesmaw, 2015), while other studies found that age was not statistically significantly associated with medication administration errors (Cheragi et al., 2013; Keshk & Abdel-Moneem, 2012; Toruner & Uysal, 2009). Bolandianbafghi et al. (2017) explained that the self-report questionnaires might have been influenced by other factors, such as fear of revealing personal information, overestimated self-assessment, and change in coworkers' behaviors if they have seen the responses. A study recruited 423 nurses working in 24 university hospitals reported that the average number of medication errors was higher in male nurses compared to female nurses (Izadpanah, Nikfar, Imcheh, Amini, & Zargaran, 2018).

An understanding of quality and safety among nurses is also important. Levels of knowledge of pharmacology, the potential harm of each medication, and interactions between medication and food or between different medications when administered together are also important factors to safe medication management (Bjorksten, Bergqvist, Andersen-Karlsson, Benson, & Ulfvarson, 2016; Dilles, Elseviers, Van Rompaey, Van

Bortel, & Stichele, 2011; Patrician & Brosch, 2009; Soltanian, Molazem, Mohammadi, Sharif, & Rakhshan, 2016).

Years of nursing experience were also significantly related to medication administration errors (Feleke et al., 2015; Sheu, Wei, Chen, Yu, & Tang, 2009; Vazin, Zamani, & Hatam, 2014; Westbrook, Rob, Woods, & Parry, 2011). Years of nursing experience is also one of the nurse characteristics that is important to nurses' reaction to their own medical errors (Lewis, Baernholdt, & Hamric, 2013), which could cause nurse burnout because of the devastating "second victim" syndrome where nurses suffer mental anguish following medical errors that cause harm (Scott, 2011). The majority of medication administration errors were committed by nurses who had been working for less than 2 years (Sheu et al., 2009). Furthermore, each additional year of experience, up to six years, was associated with a reduction in the risk of medication administration errors by 10.9%, and of serious errors by 18.5% (Westbrook et al., 2011). Finally, nurse burnout was related to patient safety incidents (Laschinger & Leiter 2006; Van Gerven et al., 2016). However, Halbesleben et al. (2008) found no significant relationship between nurse burnout and adverse event reports. Only a few studies have examined the relationship between nurse burnout and medication administration errors, and there were inconsistent findings among those studies.

Work environment. The nursing practice environment is also related to adverse patient outcomes, including medication errors, patient dissatisfaction, and hospital-acquired pressure injuries (Swiger, Patrician, Miltner, Raju, Breckenridge-Sproat, & Loan, 2017). However, two studies reported inconsistent findings on medication errors and the overall work environment. One found that a better overall work environment had

lower incidences of administering the wrong medicine or dose, whereas another study had no significant findings on this relationship (Cho, Chin, Kim, & Hong, 2016; Flynn, Liang, Dickson, Xie, & Suh, 2012). The work environment was the main theme for a qualitative study describing the causes of medication errors from the perspective of physicians, nurses, and pharmacists (Farzi, Irajpour, Saghaei, & Ravaghi, 2017). The most important underlying reasons for medication administration errors among nurses were heavy workload and insufficient number of staff (Fathi et al., 2017; Lawton, Carruthers, Gardner, Wright, & McEachan, 2012; Vazin et al., 2014; Ulas et al., 2015; You et al., 2015). One possible reason that medication administration errors occurred while nurses had heavy workloads was that double-checking was not performed for every medication administration (Härkänen, Ahonen, Kervinen, Turunen, & Vehviläinen-Julkunen, 2015). A number of total nursing care hours per patient per shift was significantly negatively related to medication administration errors occurring in medical-surgical and critical care units (Patrician, Loan, McCarthy, Fridman, Donaldson, Bingham, & Brosch, 2011). The night shift work schedule was also related to medication administration errors (Zeraatchi, ATalebian, Nejati, & Dashti-Khavidaki, 2013). Yet, other studies reported that the highest frequency of medication administration errors occurred during the day shift (Härkänen et al., 2015; Sheu et al., 2009; Vazin et al., 2014).

Monitoring nursing outcomes could be related to the frequency of medication administration errors as well. Medication error was one of the indicators of the Military Nursing Outcomes Database (MiNOD) that military hospitals used to monitor quality of nursing care. Loan, Patrician, and McCarthy (2011) found that in the long term of using

MilNOD, the medication administration error rate significantly decreased from the baseline to the 10th quarter of data collection in both medication administration errors with and without harm. Also, it was reported in the Patrician et al. (2017) study that safety improvement on nurse-committed medication error rates were decreased over a 20-year period by continuous monitoring.

Consequences of medication administration errors. Medication administration errors received little attention after a Harvard Medical Practice study (Brennan et al., 1991; Leape et al., 1991). However, when the Institute of Medicine reported that preventable medical errors result in between 44,000 and 98,000 deaths annually, medication errors received considerable attention. This report also claimed that medication error in particular result in 7,000 deaths annually. Medication errors are a major burden on healthcare. The consequences of these errors could vary from temporary to permanent patient harms to costs associated with medication error management, prolonged hospital stay, and death (Eshetie et al., 2015; Esque Ruiz et al., 2016; Sheu et al., 2009). Regarding the severity of medication administration errors, Eshetie et al. (2015) reported that 91% of medication administration errors resulted in temporary harms and 9% caused permanent harm or death. Medication errors were the primary cause of hospitalization among children; for example, a child with type 1 diabetes was treated with the wrong insulin injection, resulting in hospitalization with severe hypoglycemia (Eshetie et al., 2015). The most cases of permanent harm were due to administration of the wrong drug.

In a Sheu et al. (2009) study, RNs in random units were surveyed and interviewed about medication administration errors and their adverse effects. The findings showed that out of a total of 259 actual errors, 84% of medication errors caused no harm to patients, 16% of patients experienced different levels of adverse effects: seven percent experienced mild effects (e.g. temporary change of vital sign or blood sugar levels, or an allergic reaction), five percent experienced severe effects (e.g. required cardiopulmonary resuscitation, or transfer to ICUs), two percent resulted in a coma, and two percent with death (Sheu et al., 2009).

Medication errors not only harmed the patients, but also resulted in harm to nurses. One report of nurses from two hospitals (an academic medical center and a community hospital) in the southeastern U.S. proposed that there were relationships between RN involvements in preventable adverse events and two domains of burnout (emotional exhaustion and depersonalization) (Lewis, Baernholdt, Yan, & Guterbock, 2015). Nurses also have committed suicide due to medication administration errors (Aleccia, 2011) because of the extreme guilt of harming a patient, referred to as second victim syndrome.

Summary of Review of the Literature

The purpose of this literature review of both quantitative and qualitative studies is to identify the scope and context of professional nurse burnout and medication administration errors in nursing and their relationships. Possible factors related to nurse burnout are personal characteristics, and work environment and job characteristics such as a better work environment is related to lower nurse burnout. The results revealed clearly that professional burnout among nurses impacts the following nurse outcomes:

physical and mental illness, job dissatisfaction and intention to leave the nursing job; and organizational outcomes including organizational commitment and turnover; as well as patient outcomes in terms of patient safety, such as adverse events. Medication administration errors are an indicator of patient safety that has received considerable attention from healthcare organizations and healthcare professionals. The consequences of these errors could vary from temporary to permanent harms to costs associated with medication error management, prolonged hospital stay, and death. Also, these errors could affect nurses in the form of second victim syndrome.

Little evidence of the relationship between nurse burnout and medication administration errors exists, and those findings are inconsistent. Therefore, the purpose of the study is to examine the relationship between nurse burnout and medication administration errors among nurses who work in Alabama acute care hospitals.

Theoretical Framework

Although we can pinpoint that nurses suffer high levels of burnout worldwide, few studies have examined a unified theory/model that explains the etiology, progression, and consequences of nurse burnout. Several existing models may explain the relationship between burnout and nurse and patient outcomes. The Neuman Systems Model explains the relationship between nurse burnout and coping skills (Neuman, 1990; Hansen, 2000; Pilkington, 2009) by focusing on the wellness of nurses in relation to environmental stress and reaction to burnout. Another theory that has guided research in examining nursing worklife factors, burnout, and nurse and patient outcomes is the Nursing Worklife Model (Laschinger & Leiter 2006). Five worklife factors included in the model

are effective leadership, staff participation, adequate staffing, support resources and nurse-physician relationship (Laschinger & Leiter 2006). Yet, neither of these models explains other factors that may contribute to nurse burnout, such as nurse age, nor do they explore the patient safety consequences of burnout, such as medication administration errors.

The Original Conservation of Resources (COR) Theory

The COR theory was generated by Hobfoll (1989) to explain the nature of stress and to fill the niche between one's physical and social environmental demands and his or her perception of deriving value from and meeting those demands. The basis of the COR theory is that people strive to obtain, maintain and create resources that they value (Hobfall, 1989). In other words, resources in the COR theory are linked to the process of creating or maintaining survival and well-being. The original COR theory is shown in Figure 1. Figure 2 shows the COR theory adapted to nurse burnout and medication administration errors, which will be discussed later in this section.

Stress in the COR theory is defined as a person's reaction to the environment under three conditions, called "threats:" 1) when resources are threatened with loss; 2) when resources are actually lost; and 3) when the individual lacks the ability to gain resources following investment of personal resources (e.g., time and knowledge) (Hobfoll, 1989). As such, stress could result when any of the four types of resources is threatened. These resources are objects, personal characteristics, conditions, and energies (Hobfoll, 1989). *Objects* are resources that have physical presence, such as shelter and clothing, which may be linked to socioeconomic status. *Condition* resources are valued as structures or states, such as social relationships, status at work, work environment, and

good health. This kind of resource influences one's decision to stay at a particular job or to leave. *Personal* characteristic resources are individual traits, characteristics, and coping skills. Social support, including family or co-worker support, can increase or reduce this sense of self. *Energy* resources are valued skills and abilities that can be exchanged for other resources, including time, money and knowledge (Alvaro et al., 2010; Hobfoll, 1989,).

The Conservation of Resources Theory (COR) in nurse burnout

The COR theory can explain the nature of burnout because burnout describes workers who experience work-related mental stress in people-oriented occupations such as human services, health care, and education (Freudenberger, 1974; Hobfoll & Freedy, 1993; Maslach & Goldberg, 1998). Hobfoll and Freedy (1993) explained burnout as physical exhaustion from an excessive workload that is likely to make workers feel overwhelmed and unable to meet their work-related goals because a heavy workload decreases time to consider how to mobilize resources, and the complexity of problems can be beyond intellectual and organizational resources. For example, nurses invest energy rescores (time and their nursing knowledge) to gain some object resources (e.g., money, shelter, and clothing) and condition resources such as building relationships with co-workers or interprofessional workers. Therefore, the COR theory (Prapanjaroensin, Patrician, & Vance, 2017) has been adapted to guide the study on the relationship between nurse burnout and patient safety including medication administration errors.

Nurses' goals are to provide quality patient care and maintain patient safety (Mitchell, 2008). Therefore, anything that could help nurses achieve their goals are resources. According to the COR theory, a persistent threat to valued resources

culminates in burnout (Hobfoll, 1989), and threats to these resources could also be connected to job performance (Alvaro et al., 2010; Hobfoll, 1989), which in turn can affect patient safety. Based on the literature, Figure 2 was created to demonstrate the relationships among these four resources with threats to these resources, nurse burnout, nurse performance and medication administration errors and patient safety grade. However, object resources are not included in the study. Also, the resource of energy is not measured because the energy resource aids in the acquisition of other kinds of resources, and this study does not aim to identify the resources that reduce nurse burnout. Figure 3 shows all variables that are included in this study. The two resources of the COR theory (Table 3 and Figure 3) that are included in this study are conditions and personal characteristics (these will be explained for each variable in each resource later in this section), which may lead to nurse burnout if these resources are threatened by either perceived or actual loss of resources or by inability to gain such resources. Nurse burnout is known to be a type of psychological stress, which may result in reduced efficacy in performance in the workplace (DeLucia et al., 2015). Furthermore, Alvaro et al. (2010) suggested that the COR theory links personal resources to performance in health systems. The physical and mental health of nurses, including the presence of burnout, may affect work performance, which in turn may lead to a decrease in both alertness and overall quality of care (Schalk et al., 2010, Barker & Nussbaum, 2011).

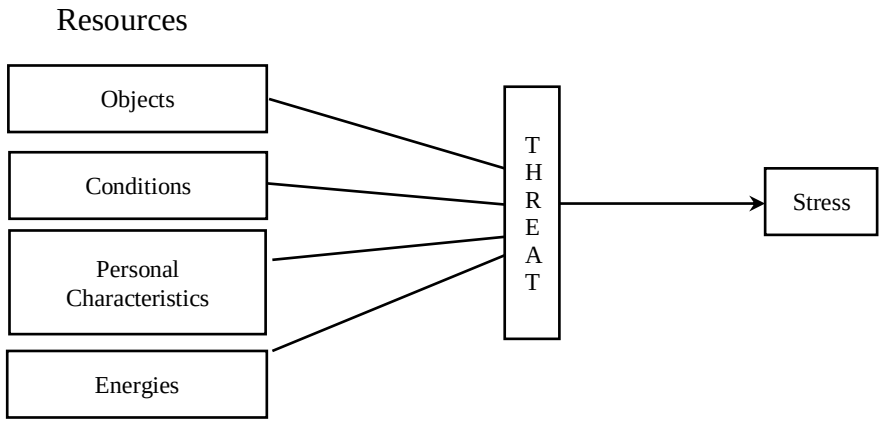

Figure 1. Original Framework of the Conservation of Resources

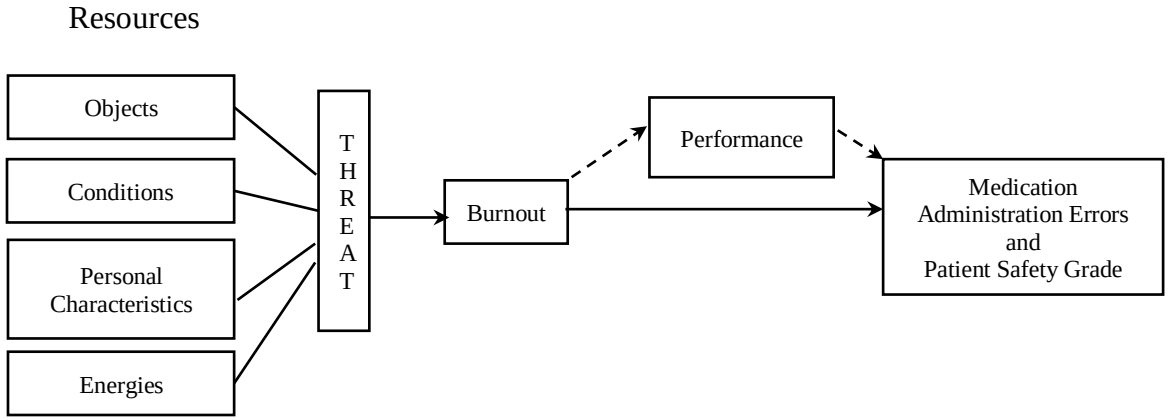

Figure 2. Theoretical Framework of the Conservation of Resources for Professional Burnout among Nurses and Medication Administration Errors

Table 3

Two Types of Resources that are Included in This Study of Nurse Burnout

Types of Resources	Variables
Condition	- Work environment
Personal Characteristics	- Age
	- Gender
	- Race
	- Marital status
	- Years of nursing experience
	- Years in current hospital

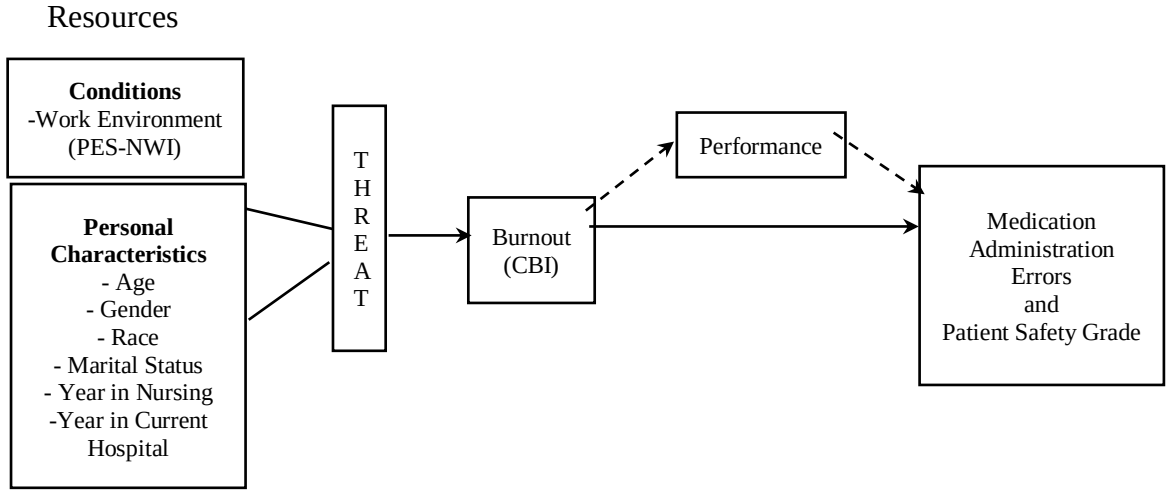

Figure 3. Applied Theoretical Framework of the Conservation of Resources for Professional Burnout among Nurses and Medication Administration Errors

Condition resources and nurse burnout. Staffing and the nursing work environment are condition resources that may contribute to feelings of accomplishment at work (Hobfoll, 1989). A favorable work environment (e.g., Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, Collegial Nurse-Physician Relations) was associated with better patient and nurse outcomes, including low nurse burnout levels, in 9 countries around the world (Aiken et al., 2011; Hanrahan, Aiken, McClaine, & Hanlon, 2010; Zhou et al., 2015). Social support from supervisors and co-workers are personal characteristic resources that are important factors for reducing burnout levels among both hospice nurses and midwives in Poland (Kalicinska et al., 2012). Based on this evidence, it is clear that work environment and social supports are important resources, and if these resources are threatened by inadequate social support, nurses may develop burnout. Furthermore, social support from family, friends, and the workplace is an important predictor of nurse burnout (Gunusen, Wilson, & Aksoy, 2017; Khamisa, Peltzer, Ilic, & Oldenburg, 2016; Orgambidez-Ramos, Borrego-Ales, Vazquez-Aguado, & March-Amegual, 2017; Vander Elst et al., 2016; Wu, Singh-Carlson, Odell, Reynolds, & Su, 2016). Nurses seem to have lower burnout levels in favorable work environments, which are characterized by good social relationships with patients and physicians (Nantsupawat et al., 2017; Schwarzkopf et al., 2017; Viotti, Gilardi, Guglielmetti, & Converso, 2015). Two studies have confirmed that both physical and verbal violence in the workplace by patients were significantly and positively related to nurse burnout levels (Bernaldo-De-Quiros et al., 2015; Viotti et al., 2015). Poor physician-nurse collaboration was related to high burnout levels in both physicians and

nurses (Schwarzkopf et al., 2017). A more extensive explanation regarding the relationship between work environment and nurse burnout was discussed earlier in this section.

Personal characteristic resources and nurse burnout. Gender, age, marital status, and work experience in nursing are significant personal characteristic resources that affect burnout in the nursing profession (Cañadas-De la Fuente et al., 2015; Henriksen, & Lukasse, 2016; Karakoc et al., 2016; Padilla Fortunatti & Palmeiro-Silva, 2017). According to prior explanation in this section, the studies of the relationship between nurse burnout and age and gender provide conflicting results. So, all variables of personal characteristics included as possible predictors of nurse burnout.

Nurse burnout, performance, and medication administration errors and patient safety grade. Alvaro et al. (2010) suggested that the Conservation of Resources theory links personal resources to performance in health systems. The physical and mental health of nurses, including the presence of burnout, may affect work performance, and this may lead to a decrease in both alertness and overall quality of care (Barker & Nussbaum, 2011; Schalk et al., 2010). DeLucia et al. (2009) noted that reduced nurse alertness may precede serious medication errors. Aiken, Sloane, Barnes, Cimiotti, Jarrín, and McHugh (2018) also found that hospitals with lower nurse burnout, nurses reported better patient safety (number of hospitals = 353).

Not only do the brains of individuals suffering from burnout function differently, but they also exhibit structural changes compared to a healthy person (Savic, 2015). The major psychological response pathway to stress and burnout involve the autonomic nervous system and hypothalamic-pituitary-adrenal (HPA) axis (Ulrich-Lai & Herman,

2009). Jovanovic, Perski, Berglund, and Savic (2011) found that patients with stress and burnout symptoms had significant reductions in the 5-HT_{1A} receptor binding in three limbic structures: the hippocampus, the anterior cingulate cortex (ACC), and the anterior insular cortex. To confirm the effects of burnout on human brain, the magnetic resonance imaging (MRI) based voxel-based morphometry and structural volumetry were measured in long-term occupationally stressed and unstressed subjects. The results show that stressed subjects presented significant reductions in the gray matter (GM) volume of the anterior cingulate cortex and the dorsolateral prefrontal cortex (Blix, Perski, Berglund, & Savic, 2013). In a more recent study on the subject of burnout, results showed a significant thinning of the mesial frontal cortex, bilaterally increased amygdala volumes, and reduced caudate volumes, accompanied by impaired fine motor function (Savic, 2015). Furthermore, burnout in both clinical and non-clinical subjects had a lower cortisol awakening response: up to 30 minutes after awakening, in contrast to the healthy control group, which could link with a stress-related preparation with regard to the upcoming day by the hippocampus (Oosterholt, Maes, Van der Linden, Verbraak, & Kompier, 2015).

Not only does burnout change the brain's structure, it also disrupts cognitive functions which could lead to inadequate nurse performance. Burnout has been found to be related to a decrease in three main cognitive functions, including executive functions, attention, and memory (Castaneda et al., 2011; Diestel, Cosmar, & Schmidt, 2013; McInerney, Rowan, & Lawlor, 2012; Morgan et al., 2011; Oosterholt, Van der Linden, Maes, Verbraak, & Kompier, 2012; Sandström, Rhodin, Lundberg, Olsson, & Nyberg, 2005). Executive functions are interpreted as general-purpose control mechanisms that

operate various cognitive subprocesses (Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000). An important component underlying the cognitive functions related to job performance seem to be the working memory system. Working memory refers to the part of short-term memory that is concerned with the immediate conscious perceptual and linguistic process, which is the key component for reasoning and the guidance of decision-making and behaviors for complex tasks (Baddeley, 2000). These results are surprising, given the fact that impaired cognitive functions could be one of the mediating factors that establish the relationship between burnout and reduced job performance (Deligkaris et al., 2014), particularly in the nursing profession.

Approximately 460 nurses in 90 units in Taiwan were surveyed to investigate how the interaction of time pressure and burnout had an impact on patient safety. Teng et al. (2010) reported that time pressure is not related to patient safety; however, the interaction between time pressure and nurse burnout levels have a significant impact on patient safety. Aiken and colleagues (2018) found that nurses who reported better scores on burnout (MBI) reported better patient safety grade over time (2005 to 2016). Furthermore, nurse burnout could influence error recognition. For example, a higher workload causes higher levels of nurse burnout and leaves nurses little opportunity to monitor whether or not their patients are receiving their medication in the appropriate dosages and at the appropriate times (Wakefield et al., 2005).

To find the relationships of work and practice environment to professional burnout, Laschinger and Leiter (2006) surveyed 8,597 Canadian nurses on measures of work environment, burnout, and frequency of adverse patient events. The nursing work environment was defined as characteristics of the workplace that enable professional

nursing practice (i.e., Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, Collegial Nurse-Physician Relations; Lake, 2002). The results revealed that burnout mediated the relationship between work environment and adverse events. In contrast to these results, a study conducted with 148 nurses in a hospital in the US found no relationship between burnout and patient adverse events (Halbesleben et al., 2008). The low sample size may be related to these conflicting results.

In summary, the COR theory guides this study by examining whether condition resources (work environment [using the five subscales of the Practice Environment Scale of the Nursing Work Index], and personal characteristic resources [gender, age, race, marital status, years of work experience in nursing, and years in current hospital] are related to nurse burnout [Copenhagen Burnout Inventory], which leads to medication administration errors and patient safety grade [subscales of Hospital Survey on Patient Safety Culture]) (Figure 3).

Summary

In the nursing profession, the main goals of nursing care are surveillance and action when adverse events occur. The quality of patient care, patient safety, and medication administration errors may be impacted if nurses are experiencing poor physical or mental health. Burnout is an issue of concern for healthcare workers, especially nurses, because the caregiving relationship between nurses and patients involves significant emotional output. Approximately 30% to 60% of nurses self-reported high levels of burnout in many countries. Furthermore, burnout has become an important concern for health care organizations because of its negative impact on workforce

turnover and job performance among nurses. A growing body of research has focused on the link between burnout and these effects, yet studies on nurse burnout and medication administration errors are sparse and have conflicting results.

Examining the relationships between burnout among nursing staff and medication administration errors and patient safety grade are the first step toward finding strategies to reduce burnout among nurses and thus improve patient safety in health care. To achieve this goal, the Conservation of Resources theoretical framework was used to guide the study. In the next chapter, more details on strategies that were used in the study, including sampling, informed consent, data collection, reliability and validity of study, as well as the data analysis plan, will be discussed.

CHAPTER 3

METHODS

The purpose of this chapter is to describe the methods for conducting this study. Included are the following: the sampling method, including inclusion and exclusion criteria and recruitment plan; the plan for obtaining informed consent; detailed procedures for data collection; the reliability and validity of the instruments; and the data analysis plan. This study is a secondary analysis, so the parent study will be explained in each section prior to explaining the study. The introduction to the study, including specific aims, hypotheses, and research design, is provided below to introduce the methodological aspects.

Research Design

A correlational design using a cross-sectional survey was used to investigate the association between nurse burnout and medication administration errors. This design seeks to examine variables in their natural environment and does not include any intervention. In this particular study, the variation in nurse burnout levels were examined for their relationship with the corresponding variation in medication errors. A non-experimental or correlational design is appropriate for this type of study. Furthermore, a cross-sectional design is also appropriate for this research question because two concepts, e.g., nurse burnout levels and medication errors, can be measured at the same time, using the same sample.

Research Methods

This study is a secondary data analysis using data that has been collected for a larger study entitled, "The Alabama Hospital Staff Nurse Study." The parent study collected standardized information on several nursing indicators and patient outcomes. The strategies that the parent study used are discussed in each section before the discussion of the strategies for the study.

Setting and Sample.

Parent study. Staff RNs in Alabama acute care hospitals were recruited in the study. The sampling approach was designed to gather complete data from a statewide sample of hospital nurses. A mailing list of all RNs from the Alabama State Board of Nursing had been obtained for the study (N = 71,487 nurses); however, some mailing addresses were not located in Alabama, and those were excluded from the parent study. There are approximately 122 eligible Alabama hospitals and 58,997 eligible Alabama nurses. All of those nurses received a postcard in July 2018, introducing the study to them. According to 2016 statistics of the nurse workforce in Alabama, 49% of RNs were hospital staff nurses (Davis, 2017). This number is used to calculate the estimated number of staff nurses for this study ([49x58,000]/ 100, n=28,420). We anticipated a response rate of 20% ([20x28,420]/100, n=5,684) based on other similar statewide surveys of RNs (Aiken et al., 2008). This sampling strategy was expected to provide a representative sample of nurses from small, medium, large, urban, and rural hospitals.

This study. Of the nurses who responded in the parent study, those who were included in the study met the following qualifications: 1) staff nurses, 2) working full time (≥ 36 hours/week), and 3) working on inpatient units. Nurses were excluded from

the study if they worked part time because these nurses will have less likelihood of exposure to burnout since burnout is a state of physical and mental exhaustion from work. The expected sample size was calculated using G*Power software (Faul, Erdfelder, Buchner, & Lang, 2009) with an α error probability of 0.05, a power (1-β error probability) of 0.95, a number of predictors of nine (from A 3), and different levels of effect sizes based on Cohen's f^2 (Cohen, 1988) (Table 4). A total of 928 nurses were included in this study which falls in small level of effect size.

Table 4

Sample Size Estimates by Different Levels of Effect Sizes

Levels of Effect sizes	Effect size based on Cohen's f^2	Sample Size Estimate
Small	0.02	1,188
Medium	0.15	166
Large	0.35	77

Informed Consent.

Parent study. All 58,000 Alabama RNs were sent a postcard to introduce the study and a web link and QR code to access the electronic survey. Each addressee had a code number assigned to them, which was used to log into the survey. The listing of codes and addresses were kept by the survey administrator in a secure manner. The electronic survey contained a cover letter explaining the purposes of the study, ensuring confidentiality, and assuring the voluntary nature of participation. The cover letter also advised the nurses that refusal to participate in the study would in no way jeopardize their employment status. The cover letter stated that returning the completed survey implied consent to participate. The cover letter is attached in Appendix A. The parent study was approved as exempt human subjects research by the University of Alabama at

Birmingham Institutional Review Board ((IRB; IRB #300000916). The UAB IRB letter of approval is attached in Appendix B.

This study. The data that were obtained did not include any identifying information of the participants.

Data Collection

Parent study. RNs received the postcard with identification code and web-link to access the survey in July 2018. Nurses could choose to respond at any time after reading the postcard. The total amount of time that each participant needed in order to respond to the survey was 25-30 minutes.

This study. The secondary data set was obtained by permission of the Principal Investigator of the parent study and the IRB. The secondary data that was requested included individual characteristics, the Practice Environment Scale of the Nursing Work Index, the Copenhagen Burnout Inventory, and medication administration error and patient safety grade items.

Reliability and Validity of Proposed Instruments

The requested secondary data set contained the following survey items: demographic characteristics, work environment from PES-NWI, burnout from CBI, and medication administration error items from the Hospital Survey on Patient Safety Culture. Demographic characteristics included gender, age, marital status, race, years in current hospital and years of nursing experience. The operational definitions of each variable are shown in Table 5.

Table 5

Operational Definitions, Types and Levels of Each Variable

Variable	Definition	Type and levels of measurement
Demographic		
Age	The length of time that a person has lived	year
Gender	The state of being male or female	Categorical 3 level
Marital status	A person's state of being single or married	Categorical 3 level
Years of experience	The number of years that a person has worked as a nurse	Year
Years in Hospital	The length of time that a nurse has worked in the current hospital when they responded to the survey	Year
Race	The state of belonging to a social group that has a common national or cultural tradition	Categorical 3 levels
The Copenhagen Burnout Inventory (CBI) subscale		
Personal Burnout	The degree of physical and psychological fatigue and exhaustion experienced by the person	Categorical 5 levels
Client-related Burnout	The degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work with clients	Categorical 5 levels
Work-related Burnout	The degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work	Categorical 5 levels
The Practice Environment Scale of the Nursing Work Index (PES-NWI) subscale		
Nurse Participation in Hospital Affairs	The reflective of nurse involvement in forming the hospital-wide care environment	Categorical 4 levels

Variable	Definition	Type and levels of measurement
Nursing Foundations for Quality of Care	The reflective of the hospital-wide structural support of nursing	Categorical 4 levels
Nurse Manager Ability, Leadership and Support of Nurses	The abilities of the nurse manager to lead the unit, manage, and support nursing staff	Categorical 4 levels
Staffing and Resource Adequacy	The adequacy of staff and resources to support the services to do the job	Categorical 4 levels
Collegial Nurse-Physician Relations	The working relationships between physicians and nurses on the unit	Categorical 4 levels
Composite Score	The mathematically derived average of the PES-NWI subscales. Using an average prevents the weighting of subscales that contain more items than others	Continuous
Hospital Survey on Patient Safety Culture		
Patient Safety Grade	The degree of avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery	Categorical 5 levels
Medication Administration Errors	"Any difference between what the patient received or was supposed to receive and what the prescriber intended in the original order"	Continuous

Self-report. The main measurements that were used in this study are the Copenhagen Burnout Inventory (CBI), the Practice Environment Scale of the Nursing Work Index (PES-NWI), and items from the Hospital Survey on Patient Safety Culture. All the above are self-report instruments. The main concerns of using self-report instruments are their validity and reliability. The details of the advantages and disadvantages of self-reporting are shown in Table 6. However, the validity and reliability for each measurement have been tested with more than acceptable scores.

Table 6

Advantages and Disadvantages of Self-Report for This Particular Study

Advantages	Disadvantages
- Directly get nurses' opinions (good validity)	- Fixed choice questions (lack flexibility) and could force nurse to answer (low validity); for example, there are only two choices for gender: male and female, so those who are transsexual should select their birth gender
- Can be collected quickly from a large sample. A total of 58,000 postcards were sent to nurses	- Social desirability bias. We might not get the actual numbers of medication errors because nurses may feel uncomfortable reporting them. The top reasons for not reporting were fear of manager and peer reaction, fear of adverse consequences for reporting errors, and blame (Patrician & Brosch, 2009)
- Can be easily replicated; for example, we can use the same survey as other states in order to compare the data such as burnout scores and medication errors	- Acquiescence (saying yes more than no or just agreeing). For example, the PES-NWI has four subscales: a nurse could respond to all questions as "strongly agree" to get impression-management interpretation in her work environment
- Closed questions are quantifiable (easy to present findings in tables or figures). All questions in demographics section, CBI, PES-NWI, and medication errors are choices or numbers. Therefore, the findings could be presented in graphs, diagrams, and tables.	- Questions may be misunderstood (low reliability). In sending out the survey, nurses could have questions on some items, but there was no researcher physically present to answer those questions. However, nurses can send emails to the PI to clarify all questions.
	- Low response rate. After calculating approximate percentages of staff nurses and response rates, the number of responses could be 5,864 nurses with a total of 58,997 nurses that received postcards.

Copenhagen Burnout Inventory. Burnout was measured by the Copenhagen Burnout Inventory (CBI). Burnout is a state of physical, emotional, and mental fatigue and exhaustion that results from long-term involvement in work situations that are emotionally demanding (Kristensen et al., 2005). The CBI has three dimensions (i.e., Personal, Work-related, and Client-related burnout) with 19 items. Personal burnout is defined as "the degree of physical and psychological fatigue and exhaustion experienced by the person" (p. 197). Work-related burnout is defined as "the degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work" (p. 197). Client-related burnout is defined as "the degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work with clients" (Kristensen et al., 2005, p. 197).

The CBI was established to measure burnout levels among employees in the human services sectors. The CBI was tested for validity and reliability in a 5-year prospective intervention study with 1,914 participants from seven different types of workplaces, including a state psychiatric prison, a social welfare office, a country somatic hospital, a psychiatric ward, an institution for the severely disabled, a homecare service in the capitol, and a homecare service in a provincial town with several types of human service professionals, such as social workers, social care workers, midwives, hospital physicians, nurses, and assistant nurses (Borritz, Rugulies, Bjorner, Villadsen, Mikkelsen, & Kristensen, 2006). The findings show very high internal consistency reliability for each subscale as indicated in Table 7.

Table 7

Cronbach's Alpha for Each Subscale of the CBI

Subscale	Survey item	Cronbach's alpha
1) Personal burnout	1, 2, 3, 4, 5, 6	0.87
2) Work-related burnout	7, 8, 9, 10, 13, 14, 15	0.87
3) Client-related burnout	11, 12, 16, 17, 18, 19	0.75

The CBI scores demonstrate predictive validity by inversely correlating with job satisfaction, job insecurity, role conflicts, quality of leadership, emotional demands, sickness days, sickness spells, sleep problems, use of pain-killers, and intention to quit the job. The CBI scores were negatively correlated to job satisfaction (r = -0.51), quality of leadership (r = -0.35), commitment at the workplace (r = -0.27), and social support (r = -0.20) (Borritz et al., 2006). Each subscale in the CBI was negatively related to vitality (r = -.46 to -.75), mental health (r = -.39 to -.67), and general health (r = -.34 to -.49) (Kristensen et al., 2005). However, the CBI scores were positively related to emotional demands (r = 0.42), and role conflicts (r = 0.44) (Borritz et al., 2006).

Examples of CBI questions are "How often do you feel weak and susceptible to illness?" "Do you feel that every working hour is tiring for you?" "Do you find it hard to work with clients?" and "Are you tired of working with clients?" The items are scored using a 5-point Likert scale that varies with the specific questions. For example, the first three items of the work-related burnout subscale are scored from 1 = very low degree, 2 = low degree, 3 = somewhat high degree, 4 = high degree, to 5= very high degree. Whereas the last four items of the work-related burnout subscale are scored as 1 = never/almost never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = always. The response

items are recoded into scores of 100, 75, 50, 25, and 0 from always = 100 to never = 0. The items within a subscale are then averaged. Lower scores indicate a lower degree of burnout. The possible range for all subscales is 0-100 (Kristensen et al., 2005). In one study, researchers chose a cutoff score of 50 or higher to indicate burnout as a dichotomous variable (Henriksen & Lukasse, 2016), while in another study, researchers chose 25 or lower, 25 to 50, and higher than 50 to categorize low, medium, and high burnout (Madsen, Lange, Borritz, & Rugulies, 2015).

The Practice Environment Scale of the Nursing Work Index (PES-NWI). The PES-NWI is a 31-item measurement to assess the nursing practice environment, and includes 5 subscales as follows: 1) Nurse Participation in Hospital Affairs; 2) Nursing Foundations for Quality of Care; 3) Nurse Managers, Ability, Leadership, and Support of Nurses; 4) Staffing and Resource Adequacy; and 5) Collegial Nurse-physician Relations. The advantages of the PES-NWI are as follows: 1) it has been modified for ten practice settings in five countries and translated into three languages; 2) it has been tested and found valid and reliable on both individual levels (Kutney-Lee, Lake, & Aiken, 2009; Lashinger & Leiter, 2006) and unit levels (Gabriel, Erickson, Moran, Diefendorff, & Bromley, 2013); and 3) significant associations have been reported with regard to nurses, patients, units, and organizational outcomes (Warshawsky, & Havens, 2011).

Principal component analysis (PCA) was conducted among nurses to examine the construct validity of the PES-NWI. The PCA showed all five subscales with eigenvalues exceeding 1, explaining thirty-nice percent, five percent, five percent, four percent, and four percent of the variance, respectively, and explaining 58% of the total variance. Generations of the scree plot, by using an SPSS version 14.0, suggested a five-factor

solution. For reliability, the PES-NWI presented excellent internal consistency reliability with a Cronbach's alpha coefficient of 0.95 overall. For each subscale, the Cronbach's alphas were all above > 0.7 (Table 8) (Parker, Tuckett, Eley, & Hegney, 2010).

Researchers who measured the pre- and post-intervention PES-NWI suggested that it might be susceptible to change over time, but only one study has been done with a longitudinal design (Gardner, Woollett, Daly, & Richardson, 2009). Also, the scoring and reporting of the PES-NWI has been done in a variety of forms, including the use of composite scores, subscale scores, favorability scores, and individual items scores (Warshawsky, & Havens, 2011).

Table 8

Cronbach's Alpha for Each Subscale of the PES-NWI

Subscale	Survey item	Cronbach's alpha
1) Nurse Participation in Hospital Affairs	5, 6, 11, 15, 17, 21, 23, 27, 28	0.89
2) Nursing Foundations for Quality of Care	4, 14, 18, 19 ,22 ,25, 26, 29, 30, 31	0.81
3) Nurse Manager, Ability, Leadership, and Support of Nurses	3, 7, 10, 13, 20	0.71
4) Staffing and Resource Adequacy	1, 8, 9, 12	0.77
5) Collegial Nurse-physician Relations	2, 16, 24	0.85

The PES-NWI is the continuous variable by which all subscales are averaged. Mean for each subscale is calculated as well. The practice environment is classified as favorable if four or five subscale mean scores are greater than 2.5, mixed if two or three subscale means are greater than 2.5, and unfavorable if none or one of the five subscales achieves a mean score of 2.5 (Lake and Friese, 2006).

Hospital Survey on Patient Safety Culture. A medication administration error is defined as any difference between what the patient received or was supposed to receive and what the prescriber intended in the original order (Keers, Williams, Cooke, &

Ashcroft, 2013). The Hospital Survey on Patient Safety Culture is a questionnaire that groups items by safety dimensions, such as teamwork within units, supervisor/manager expectations, actions promoting patient safety, organizational learning/continuous improvement, management support for patient safety, overall perceptions of patient safety, feedback and communication about errors, communication openness, frequency of events reported, teamwork across units, staffing, handoffs and transitions, nonpunitive response to errors, patient safety grade, and number of events reported (Sorra et al., 2016). Items from a section in the original Survey of Hospital Survey on Patient Safety Culture were adapted for use in the study. These items included the patient safety grade (Section E) which indicated as "Please give your work area/unit in this hospital an overall grade on patient safety," and reported in five Likert scale (failing =1, poor = 2, acceptable =3, very good = 4, and excellent =5) (Sorra et al., 2016). Also, the self-report of the number of medication administration errors occurring on a person's unit is included in the questionnaire. These items are in Appendix B.

The Hospital Survey on Patient Safety Culture was developed by researchers at Westat under an Agency for Healthcare Research and Quality (AHRQ) contract. The survey was pilot tested in 2003 in 21 hospitals in six states in the U.S. A total of 1,437 participant responses in the pilot study were analyzed by examining item response variability, reliability, and both exploratory and confirmatory individual-level factor structures of the safety dimensions (Sorra & Nieva, 2004). Based on findings from the pilot study, some items were dropped, resulting in internal consistency reliability ranging from 0.63 to 0.84. In November 2004, the survey was finalized and made publicly available by AHRQ (Sorra & Nieva, 2004). In 2009, a total of 454 healthcare staff

participated in a study on examining the psychometric analyses of AHRQ's Hospital Survey on Patient Safety Culture (Blegen, Gearhart, O'brien, Sehgal, & Alldredge, 2009).

In 2010, the multilevel psychometric properties section of the survey was conducted in 331 U.S. hospitals with 2,267 hospital units and 50,513 participants (Sorra & Dyer, 2010). The Cronbach's alpha reliability for the composite items ranged from 0.62 to 0.85, with an average of 0.77 (Sorra, & Dyer, 2010). Two interesting composites that the study used are the frequency of event reporting (Cronbach's alpha reliability = 0.85) and overall perceptions of patient safety (Cronbach's alpha reliability = 0.74). These two composites had an acceptable reliability factor (0.70 or greater) (Sorra, & Dyer, 2010).

Sorra and Dyer (2010) also reported multilevel psychometric properties of the survey. The findings show that the item intraclass correlation coefficient (ICC) for the unit levels were all above the 0.05 or 5% criterion (average ICC of .10, ranging from 0.06 to 0.23), which indicates that between 6% and 23% of the variance in individual responses to the items could be attributed to unit membership, while the ICC for the hospital levels fell below the 5% criterion (average ICC of .05, ranging from 0.02 to 0.10), which indicates that between 2% and 10% of the variance in individual responses to the items could be attributed to hospital membership (Sorra & Dyer, 2010. Furthermore, multilevel confirmatory factor analysis reports were obtained at both unit and hospital levels. At the unit level, the between-unit factor loadings ranged from 0.54 to 1.00, whereas the within-unit factor loadings ranged from 0.40 to 0.93. At the hospital level, the between-hospital factor loadings ranged from 0.60 to 1.00, and the within-hospital factor loadings ranged from 0.36 to 0.93 (Sorra & Dyer, 2010).

Data Analysis Plan

Data were systematically entered into Microsoft Excel, and analyses were performed using SPSS version 25.0 (IBM Corp, 2017) and R statistical software (R Core Team, 2014). Data cleaning was performed prior to the data analysis. Listwise deletion was employed to address the missing data points. Outliers were identified by creating boxplots and histograms for every item. There were no outliers for any of the continuous data, nor the categorical data in this sample. The Shairo-Wilk tests and histograms were used to check for the normality of the variables (Field, Miles, & Field, 2012). To detect any problems with multicollinearity, generalized variance inflation factor (GVIF) analysis was applied for each continuous variable using R studio with the CAR package. If there are p coefficients in a predictor, then $GVIF^{1/2(p)}$ is a measure of the decrease in the precision of estimation due to collinearity- analogous to taking the square root of the usual VIF (for one coefficient). When p =1 (the predictor has only one coefficient), the GVIF reduces to the usual VIF (Fox, & Weisberg, 2018). If in a model each $GVIF^{1/2(p)}$ is below 1.58 [equivalent to a Tolerance statistic > 0.4 for single-coefficient predictors (Tolerance = $1-R^2$ of a predictor regressed on the others; VIF = 1/Tolerance)], there would not be indication of strong multicollinearity among predictors. If two predictors were highly correlated ($GVIF^{1/2(p)} > 1.58$), the solutions considered were either dropping a predictor, or combing or transforming the predictors (Weisberg, 2005). For example, if years in current hospital and years of experience in nursing are highly correlated, years of nursing experience was dropped from the model.

The psychometric properties in the PES-NWI and CBI instruments were evaluated for reliability and validity. For reliability, stability was tested by calculating the intraclass correlation coefficient (ICC), and internal consistency was tested by calculating Cronbach's alpha. For validity, convergent validity was tested by analyzing correlation tests between PES-NWI and CBI, and between CBI and medication administration error items (Souza, Alexandre, & Guirardello, 2017). Confirmatory factor analysis (CFA) tests were performed for PES-NWI and CBI. CFA requires the tested instrument to have a prior exploratory factor analysis (EFA), of the number of factors that exist in the data (Brown, 2014). The 'psych' and 'lavaan' packages in R were used (Revelle, & Revelle, 2019; Rosseel, 2018).

To obtain sample information, descriptive statistics were conducted, and mean, standard deviation, and range for continuous variables, as well as frequency and percentages for categorical variables were reported for the demographic variables (Table 10).

The data analysis steps are as follows (Daniel, & Cross, 1995):

1) State hypothesis and identify the claim. This study is based on three main specific aims which are clarified below.
2) Compute the test value. Tests that were performed were correlation (Pearson), two sample comparisons (T-test), ANOVA, multiple regression, and multilevel modeling.
3) Find the p-value for each test.
4) Make the decision of statistical significance. Two tailed analysis with $p < .05$ was used as the cutoff for statistical significance. However, the effect size for each

analysis was also part of making a decision. A medium to large effect size is preferable.

The statistical tests that were conducted to address the specific aims are as follows:

Specific Aim 1: To describe burnout levels among Alabama nurses overall, by hospitals, regions, locations, and hospital sizes.

Statistical Test: To address Specific Aim 1, descriptive statistics were performed, including means, medians, and other measures of centrality as well as variability (standard deviations). Also, one-way Analysis of Variance (ANOVA) tests were performed to compare burnout by hospitals, regions, and hospital size, an independent samples t-test was performed to compare burnout score by rural versus urban. Eta^2 and Cohen's *d* were performed to obtain effect sizes. SPSS version 25.0 was used (IBM Corp, 2017).

Once the data set was prepared, the burnout items were re-coded to the original format labels of 100 (always), 75, 50, 25, and 0 (never/almost never), and then were summed. Higher scores indicate a greater degree of burnout. If fewer than three questions on personal-related burnout and client-related burnout were answered, the response was classified as a non-responder. If fewer than four questions on work-related burnout were answered, the respondent was classified as a non-responder (Kristensen et al., 2005). In this way, listwise deletion was employed to address missing data on the CBI. There were three participants who responded to only one or two questions for client-related burnout, therefore those three participants were excluded from analyses.

Overall burnout rates were calculated along with burnout scores by hospitals, regions, rural versus urban, and hospital size.

By Region. Alabama is divided into 5 regions by the Alabama Statewide Area Health Education Centers (AHEC) Program (UAB School of Medicine, 2019) as follows:

1. North, including Lauderdale, Colbert, Franklin, Marion, Limestone, Lawrence, Winston, Walker, Madison, Morgan, Cullman, Marshall, and Jackson counties
2. West, including Lamar, Fayette, Pickens, Greene, Sumter, Choctaw, Tuscaloosa, Hale, Marengo, Bibb, Perry, Dallas, and Wilcox counties
3. Southern, including Washington, Mobile, Clarke, Baldwin, Monroe, Conecuh, Escambia, Butler, Crenshaw, and Covington counties
4. East, including Dekalb, Cherokee, Cleburne, Randolph, Chambers, Etowah, Calhoun, Clay, Tallapoosa, St. Clair, Talladega, Coosa, Blount, Jefferson, Shelby, and Chilton counties
5. Southeast, including Autauga, Lowndes, Elmore, Montgomery, Macon, Bullock, Pike, Coffee, Geneva, Dale, Lee, Russell, Barbour, Henry, and Houston counties

By Location. To classified rural versus urban, the methods developed and used by the Alabama Rural Health Association includes four variables which are generally accepted as being characteristics of rural areas in a formula with each variable accounting for 25 of a possible 100 points. The higher the overall point, the more rural a county is considered as being. The four variables are as following: 1) the percentage of total employment in the county which is comprised by those employed by the public elementary and secondary school systems, 2) the dollar value of agricultural production per square mile of land, 3) the population per square mile of land, and 4) an index is used

to assign a score to countries which considers the population of the largest city in the county, the populations of other cities in the county, and the population of cities which are in more than one county. Hospitals that are categorized as rural are hospitals in the following counties: Autauga, Balwin, Barbour, Bibb, Blount, Bullock, Butler, Chambers, Cherokee, Chilton, Choctaw, Clarke, Clay, Cleburne, Coffee, Colbert, Conecuh, Coosa, Covington, Crenshaw, Cullman, Dale, Dallas, Dekalb, Elmore, Escambia, Fayette, Franklin, Geneva, Greene, Hale, Henry, Jackson, Lamar, Lawrence, Limestone, Lowndes, Macon, Marengo, Madison, Marshall, Monroe, Perry, Pickens, Pike, Randolph, Russell, St. Clair, Sumter, Talladega, Tallapoosa, Walker, Washington, Wilcox, and Winston. Urban areas include the following counties: Calhoun, Etowah, Houston, Jefferson, Lauderdale, Lee, Madison, Mobile, Montgomery, Morgan, Shelby, and Tuscaloosa (Alabama Rural Health Association, 2019). Nine out of 42 hospitals were classified as rural hospitals in this study.

By Hospital Size. Hospital size was defined as small (< 100 beds), medium (100-250 beds), and large (>250 beds) (Neff, Cimiotti, Sloane, & Aiken, 2013).

Specific Aim 2: To examine whether resources (condition and personal characteristics) are related to nurse burnout.

Specific Aim 2A: To examine whether each resource is related to nurse burnout (condition related to nurse burnout (work environment) and personal characteristics to nurse burnout (age, gender, race, marital status, years in nursing experience, years in current hospital).

Statistical Test: To address Specific Aim 2A, correlation analyses (Pearson's R) were conducted for each variable, including work environment, age, years in current

hospital, and years of nursing experience, while more than two sample comparisons ANOVAs were conducted for gender, race, and marital status. However, the assumptions of correlation were tested, including testing for normality, linearity, and homoscedasticity prior to deciding which test was conducted for each variable (Field, Miles, & Field, 2012). If a variable did not meet all the assumptions, the Spearman Rank correlation was conducted for that variable (Field et al., 2012). Furthermore, the assumption of two sample comparisons were tested, including homogeneity of variance, normal distribution, and independent sample, and if a variable did not meet these assumptions, the Mann-Whitney U test was performed (Field et al., 2012). The effect size of r^2 and eta^2 were performed (Faul, Erdfelder, Buchner, & Lang, 2009). SPSS version 25.0 was used (IBM Corp, 2017).

With multiple comparison tests, the problem is more complicated because the probability of a Type I error grows with the number of the tests (Benjamini, & Hochberg, 1995). Therefore, the False Discovery Rates (FDR) were calculated to assess the expected proportion of type I errors (false positive) (Benjamini, & Hochberg, 1995). The FDR is simply the proportion of falsely rejected hypotheses:

$$FDR = \frac{Number\ of\ falsely\ rejected\ null\ hypotheses}{Total\ number\ of\ rejected\ null\ hypotheses}$$

R statistical software was used to obtain the FDRs (R Core Team, 2014).

Specific Aim 2B: To examine whether all resources together (both condition (work environment) and personal characteristics (age, gender, race, marital status, years in nursing experience, years in current hospital) predict nurse burnout.

Statistical Test: To address Specific Aim 2B, a linear mixed model analysis was conducted by using work environment, gender, marital status, age, race, years in current

hospital, and years of nursing experience as predictors and nurse burnout as an outcome. The assumptions of multiple regression that were tested were independence of observations, linearity, homoscedasticity, multicollinearity, outliers, and normal distribution of residuals (errors) (Weisberg, 2005). Also, the effect size of Partial Eta^2 was calculated for multiple predictors (Cohen, 1973).

Specific Aim 3: To examine whether there is a relationship between nurse burnout and medication administration errors and patient safety grade ratings among Alabama hospital-based nurses.

Specific Aim 3A: To examine whether there is a relationship between nurse burnout and medication administration errors among Alabama hospital-based nurses. Statistical Test: To address Specific Aim 3A, a multilevel linear mixed-effect mixed-modeling with nurses nested within hospitals was performed.

The scores for medication administration error items were calculated according to the frequency of response for each survey item. Next, all assumptions for multilevel modeling were checked, including linearity, normality, and homogeneity of variance (Snijders Tom & Bosker Roel, 2000). Medication administration errors was assigned as an outcome, whereas burnout was assigned as a fixed effect. Hospital was a random variable. Control variables were age, gender, race, and years in current hospital because these factors are not particularly associated medication administration errors, but they nevertheless could be related to nurse burnout (from the literature review in Chapter 2). Multilevel mixed-effect linear mixed-modeling, with nurses nested within hospitals, was conducted; intra-class correlation coefficients (ICC), regression coefficients, standard errors, and significance (*p*-values) were reported (Snijders Tom & Bosker Roel, 2000).

The effect size for multilevel modeling analysis is not straightforward (Singer, & Willett, 2003). Consequently, Partial Eta^2 is the generally accepted index (Cohen, 1973). SPSS version 25.0 was used (IBM Corp, 2017).

Specific Aim 3B: To examine whether there is a relationship between nurse burnout and patient safety grade ratings among Alabama hospital-based nurses. Statistical Test: To address Specific Aim 3B, a multilevel ordinal mixed-effect mixed-modeling with nurses nested within hospitals was performed

Patient safety grade was grouped into three categories as follows: the two lowest response categories (poor and failing) were combined as negative responses, the two highest response categories (excellent and very good) were combined as positive responses, and the midpoint of the scale was reported as a separate, neutral category (Acceptable) (Sorra et al., 2016). An example of how to compute frequency percentages is in Table 9.

Table 9

Example of How to Compute Frequency Percentages

	Patient Safety Grade		
Response	Number of responses	Response Percentage	Combined percentage
Excellent	1	10%	30% Positive
Very good	2	20%	
Acceptable	1	10%	10% Neutral
Poor	4	40%	60% Negative
Failing	2	20%	
Total	10	100%	100%
Missing	3	-	-
Total number of responses	13	-	-

Frequency of Patient Safety Grade with three categorical levels was assigned as an outcome in hospital level model, whereas burnout was assigned as a fixed effect. Hospital was a random variable. Control variables were age, gender, race, and years in current hospital. A multilevel mixed-effect ordinal mixed-modeling, with nurses nested within hospitals, was conducted. Fitting cumulative link mixed models with clmm2 function from the 'ordinal' package in R was applied (Christensen, 2018) to obtain regression coefficients, standard errors, odd ratios, and significance (*p*-values) (Grilli, & Rampichini, 2012). Pseudo Eta^2 is the generally accepted index for multiple predictors (Cohen, 1973). Pseudo Eta^2 was obtained by using the lsr Package in R (Navorro, 2015).

Table 10

Statistical Procedures following Specific Aims

Variables/ Specific Aim	Statistical Tests
Demographic	
Categorical Variables: Gender Marital status Race	Frequency and percentages
Continuous Variables: Age Years of nursing experience Years in current hospital Work environment	Mean, standard deviation, and range
Specific Aim 1: To describe burnout levels among Alabama nurses overall and by hospitals, regions, locations, and hospital sizes.	Means, medians, and standard deviation, and range ANOVA and Independent t-test The effect size of partial eta^2 and Cohen's *d* were performed
Specific Aim 2: To determine whether resources (condition and personal characteristics) are related to nurse burnout	
Specific Aim 2A: To determine whether each variable in resources (staffing, work environment, gender, marital status, age, and years of nursing experience) is related to nurse burnout	Correlation (Pearson R Test) - Checked assumptions including normally distribution, linearity, and homoscedasticity More than two sample comparisons (ANOVA) - Checked assumptions including normally distribution, linearity, and homoscedasticity prior The effect size of partial eta^2 and Cohen's *d* were performed
Specific Aim 2B: To determine whether all resources are related to nurse burnout	Multilevel mixed modeling with nurses nested within hospitals - Checked assumptions including are independence of observations, linearity, homoscedasticity, multicollinearity, outliers, and normally distribution of residuals (errors) The effect size of partial eta^2 was calculated

Variables/ Specific Aim	Statistical Tests
Specific Aim 3: To determine whether there is a relationship between nurse burnout and medication administration errors and patient safety grade among AL hospital-based nurses	
Specific Aim 3A: To determine whether there is a relationship between nurse burnout and medication administration errors among AL hospital-based nurses	Multilevel mixed modeling with nurses nested within hospitals - Calculated means and standard deviation of medication administration errors - Checked assumptions of multilevel models, including linearity, normality, and homogeneity of variance - Assigned variables for the fixed effect and random effect: o DV: medication error o Fixed effect: burnout o Random effect: hospital o Control variable: age, gender, race, and years in current hospital The effect size of partial eta^2 was calculated
Specific Aim 3B: To determine whether there is a relationship between nurse burnout and patient safety grade among AL hospital-based nurses	Ordinal mixed modeling with nurses nested within hospitals - Grouped patient safety grade into three categories - Assigned variables for the fixed effect and random effect: o DV: patient safety grade o Fixed effect: burnout o Random effect: hospital o Control variable: age, gender, race, and years in current hospital The effect size of pseudo Eta^2 was calculated

Human Subjects

The ethical issues that were considered concerning nurses as human subjects are coercion, respect for confidentiality and anonymity, and protection of privacy. Since a nursing community often contains a hierarchy, it is important to consider managerial levels when recruiting participants. Recruitment strategies must ensure that participation is voluntary without coercion; that is, nurse participation is not negotiated with nurse managers (Shaha, Wenzel, & Hill, 2011). Related to the principle of coercion is that of informed consent. Giving informed consent is the most fundamental principle of ethical research (Shaha et al., 2011). Informed consent attempts to ensure a person's right of autonomy, to prevent assault on a person's integrity, and to protect a person's personal liberty (Shamoo & Resnik, 2015). A subject can make a decision to participate in a study after she or he has been informed as to the purposes, method, possible risks and benefits of the study (Fouka & Mantzorou, 2011; Shamoo & Resnik, 2015). Therefore, in the parent study, a postcard sent to nurse participants included a cover letter that provides information for nurses to consider before participating in the study. Also, the cover letter explained that participation is voluntary, and that nurses can withdraw from the study at any time. The completion of the questionnaire was evidence of consent for each nurse. For this study, nurse managers were not involved with, and did not have access to the data.

Researchers who conduct studies including nurses as human subjects must ensure that the participants' information is protected (Shamoo & Resnik, 2015). If researchers cannot conduct the study under conditions of anonymity, they have to address the issue of confidentiality (Fouka & Mantzorou, 2011). Consequently, all participants' information

and their responses were de-identified in the computer with passcode access and kept in the limited-access room of the survey administrator to maintain confidentiality.

Another vital ethical consideration is that of privacy. Privacy is the right that an individual has to determine the time and circumstances under which information will be shared with the public (Fouka & Mantzorou, 2011; Shamoo & Resnik, 2015). Shamoo and Resnik (2015) claimed that privacy would be a more significant ethical issue when research was conducted in homes or workplaces. Participants might feel uncomfortable filling out the questionnaire at the hospital, so researchers should allow nurses to fill out the questionnaires at home (Teng et al., 2010). Consequently, a postcard was sent to the nurses' home addresses, and they could log in to respond to the online survey via their personal computers at home at their leisure.

Summary

In order to achieve the study purpose, a cross-sectional design was applied to three sections from the survey: demographic characteristics, CBI, and medication administration errors. Those measurements have been tested for validity and reliability among nursing staff. All participants' rights were explained in the cover letter. The returned completed survey implies consent to participate. To address the two specific aims, descriptive statistics and multilevel modeling with nurses nested within hospitals were analyzed using R statistical software. In the next chapter, the statistical findings of the study will be reported by following the specific aims.

CHAPTER 4

RESULTS

This chapter provides study findings consisting of a description of the sample and findings from analyses related to the research questions. The first section describes participant characteristics, including age, gender, marital status, race, years of nursing experience, years in current hospital, burnout levels, hospital, and workplace. Burnout levels were Personal, Work-, and Client-related characteristics. Hospital included regions, rural versus urban, and hospital size by bed count. Additional workplace characteristics were Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, Collegial Nurse-Physician Relations. The second section provides reliability, including Cronbach's alpha and correlated item dimension correlations and validity (confirmatory factor analysis). Presentation of the three main research questions and all assumptions for each test are addressed in the third section of this chapter.

Description of the Sample, Hospital and Workplace Characteristics.

Participant Characteristics.

A total of 1,730 nurses responded to the online survey (see Figure 4). Of those 1,354 were inpatient staff nurses. Responders that completed less than 20 percent and did not respond completely to the CBI and the PES-NWI were excluded from the analysis (*n* = 338). Another three responders were excluded because less than three questions were

answered in the Client-related Burnout dimension (*n* = 3). Licensed Practical Nurses (LPNs) were also excluded from the analysis (*n* = 2). Also, the hospitals that had less than three nurses who responded were excluded from the analysis (*n* = 83). A final sample consisting 928 nurses were included in all parts of the analysis.

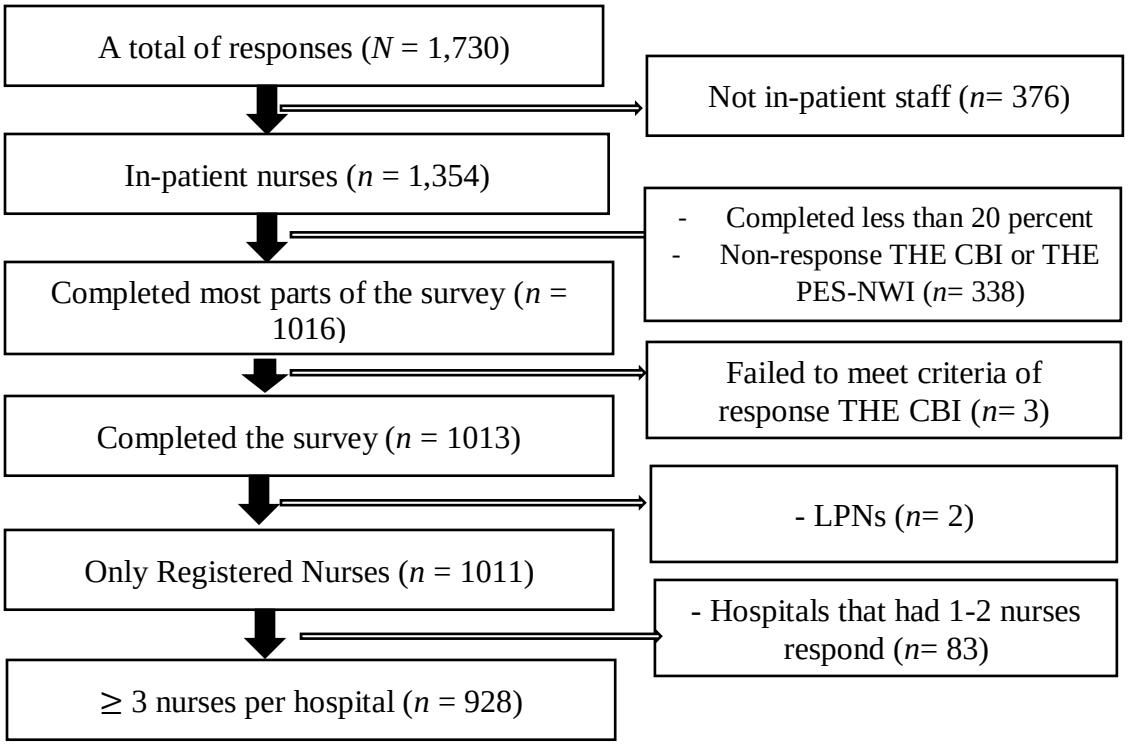

Figure 4. Flow Diagram Showing Exclusions and Final Sample Size of the Study

Descriptive statistics for the sample are presented in Table 11. The participants' ages ranged from 21 to 73 years with an average age of 39.49 years (Standard Deviation (*SD)* = 13.32). The participants' years of nursing experience ranged from 0 to 50 years with an average of 12.11 years (*SD* = 11.46), and years in current hospital ranged from 0 to 42 years with an average of 8 years (SD = 8.64). The majority of participants were

female (*n* =815, 87.8%). Most participants were white (*n* = 743, 80.1%) and were married/remarried *(n* = 542, 58.4%).

Table 11

Sample Characteristics (N =928)

Characteristics	Mean (SD)	Median (IQR)	Min - Max
Age (years)	39.49 (13.32)	37.00 (27-52)	21-73
Years in RN	12.11 (11.46)	8.00 (3-19)	0-50
Years in Current Hospital	8.00 (8.64)	4.00 (2-11)	0-42
	N	%	
Gender			
Female	815	87.8	
Male	93	10.0	
Prefer not to disclose	20	2.2	
Race			
White	743	80.1	
Black or African American	103	11.1	
Other	82	8.8	
Marital Status			
Married/ Remarried	542	58.4	
Single/ Divorced	339	36.5	
Other	47	5.1	

Hospital Characteristics.

Of the 88 acute care hospitals represented in the parent study, 42 were included in this sample. The majority of nurses worked in the East region of Alabama (*n* = 597, 64.3%), and most hospitals were in the East (*n* =15, 35.7%). Most of the hospitals were in urban areas (*n* = 32, 76.2%). More nurses worked for urban hospitals (*n* = 882, 95.0%) compared to rural hospitals (*n* = 46, 5.0%). Twenty-three hospitals were considered large hospitals (54.8%), while 11 hospitals are medium (26.2%). Most nurses worked for the large (*n* = 773, 83.3%) and medium (*n* = 128, 13.8%) hospitals (Table 12).

Table 12

Hospital Characteristics (*N* =928 *nurses*, N=42 *hospitals*)

Characteristics	Nurses (N=928)		Hospitals (N=42)	
	N	%	N	%
Regions				
North	70	7.50	7	16.70
West	25	2.70	2	4.80
Southern	80	8.60	8	19.00
East	597	64.30	15	35.70
Southeast	156	16.8	10	23.80
Rural Versus Urban				
Rural	46	5.00	10	23.80
Urban	882	95.00	32	76.20
Hospital Size by Bed Count				
Small	27	2.90	8	19.00
Medium	128	13.80	11	26.20
Large	773	83.30	23	54.80

Nurse Burnout.

The scores for all burnout dimensions ranged from 0 to 100. The average of Personal Burnout scores was 56.26 (*SD* = 21.39), Work-related Burnout scores averaged 54.40 (*SD* = 22.56), and Client-related Burnout scores averaged 38.75 (*SD* = 25.41). However, after categorizing the burnout scores to burnout levels as low (score 0-25), moderate (score 26-50), and high (score 51-100) (Madsen, Lange, Borritz, & Rugulies, 2015), most participants had a high Personal Burnout levels (*n* = 556, 60.0%), high Work-related Burnout (*n* = 497, 53.7%), and low to medium Client-related Burnout level (*n* = 662, 71.5%) (Table 13).

Table 13

Burnout Scores and Levels Overall

Burnout	Mean (SD)	Median (IQR)	Min - Max
Burnout Scores (CBI)			
Personal	56.26 (21.39)	58.33 (42-71)	0-100
Work-related	54.40 (22.56)	53.57 (39-71)	0-100
Client-related	38.75 (25.41)	37.50 (21-54)	0-100
Burnout Levels (CBI)	**N**	**%**	
Personal Burnout			
Low	98	10.6	
Moderate	272	29.4	
High	556	60.0	
Work-related Burnout			
Low	117	12.6	
Medium	312	33.7	
High	497	53.7	
Client-related Burnout			
Low	338	36.5	
Medium	324	35.0	
High	264	28.5	

Nursing Practice Environment.

Descriptive results, including mean, median, standard deviation, minimum, and maximum for the PES-NWI scores are shown in Table 14. All five subscales and total scores ranged from 1 to 4. Nurse Participation in Hospital Affairs had an average of 2.73 (*SD* = 0.72). Nursing Foundations for Quality of Care had an average of 3.08 (*SD* = 0.60). Nurse Manager, Ability, Leadership, and Support of Nurses had an average of 2.82 (*SD* = 0.86). Staffing and Resource Adequacy had an average of 2.50 (*SD* = 0.87). Collegial Nurse-Physician Relations had an average of 3.07 (*SD* = 0.70). The PES-NWI composite score was of 2.84 (*SD* = 0.62).

Table 14

Nursing Practice Environment Subscales and Composite Score (N =924-925)

Characteristics	Mean (SD)	Median (IQR)	Min - Max
Nurse Participation in Hospital Affairs	2.73 (0.72)	2.78 (2.22-3.22)	1-4
Nursing Foundations for Quality of Care	3.08 (0.60)	3.10 (2.80-3.10)	1-4
Nurse Manager, Ability, Leadership, and Support of Nurses	2.82 (0.86)	3.00 (2.20-3.60)	1-4
Staffing and Resource Adequacy	2.50 (0.87)	2.50 (1.75-3.00)	1-4
Collegial Nurse-Physician Relations	3.07 (0.70)	3.00 (2.67-3.67)	1-4
PES-NWI Composite Score	2.84 (0.62)	2.85 (2.44-3.27)	1-4

Reliability and Validity of the CBI and the PES-NWI

As a result of missing data, the Cronbach's alpha was done using pairwise deletion. However, for the Confirmatory Factor Analysis (CFA), missing data at random was assumed and missing data were less than 1%, so the list-wise deletion was applied. After list-wise deletion was used, the sample size for the CBI was 887, and the PES-NWI was 819. These samples are large enough to use the estimation that has been corrected for non-normality. All procedures for reliability and validity were done by using R Studio Version 1.1.456.

CBI.

Descriptive statistics for the individual 19-item scores and measures of internal consistency for the three dimensions of burnout are shown in Table 15. Cronbach's alphas are excellent for Personal, Work-related, Client-related burnout as 0.91, 0.89, and 0.92, respectively. Correlated item-dimension correlations, which are correlations between each item and the dimension scores computed without the item, are shown in Table 5. None of the items has corrected correlations smaller than 0.40. The results from the CFA on the 19-item set also are presented with model fit. The CFA model provided

an adequate fit to the data, as indicated by the X^2/df ratio and the other three fit indices. Even the robust X^2/df and its p-value is significantly different from zero at the .05 significance level ($X^2/df = 9.49$, $p < .001$); a robust RMSEA (0.105), CFI (0.899), and SRMR (0.066) indicate that the factor structure of the 19 items was considered adequate (Table 4). R^2 shows how strongly an item is correlated to the measurement. An R^2 higher than 0.25 is preferable. Item 10, "Do you have enough energy for family and friends during leisure time?" seems to have less ability to explain work-related burnout. However, after removing item 10 from the model, the fit indices were worse. Therefore, item 10 was included in both the model and the analysis.

PES-NWI.

Descriptive statistics for the individual 31-item scores and measures of internal consistency for the five dimensions of the PES-NWI are shown in Table 16. Cronbach's alpha was good to excellent for all dimensions of the PES-NWI, and none of the items has corrected correlations smaller than 0.40. The results from the CFA on the 31-item set also are presented in Table 6 along with model fit. The CFA model provided an adequate fit to the data as indicated by the X^2/df ratio and the other three fit indices. Even robust X^2/df of 4.83 and p-value (< .001) is significantly different from zero at the .05 significance level; a robust RMSEA (0.076), CFI (0.884), and SRMR (0.064) indicate that the factor structure of the 31-item was considered adequate (Table 5). Each item has a good ability to explain its subscale ($R^2 > 0.25$).

Table 15

Internal Consistency and Confirmatory Factor Analysis (CFA) for the CBI

Subscale	Items	Descriptive		Internal Consistency		CFA (n=887)
		Mean	SD	Cronbach's Alpha	Corrected Item	R^2
Personal Burnout	1. How often do you feel tired?	70.38	21.89	0.91	0.75	0.644
	2. How often are you physically exhausted?	61.82	24.56		0.82	0.734
	3. How often are you emotionally exhausted?	61.29	24.51		0.79	0.684
	4. How often do you think: "I can't take it anymore"?	43.66	30.27		0.72	0.612
	5. How often do you feel worn out?	62.04	24.91		0.85	0.806
	6. How often do you feel weak and susceptible to illness?	38.52	26.69		0.65	0.462
Work-related Burnout	7. Do you feel worn out at the end of the working day?	70.73	25.09	0.89	0.68	0.582
	8. Are you exhausted in the morning at the thought of another day at work?	55.98	31.10		0.80	0.727
	9. Do you feel that every working hour is tiring for you?	41.85	30.77		0.78	0.713
	10. Do you have enough energy for family and friends during leisure time?	46.13	25.86		0.40	0.186
	13. Is your work emotionally exhausting?	63.43	26.37		0.66	0.482
	14. Do you feel burnt out because of your work?	51.11	31.84		0.80	0.678
	15. Does your work frustrate you?	51.35	30.17		0.75	0.596
Client-related Burnout	11. Are you tired of working with clients?	34.19	29.62	0.92	0.78	0.637
	12. Do you sometimes wonder how long you will be able to continue working with clients?	44.81	32.02		0.72	0.530
	16. Do you find it hard to work with clients?	31.21	27.35		0.85	0.858
	17. Do you find it frustrating to work with clients?	32.32	27.77		0.86	0.869
	18. Does it drain your energy to work with clients?	37.50	29.49		0.84	0.767
	19. Do you feel that you give more than you get back when you work with clients?	52.52	32.93		0.65	0.448
Model fit:						**Interpret Findings**
Robust X^2 (149 df) =1413.429, p< .001; X^2/df = 9.486						Poor Fit
Robust Root Mean Square Error of Approximation (RMSEA) =0.105, 90%CI = 0.100, 0.110						Fair Fit
Robust Comparative Fit Index (CFI) = 0.899						Fair Fit
Robust Standardized Root Mean Square Residual (SRMR) = 0.066						Good Fit

Note. Corrected Item = Correlated item dimension correlation

Table 16

Internal Consistency and Confirmatory Factor Analysis (CFA) for the PES-NWI

Subscale	Items	Descriptive		Internal Consistency		CFA (n=819)
		Mean	SD	Cronbach's Alpha	Corrected Item	R^2
Nurse Participation in Hospital Affairs	5. Career development/ clinical ladder opportunity	2.90	0.97	0.90	0.68	0.507
	6. Opportunity for staff nurses to participate in policy decisions	2.45	0.97		0.74	0.625
	11. A chief nursing officer who is highly visible and accessible to staff	2,54	1.05		0.63	0.416
	15. A chief nursing officer equal in power and authority to other top-level hospital executives	3.03	0.89		0.58	0.360
	17. Opportunities for advancement	2.73	0.95		0.74	0.601
	21. Administration that listens and responds to employee concerns	2.42	0.99		0.71	0.575
	23. Staff nurses are involved in the internal governance of the hospital (e.g., practice and policy committees)	2.62	0.95		0.74	0.625
	27. Staff nurses have the opportunity to serve on hospital and nursing committees	3.05	0.89		0.68	0.525
	28. Nurse managers consult with staff on daily problems and procedures	2.84	0.99		0.58	0.448
Nursing Foundation for Quality Care	4. Active staff development or continuing education programs for nurses	3.07	0.90	0.89	0.60	0.453
	14. High standards of nursing care are expected by the administration	3.54	0.70		0.55	0.305
	18. A clear philosophy of nursing that pervades the patient care environment	3.01	0.84		0.75	0.682
	19. Working with nurses who are clinically competent	3.19	0.76		0.56	0.329
	22. An active performance improvement program	2.81	0.91		0.70	0.642
	25. A preceptor program for newly hired RNs	3.24	0.88		0.56	0.351
	26. Nursing care is based on a nursing rather than a medical model	2.91	0.90		0.66	0.525
	29. Written, up-to-date nursing care plans for all patients	3.02	0.86		0.63	0.364
	30. Patient care assignments that foster continuity of care, i.e., the same nurse cares for the patient from one day to the next	3.13	0.86		0.62	0.381
	31. Use of nursing diagnoses	2.91	0.90		0.61	0.369
Nurse Manager Ability, Leadership, and Support	3. A supervisory staff that is supportive of the nurses	2.88	1.00	0.90	0.78	0.700
	7. Supervisors use mistakes as learning opportunities, not criticism	2.79	0.99		0.74	0.632
	10. A nurse manager who is a good manager and leader	2.94	1.04		0.81	0.721
	13. Praise and recognition for a job well done	2.54	1.01		0.68	0.579
	20. A nurse manager who backs up the nursing staff in decision-making, even if the conflict is with a physician	2.95	1.03		0.77	0.661

Subscale	Items	Descriptive		Internal Consistency		CFA (n=819)
		Mean	SD	Cronbach's Alpha	Corrected Item	R^2
Staffing and Resources Adequacy	1. Adequate support services allow me to spend time with my patients	2.47	1.00	0.89	0.75	0.580
	8. Enough time and opportunity to discuss patient care problems with other nurses	2.41	1.05		0.82	0.474
	9. Enough registered nurses to provide quality patient care	2.78	0.91		0.66	0.819
	12. Enough staff to get the work done	2.35	1.03		0.82	0.830
Collegial Nurse-Physician Relations	2. Physicians and nurses have good working relationships	3.20	0.71	0.87	0.72	0.608
	16. A lot of team work between nurses and physicians	3.05	0.80		0.78	0.747
	24. Collaboration (joint practice) between nurses and physicians	2.95	0.82		0.74	0.714

Model fit:	**Interpret Findings**
Robust X^2 (424 df) = 2048.021, p <.001; X^2/df = 4.83	Poor Fit
Robust Root Mean Square Error of Approximation (RMSEA) = 0.076, 90%CI = 0.073, 0.080	Fair Fit
Robust Comparative Fit Index (CFI) = 0.884	Fair Fit
Robust Standardized Root Mean Square Residual (SRMR) = 0.064	Good Fit

Note. Corrected Item = Correlated item dimension correlation

Specific Aim 1: To describe burnout levels among Alabama nurses overall, by hospital, region, location (rural versus urban), and hospital size (by bed counts).

Overall. The overall nurse burnout has shown in Table 3 and reported the findings earlier. The average of Personal Burnout scores was 56.26 (*SD* = 21.39), Work-related Burnout score was 54.40 (*SD* = 22.56), and Client-related Burnout score was 38.75 (*SD* = 25.41).

By Hospital. When different raters observe in the same organization, a frequently advocated index of mean inter-rater reliability is a Spearman-Brown formula based on the intraclass correlation coefficient (ICC) from a one-way analysis of variance (ANOVA) (Glick, 1985). Shrout and Fleiss (1979) provided the following formula for estimating this index of reliability,

$$ICC_{(1,k)} = \frac{(Mean\ Squares_{between} - Mean\ Squares_{within})}{Mean\ Squares_{between}}$$

Where k is the number of raters in each organization

The minimum of staff nurses was based on the prior research studies on the PES-NWI, which showed that the minimum of three staff nurses represent each hospital with the interclass correlation coefficient (ICC) (1, k) with values greater than 0.60 (Lake et al., 2017; Lake, Hallowell, et al., 2016; Lake, Staiger et al., 2018). For this study, ANOVA has performed with the PES-NWI composite as a dependent variable and hospital (that has 3 or more nurses) as a factor. The results show as 1.321 of mean squares between organizations (BMS) and 0.345 of the mean squares within organizations (WMS). Therefore, ICC (1, k) for this study is (1.321-0.345)/1.321 = 0.7388, which is higher than 0.60 and supported that three nurses per hospital is sufficient to represent a hospital.

A total of 42 hospitals were included in this analysis. The maximum number of nurses per hospital is 431 and the minimum is three nurses. The three hospitals that had the highest Personal Burnout scores were hospital 79 (*mean* = 79.17, *SD* = 23.20), hospital 103 (*mean* = 79.17, *SD* = 5.89), and hospital 10 (*mean* = 70, *SD* = 16). The three hospitals that had the highest Work-related Burnout scores were hospital 79 (*mean* = 83.33, *SD* = 25.84), hospital 103 (*mean* = 81.25, *SD* = 12.84), and hospital 23 (*mean* = 75, *SD* = 13.36). The three hospitals that had the highest Client-related Burnout scores were hospital 79 (*mean* = 73.61, *SD* = 45.71), hospital 91 (*mean* = 58.93, *SD* = 31.86), and hospital 10 (*mean* = 57.22, *SD* = 20.20). After comparing burnout scores by hospital, ANOVA shows that each burnout dimension shows a statistically significant difference between hospitals (*p-value* and *FDR* < .05) (Table 7). Eta Squared (η^2) was calculated for the effect size. The hospital has a medium effect on Personal Burnout (η^2 = 0.0694), Work-related Burnout (η^2 = 0.0863), and Client-related Burnout (η^2 = 0.0675) (Table 17).

Table 17

Burnout Scores by Hospital and Comparing between Hospitals (ANOVA)

Hospital Code	N	Personal Burnout		Work-related Burnout		Client-related Burnout	
		Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
2	5	54.17 (15.86)	62.50	52.14 (16.87)	50.00	34.17 (25.75)	37.50
3	3	55.56 (10.49)	54.17	47.62 (16.10)	46.42	34.72 (27.11)	33.33
4	13	54.17 (24.24)	54.17	55.77 (21.36)	64.29	31.09 (16.63)	33.33
5	8	50.78 (19.54)	55.21	51.79 (19.93)	57.14	37.50 (23.57)	35.42
8	22	46.70 (20.43)	45.83	39.77 (16.87)	39.29	22.92 (13.77)	22.92
10	15	70.00 (16.00)	62.50	70.24 (17.37)	67.86	57.22 (20.20)	54.17
23	7	67.29 (15.10)	70.83	75.00 (13.36)	75.00	44.64 (24.85)	41.67
26	21	60.91 (20.77)	66.67	57.82 (25.65)	60.71	41.67 (19.98)	45.83
33	15	48.89 (17.64)	50.00	46.19 (16.67)	46.43	35.56 (17.95)	33.33
34	5	60.83 (22.75)	54.17	55.36 (25.25)	50.00	30.83 (13.37)	25.00
38	6	65.28 (11.39)	64.58	56.55 (13.44)	50.00	31.94 (18.94)	31.25
39	27	62.96 (21.47)	66.67	57.94 (23.36)	57.14	39.51 (32.39)	29.17
41	6	43.06 (30.52)	45.83	47.62 (20.03)	46.43	39.58 (18.77)	41.67
48	4	54.17 (17.68)	52.08	51.79 (24.13)	51.79	38.54 (13.34)	39.58
50	10	47.08 (24.93)	54.17	41.79 (29.11)	44.64	32.92 (26.89)	33.33
54	36	56.83 (17.77)	58.33	56.25 (21.62)	53.57	36.81 (24.20)	33.33
57	11	54.55 (27.10)	45.83	53.57 (27.85)	42.85	42.42 (29.69)	33.33
66	3	66.67 (22.05)	75.00	67.86 (18.90)	75.00	54.17 (14.43)	45.83
71	4	62.50 (25.69)	60.42	66.96 (26.47)	64.29	43.75 (26.68)	33.33
72	3	44.17 (22.92)	45.00	32.14 (18.90)	39.29	18.06 (9.62)	12.50
74	15	46.81 (30.75)	37.50	49.52 (28.80)	42.86	36.94 (33.48)	41.67
75	4	35.42 (24.88)	37.50	28.57 (18.21)	32.14	26.04 (27.92)	25.00
79	3	79.17 (23.20)	83.33	83.33 (25.84)	25.84	73.61 (45.71)	100.00
85	5	61.67 (8.01)	58.33	62.14 (14.42)	60.71	32.50 (29.96)	16.67
86	4	57.29 (23.17)	58.33	46.43 (33.50)	42.86	26.04 (29.73)	18.75
90	5	45.00 (19.04)	45.83	33.57 (15.69)	28.57	14.17 (17.58)	8.33
91	7	63.10 (20.19)	54.17	68.88 (22.18)	60.71	58.93 (31.86)	58.33
92	9	68.98 (25.35)	66.67	66.27 (25.70)	71.43	44.44 (36.56)	50.00
96	5	54.17 (20.41)	45.83	48.57 (20.30)	50.00	20.83 (15.02)	20.83
99	6	59.03 (17.76)	60.42	47.62 (20.29)	48.21	33.33 (21.41)	31.25
102	89	59.22 (18.78)	58.33	57.16 (20.29)	60.71	36.48 (22.97)	37.50
103	4	79.17 (5.89)	81.25	81.25 (12.84)	83.93	40.63 (16.45)	43.75
106	10	69.58 (12.74)	68.75	64.29 (17.50)	62.50	49.17 (16.64)	50.00
107	15	47.22 (22.48)	45.83	43.81 (21.41)	39.29	25.83 (24.36)	20.83
112	7	48.81 (22.79)	41.67	50.51 (17.43)	46.43	33.93 (17.08)	29.17
114	431	56.38 (21.17)	58.33	54.94 (22.67)	53.57	41.08 (25.83)	37.50
116	36	47.80 (21.61)	45.83	47.92 (20.87)	48.10	39.24 (28.35)	41.67
117	30	56.33 (26.59)	62.50	51.55 (20.84)	58.93	35.14 (24.51)	33.33
118	8	45.42 (18.05)	37.50	42.86 (24.67)	46.43	18.23 (21.36)	8.33
120	8	57.81 (20.83)	54.17	60.27 (23.49)	64.29	42.71 (24.78)	37.50
122	3	45.83 (15.02)	41.67	30.95 (14.43)	28.57	18.60 (16.84)	8.3342

Comparing hospitals: ANOVA

		SS	df	MS	F	p	FDR	η^2
Personal Burnout	Between Groups	29361.5	40	734.04	1.650	.021	.021	0.0694
	Within Groups	393700.2	885	444.86				
	Total	423061.7	925					
Work-related Burnout	Between Groups	40621.0	40	1015.52	2.089	.0005	.0005	0.0863
	Within Groups	430191.5	885	486.09				
	Total	470812.5	925					
Client-related Burnout	Between Groups	40327.3	40	1008.18	1.603	.022	.022	0.0675
	Within Groups	556728.4	885	629.07				
	Total	597055.7	925					

Note. SS = Sum of Squares; MS = Mean Square; FDR = False Discovery Rate; η^2 = Eta Squared

By Region. Alabama was divided into 5 regions by the Alabama Statewide Area Health Education Centers (AHEC) Program (UAB School of Medicine, 2019) (Figure 5). After calculating burnout scores by region, nurses who worked in the West region reported the highest Personal Burnout (*mean* = 60.33, *SD* = 20.70) and reported the highest Work-related Burnout (*mean* = 56, *SD* = 26.58). Nurses who worked in the Southeast region reported the second highest on Personal Burnout (*mean* = 57.16, *SD* = 20.09) and reported the second highest Work-related Burnout (*mean* = 55.30, *SD* = 21.15).

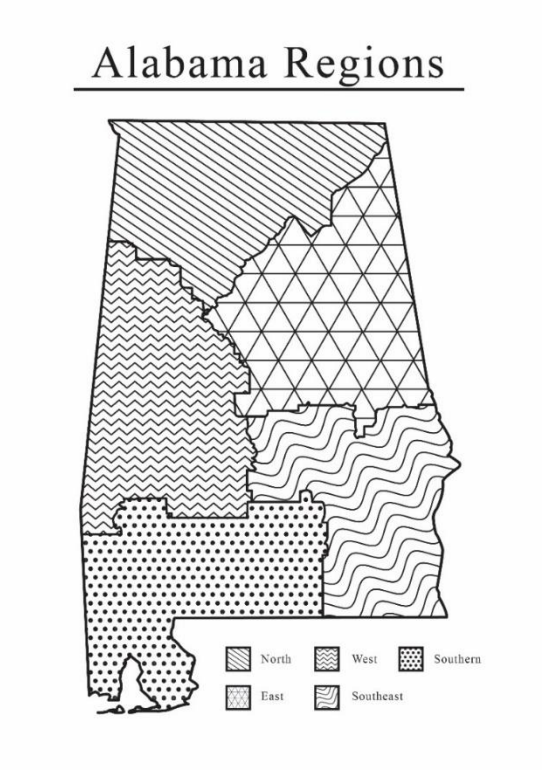

Figure 5. Alabama Regions Maps

However, the highest Client-related Burnout was reported by nurses who worked in the East (*mean* = 40.17, *SD* = 26.04), followed by the West (*mean* = 39.17, *SD* = 21.85), and the Southeast (*mean* = 36.48, *SD* = 23.22). ANOVA was performed to compare burnout scores by region. There are no statistically significant differences with regard to burnout dimension scores between regions (*p* and *FDR* > .05) (Table 8). Eta Squared was calculated for the effect size. Therefore, Region has a small effect on Personal Burnout (η^2 = 0.002), Work-related Burnout (η^2 = 0.001), and Client-related Burnout (η^2 = 0.006) (Table 18).

Table 18

Burnout Scores by Region and Comparing between Regions (ANOVA)

Region	Personal Burnout		Work-related Burnout		Client-related Burnout	
	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
North	56.52 (19.17)	58.33	55.10 (23.25)	53.57	36.35 (23.58)	33.33
West	60.33 (20.70)	66.67	56.00 (26.58)	57.14	39.17 (21.85)	21.85
Southern	54.29 (26.17)	60.42	52.05 (24.09)	53.57	34.53 (26.84)	33.33
East	56.09 (21.31)	58.33	54.52 (22.50)	53.57	40.17 (26.04)	37.50
Southeast	57.16 (20.09)	58.33	55.30 (21.15)	57.14	36.48 (23.22)	33.33

Compare Regions: ANOVA

		SS	df	MS	F	p	FDR	η^2
Personal Burnout	Between Groups	875.1	4	218.77	.477	.752	.7896	0.002
	Within Groups	422186.6	921	458.40				
	Total	423061.7	925					
Work-related Burnout	Between Groups	665.9	4	166.48	.326	.861	.8610	0.001
	Within Groups	470146.5	921	510.47				
	Total	470812.5	925					
Client-related Burnout	Between Groups	3823.3	4	955.82	1.484	.205	.2532	0.006
	Within Groups	593232.5	921	644.12				
	Total	597055.7	925					

Note. SS = Sum of Squares; MS = Mean Square; FDR = False Discovery Rate; η^2 = Eta Squared

By Location (Rural Versus Urban). Fifty-five Alabama counties were classified as rural and 12 are classified as urban (Alabama Rural Health Association, 2019) (Figure 6). Nurses who work in an urban area reported higher burnout scores for each dimension (mean of Personal Burnout = 56.56, mean of Work-related Burnout = 54.90, and mean of Client-related Burnout = 39.24) compared to those who worked in rural areas (mean of

Personal Burnout = 49.46, mean of Work-related Burnout = 44.80, and mean of Client-related Burnout = 29.35). To compare burnout scores between rural and urban hospitals, the assumptions of the t-test were checked before performing any test. According to the Central Limit Theorem, burnout scores were assumed to meet normality distribution assumption (Rosner, 2017). Levene's test for equality of variances was performed and show that all three burnout dimensions failed to reject the null hypothesis. The test demonstrated that there is no difference between the variances in the study population [Levene's test: personal burnout ($F_{1,924}$ = .00, p = .988), Work-related Burnout ($F_{1,924}$ = .392, p = .531), and Client-related Burnout ($F_{1,924}$ = 1.384, p = .240)]. Therefore, the assumptions of the independent samples t-test were met.

Nurses who work in rural areas have statistically significant lower Personal Burnout scores (*t (924)* = -2.22, p = .027, *FDR* = .041), Work-related Burnout *t (924)* = -2.97, p = .003, *FDR* = 0.010), and Client-related Burnout *t (924)* = -2.58, p = .010, *FDR* = 0.023) (Table 9) than those who work in urban counties. Cohen's *d* was calculated for effect sizes. Rural versus urban has a small to medium effect size on Personal Burnout (*Cohen's d* = 0.335), Work-related Burnout (*Cohen's d* = 0.450), and Client-related Burnout (*Cohen's d* = 0.391) (Table 19).

Figure 6. Alabama Location Map (Rural versus Urban)

Table 19

Burnout Scores for Urban versus Rural

Types	Personal Burnout		Work-related Burnout		Client-related Burnout	
	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
Rural	49.46 (20.76)	47.92	44.80 (22.19)	46.43	29.35 (22.51)	27.08
Urban	56.62 (21.37)	58.33	54.90 (22.48)	53.57	39.24 (25.46)	37.50
Comparing Rural and Urban: Independent t-test						
	t	df	Mean difference	p	FDR	*Cohen's d*
Personal Burnout	-2.22	924	-7.16	.027	.0405	0.335
Work-related Burnout	-2.97	924	-10.11	.003	.0105	0.450
Client-related Burnout	-2.58	924	-9.89	.010	.0229	0.391

Note. FDR = False Discovery Rate

Burnout Scores by Hospital Size (Bed Count). In this study, there are 8 small hospitals 19%) (27 nurses, 2.9%), 11 medium hospitals (26.2%) (128 nurses, 13.8%) and 23 large hospitals (54.8%) (773 nurses, 83.3%). Nurses who work for large hospitals reported the highest burnout scores in all three dimensions (Personal Burnout mean = 56.74, Work-related Burnout mean = 55.01, Client-related Burnout mean = 39.39) compared to those who work for small hospitals (Personal Burnout mean = 54.01, Work-related Burnout mean = 49.21, Client-related Burnout mean = 34.10) and medium hospitals (Personal Burnout mean = 53.86, Work-related Burnout mean = 51.81, Client-related Burnout mean = 35.87); however, after performing ANOVA, there are statistically significant differences in burnout scores in each dimension between hospital sizes (*p* and *FDR* >.05) (Table 10). Eta Squared was calculated for the effect size. As a result, hospital size has a small effect on Personal (η^2 = 0.002), Work-related (η^2 = 0.004), and Client-related Burnout (η^2 = 0.003) (Table 20).

Table 20

Burnout Scores by Hospital Sizes and Comparing between Hospital Sizes (ANOVA)

Hospital Sizes	Personal Burnout		Work-related Burnout		Client-related Burnout	
	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
Small	54.01 (21.84)	50.00	49.21 (24.37)	46.43	34.10 (27.86)	29.17
Medium	53.86 (22.71)	54.17	51.81 (21.77)	53.57	35.87 (24.22)	33.33
Large	56.74 (21.14)	58.33	55.01 (22.60)	53.57	39.39 (25.49)	37.50

Compare Hospital Sizes: ANOVA

		SS	Df	MS	F	p	FDR	η^2
Personal Burnout	Between Groups	1049.4	2	524.72	1.148	.318	.3515	0.002
	Within Groups	422012.3	923	457.22				
	Total	423061.7	925					
Work-related Burnout	Between Groups	1874.1	2	937.04	1.844	.159	.20869	0.004
	Within Groups	468938.4	923	508.06				
	Total	470812.5	925					
Client-related Burnout	Between Groups	1955.0	2	977.48	1.516	.220	.2567	0.003
	Within Groups	595100.8	923	644.75				
	Total	597055.7	925					

Note. SS = Sum of Squares; MS = Mean Square; FDR = False Discovery Rate; η^2 = Eta Squared

Specific Aim 2: To determine whether resources (condition and personal characteristics) are related to nurse burnout.

For this aim, three assumptions were checked, including normality of the distribution, linearity, and homoscedasticity, before correlations were performed. First, the test of normality for all continuous variables are shown in Table 21. The Shapiro Wilk statistics shows that all continuous variables failed to reject the null hypothesis of normal distribution ($p < .05$) and concluded that all variables do not follow a normal distribution in our population; however, checking the Q-Q plots for each variable, the points form a line that is roughly straight, as illustrated in Figure 7, which means the sample mean is very similar to the population mean. Furthermore, the Central Limit Theorem (CLT) states that given a large sample size from a population with a finite level of variance, the mean of all samples from the same population will be approximately equal to the mean of the population (Rosner, 2017).

Table 21

Test of Normality for All Continuous Variables (N =928)

Variables	Shapiro Wilk	
	Statistic	p-value
Age (years)	0.93	< .000
Years of Nursing Experience	0.86	< .000
Years in Current Hospital	0.79	< .000
Personal Burnout	0.99	< .000
Work-related Burnout	0.99	< .000
Client-related Burnout	0.97	< .000
Nurse Participation in Hospital Affairs	0.98	< .000
Nursing Foundations for Quality of Care	0.95	< .000
Nurse Manager, Ability, Leadership, and Support of Nurses	0.94	< .000
Staffing and Resource Adequacy	0.98	< .000
Collegial Nurse-Physician Relations	0.92	< .000
Total of the PES-NWI	0.99	< .000

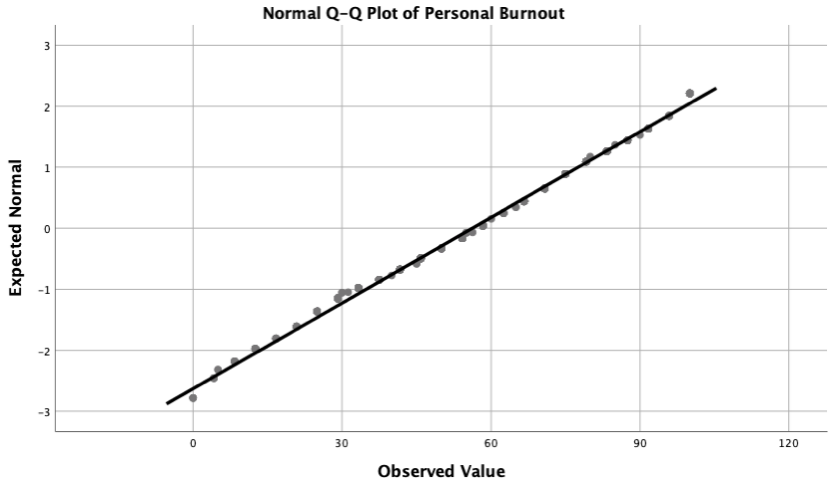

Figure 7. Normal Q-Q Plot for Personal Burnout

The next assumption that was checked was homoscedasticity, or the equality of variance. The scatterplots of the residuals show there is no clustering or systemic pattern for all Personal Burnout, Work-related Burnout, and Client-related Burnout (Figure 8, 9, 10). Points are equally distributed above and below zero on the X axis and to the left and right of zero on the Y axis, which means the homoscedasticity assumption was met for every dimension of burnout.

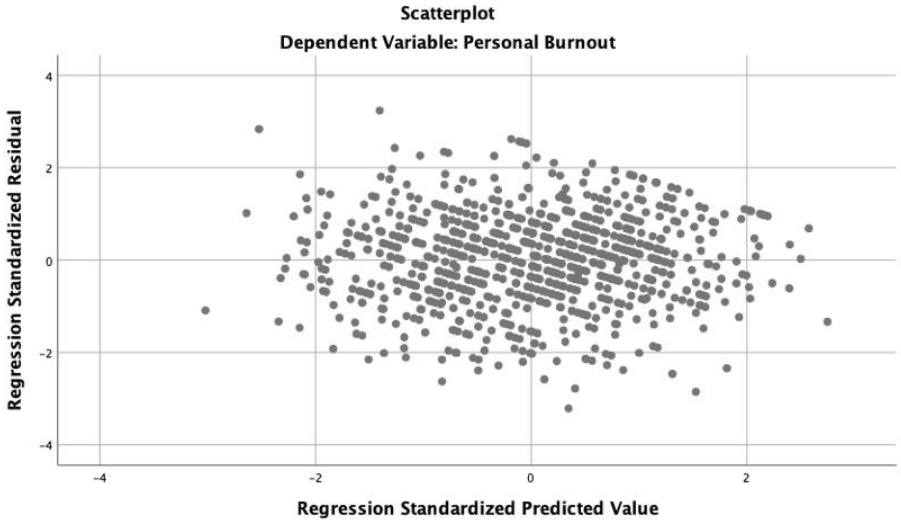

Figure 8. Scatterplot of Homoscedasticity for Personal Burnout

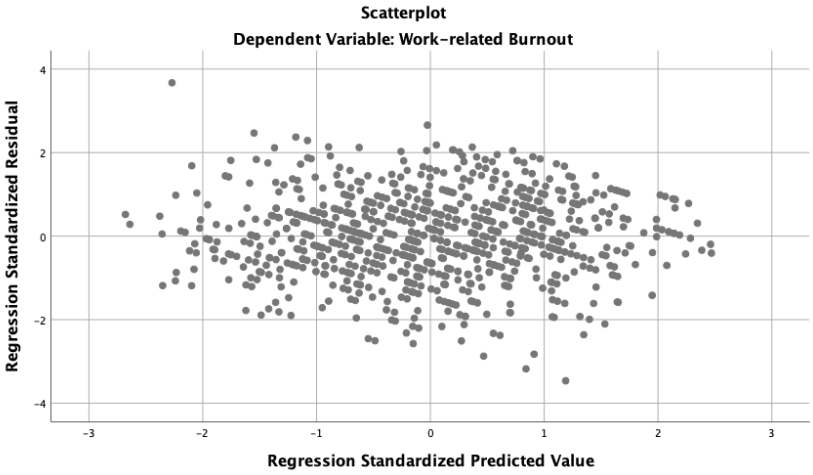

Figure 9. Scatterplot of Homoscedasticity for Work-related Burnout

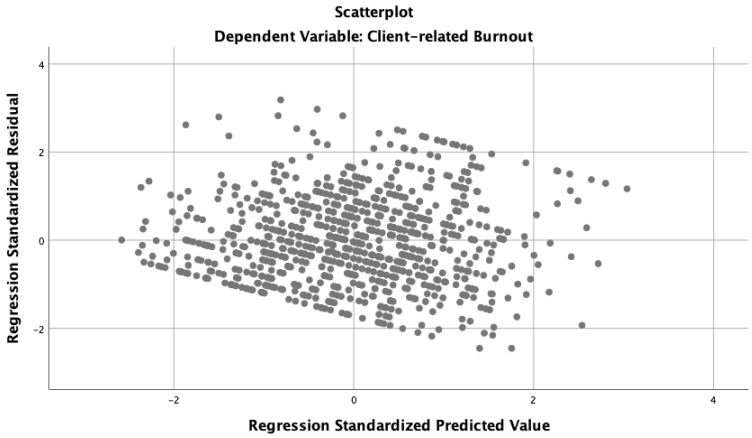

Figure 10. Scatterplot of Homoscedasticity for Client-related Burnout

Finally, the multicollinearity was checked using GVIF values. If there are p coefficients in a predictor, then $GVIF^{1/2(p)}$ is a measure of the decrease in the precision of estimation due to collinearity- analogous to taking the square root of the usual VIF (for one coefficient). When p =1 (the predictor has only one coefficient), the GVIF reduces to the usual VIF (Fox, & Weisberg, 2018). Each $GVIF^{1/2(p)}$ is below 1.58, indicating that there would not be indication of strong multicollinearity among predictors. Table 22 shows the collinearity statistic for all predictors, including gender, age, years of nursing

experience, years in current hospital, race, marital status, as well as five subscales of the PES-NWI (Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, Collegial Nurse-Physician Relations).

Table 22 also shows the composite score of the PES-NWI for each dimension of the CBI. Nurse Manager Ability, Leadership, and Support was automatically excluded from the model because of perfect multicollinearity. Other PES-NWI subscales and composite scores seems to have GVIF greater than 4 and $GVIF^{1/2(p)}$ greater than 0.25 which indicates there is multicollinearity between all subscales, so all the PES-NWI subscales were removed and only the composite score was included in the model (Table 12). Also, years of nursing experience was removed from the model since there was multicollinearity (*GVIF* = 4.26, $GVIF^{1/2(p)}$ = 2.06). The GVIF and $GVIF^{1/2(p)}$ were rechecked (present as revised models in Table 22) and found that each $GVIE^{1/2(p)}$ value is less than 0.25, indicating that the multicollinearity assumption was met with the removal of years of nursing experience. Therefore, gender, age, year in current hospital, race, marital status, and the PES-NWI composite are included in all regression models.

Table 22

The Collinearity Statistics for Each CBI Dimension

Outcome / Predictors	All Predictors			Revised Model		
	GVIF	df	$GVIF^{1/2(p)}$	GVIF		$GVIF^{1/2(p)}$
Personal Burnout						
Gender	1.25	2	1.06	1.32	2	1.07
Age	3.23	1	1.80	1.75	1	1.32
Year in RN	4.27	1	2.07			
Year in Hospital	2.27	1	1.51	1.67	1	1.29
Race	1.25	2	1.06	1.23	2	1.05
Marital Status	1.37	2	1.08	1.39	2	1.09
Nurse Participation in Hospital Affairs	7.79	1	2.79			
Nursing Foundation for Quality Care	4.74	1	2.18			
Nurse Manager Ability, Leadership, and Support	.	1	.			
Staffing and Resources Adequacy	5.02	1	2.24			
Collegial Nurses-Physician Relations	3.57	1	1.89			
PES-NWI Composite	30.89	1	5.58	1.04	1	1.02
Work-related Burnout						
Gender	1.25	2	1.06	1.32	2	1.07
Age	3.23	1	1.80	1.75	1	1.32
Year in RN	4.27	1	2.07			
Year in Hospital	2.27	1	1.51	1.67	1	1.29
Race	1.25	2	1.06	1.23	2	1.05
Marital Status	1.37	2	1.08	1.39	2	1.09
Nurse Participation in Hospital Affairs	7.79	1	2.79			
Nursing Foundation for Quality Care	4.74	1	2.18			
Nurse Manager Ability, Leadership, and Support	.	1	.			
Staffing and Resources Adequacy	5.02	1	2.24			
Collegial Nurse-Physician Relations	3.57	1	1.89			
THE PES-NWI Composite	30.89	1	5.55	1.04	1	1.02
Client-related Burnout						
Gender	1.25	2	1.06	1.32	2	1.07
Age	3.23	1	1.80	1.75	1	1.32
Year in RN	4.27	1	2.07			
Year in Hospital	2.27	1	1.51	1.67	1	1.29
Race	1.25	2	1.06	1.23	2	1.05
Marital Status	1.37	2	1.08	1.39	2	1.09
Nurse Participation in Hospital Affairs	7.73	1	2.79			
Nursing Foundation for Quality Care	4.74	1	2.18			
Nurse Manager Ability, Leadership, and Support	.	1	.			
Staffing and Resources Adequacy	5.02	1	2.24			
Collegial Nurse-Physician Relations	3.57	1	1.89			
PES-NWI Composite	30.85	1	5.56	1.04	1	1.02

Note. GIVF = Generalized Variance Inflation Factor

Specific Aim 2A: To determine whether each variable with the resources category (work environment, gender, marital status, age, race, years of nursing experience, and years in current hospital) is related to nurse burnout.

As shown in the Pearson Correlation Matrix (Table 23), the age of nurses in years is negatively and statistically correlated to Personal Burnout (r = -.213), Work-related Burnout (r = -.211), Client-related Burnout (r = -.166), Nursing Foundation for Quality Care (r = -.078), and Nurse Participation in Hospital Affairs (r = -.080) ($p < .05$), which means older nurses have lower burnout in all dimension, and they scored lower in Nursing Foundation for Quality of Care, and Nurse Participation in Hospital Affairs. Age is positively correlated to years in nursing (r = .817) and years worked in current hospital (r = .628) ($p < .05$).

Years of nursing experience is negatively and statistically significantly correlated to Personal Burnout (r = -.171), Work-related Burnout (r = -.152), Client-related Burnout (r = -.097), and Nursing Foundation for Quality Care (r = -.069); however, older nurses perceived higher Staffing and Resource Adequacy (r = .076) ($p< .05$). Years worked in current hospital is also negatively correlated to Personal Burnout (r = -.102) and Work-related Burnout (r = -.074) and is positively correlated to Staffing and Resources Adequacy (r = .069) ($p< .05$). Personal, Work-related, and Client-related Burnout are negatively and significantly correlated with all dimensions of the PES-NWI (Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, Collegial Nurse-Physician Relations), including the composite score ($p<.05$). Personal and Work-related

Burnout are associated with Nurse Participation in Hospital Affairs, Nursing Foundation for Quality Care, Nurse Manager Ability, Leadership, and Support, and Collegial Nurse-Physician Relations with a medium effect size (r = 0.3-0.4), while associated with Staffing and Resources Adequacy and the PES-NWI composite score with a large effect size (r > 0.5). Client-related Burnout is associated with all PES-NWI dimensions, including the composite score, with a medium effect size. All burnout dimensions are positively significantly associated with each of other burnout dimensions with a large effect size (r = 0.6-0.9). Furthermore, each subscale of the PES-NWI has a significant positive association with every other subscale of the PES-NWI with a large effect size (r = 0.5-0.9).

Table 23

Pearson Correlation Matrix of All Continuous Variables

Variables	1	2	3	4	5	6	7	8	9	10	11
1.Age	1										
2.Years of Nursing Experience	.817**	1									
3.Years in Current Hospital	.628**	.737**	1								
4.Personal Burnout	-.213**	-.171**	-.102**	1							
5.Work-related Burnout	-.211**	-.152**	-.074*	.858**	1						
6.Client-related Burnout	-.166**	-.097**	-.050	.619**	.729**	1					
7. Collegial RN-MD Relations	-.013	.010	.047	-.284**	-.331**	-.244**	1				
8. Nursing Foundation for Quality Care	-.078*	-.069*	-.044	-.392**	-.442**	-.361**	.623**	1			
9. Nurse Manager Ability and Leadership	-.008	.010	.008	-.402**	-.445**	-.287**	.496**	.652**	1		
10. Nurse Participation in Hospital Affairs	-.080*	-.038	-.005	-.394**	-.433**	-.328**	.559**	.809**	.737**	1	
11. Staffing and Resources Adequacy	.021	.076*	.069*	-.502**	-.573**	-.392**	.505**	.588**	.568**	.588**	1
12. PES-NWI Composite	-.033	.004	.023	-.483**	-.544**	-.390*	.754**	.867**	.844**	.884**	.801**

Note. *Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

For categorical variables with more than two levels, such as gender, race, and marital status, ANOVAs were performed to compare each dimension of burnout across the groups. All burnout dimensions are statistically different between genders (*p* and *FDR* < .0001) (Table 13). Groups that preferred not to disclose their gender reported higher burnout scores compared to those who were female or male. Eta Squared was calculated for the effect size. Gender has a small effect on Personal Burnout (η^2 = 0.024), Work-related Burnout (η^2 = 0.024), and Client-related Burnout (η^2 = 0.020) (Table 24).

Table 24

Burnout Scores by Gender and Comparing between Gender (ANOVA)

Gender	Personal Burnout		Work-related Burnout		Client-related Burnout	
	Mean (SD)	Med	Mean (SD)	Med	Mean (SD)	Med
Prefer not to disclose	75.79 (18.14)	75.00	77.86 (17.82)	80.36	62.08 (28.61)	62.50
Female	56.39 (21.13)	58.33	54.09 (22.25)	53.57	37.87 (24.90)	33.33
Male	50.85 (21.87)	50.00	52.04 (23.57)	50.00	41.38 (26.87)	41.67

Compare Between Genders: ANOVA

		SS	df	MS	F	p	FDR	η^2
Personal Burnout	Between Groups	10366.1	2	5183.07	11.592	<.0001	0.0005	0.024
	Within Groups	412695.6	923	447.12				
	Total	423061.7	925					
Work-related Burnout	Between Groups	11600.5	2	5800.22	11.658	<.0001	0.0005	0.024
	Within Groups	459212.0	923	497.52				
	Total	470812.5	925					
Client-related Burnout	Between Groups	12156.5	2	6078.27	9.592	<.0001	0.0005	0.020
	Within Groups	584899.2	923	633.69				
	Total	597055.7	925					

Note. SS = Sum of Squares; MS = Mean Square; FDR = False Discovery Rate; η^2 = Eta Squared; Med =Median

Nurses who were white reported having higher Personal burnout scores compared to those who were either Black or 'Other', whereas other groups reported higher Work-related and Client-related Burnout compared to those who were either white or black. Race is statistically different in Work-related and Client-related Burnout (*p* or *FDR* < .05). However, these three groups (White, Black, and 'Other') do not show a statistically significant difference in Personal Burnout (*p* or *FDR* > .05) (Table 14). Eta Squared was

calculated for the effect size. Race has a small effect on Personal Burnout (η^2 = 0.005), Work-related Burnout (η^2 = 0.009), and Client-related Burnout (η^2 = 0.009) (Table 25).

Table 25

Burnout Scores by Race and Comparing between Race (ANOVA)

Race	Personal Burnout		Work-related Burnout		Client-related Burnout	
	Mean (SD)	Med	Mean (SD)	Med	Mean (SD)	Med
White	56.92 (20.62)	58.33	54.96 (22.27)	53.57	39.55 (25.30)	37.50
Black or African American	51.98 (23.43)	54.17	48.41 (23.01)	23.01	31.97 (24.32)	29.17
Other	55.69 (24.87)	58.33	56.93 (23.67)	55.36	39.99 (26.73)	33.33

Compare Between Races: ANOVA

		SS	df	MS	F	p	FDR	η^2
Personal Burnout	Between Groups	2236.9	2	1118.45	2.453	.087	0.1218	0.005
	Within Groups	420824.8	923	455.93				
	Total	423061.7	925					
Work-related Burnout	Between Groups	4453.3	2	2226.66	4.407	.012	0.0229	0.009
	Within Groups	466359.2	923	505.27				
	Total	470812.5	925					
Client-related Burnout	Between Groups	5342.8	2	2671.39	4.167	.016	0.0280	0.009
	Within Groups	591712.9	923	641.08				
	Total	597055.7	925					

Note. SS = Sum of Squares; MS = Mean Square; FDR = False Discovery Rate; η^2 = Eta Squared; Med =Median

Table 26 shows means and standard deviations of burnout scores in each dimension by marital status. Nurses who were in the 'Other' group reported higher Personal and Work-related Burnout (Personal: *mean* = 59.65, *SD* = 22.67; Work-related: *mean* = 59.41, *SD* = 25.59) compared to those who were Married (Personal: *mean* = 54.64, *SD* = 21.31; Work-related: *mean* = 52.23, *SD* = 22.45) or Single (Personal: *mean* = 58.39, *SD* = 21.15; Work-related: *mean* = 57.18, *SD* = 21.94), while nurses who were single reported having higher Client-related Burnout. All dimensions of burnout have statistically significant differences between nurses who were married, single, and other (*p or FDR* < .05). Eta Squared was calculated for the effect size. Marital status has a small effect on Personal Burnout (η^2 = 0.008), Work-related Burnout (η^2 = 0.013), and Client-related Burnout (η^2 = 0.010) (Table 26).

Table 26

Burnout Scores by Marital Status and Comparing between Marital Status (ANOVA)

Marital Status	Personal Burnout		Work-related Burnout		Client-related Burnout	
	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
Married/remarried	54.64 (21.31)	58.33	52.23 (22.45)	53.57	36.57 (25.29)	33.33
Single/Divorced	58.39 (21.15)	58.33	57.18 (21.94)	57.14	41.98 (25.21)	37.50
Other	59.65 (22.67)	62.50	59.41 (25.59)	60.71	40.55 (26.02)	35.00

Compare Between Marital Status: ANOVA

		SS	df	MS	F	p	FDR	η^2
Personal Burnout	Between Groups	3501.3	2	1750.65	3.851	0.022	0.0355	0.008
	Within Groups	419560.4	923	454.56				
	Total	423061.7	925					
Work-related Burnout	Between Groups	6332.6	2	3166.32	6.292	0.002	0.0084	0.013
	Within Groups	464479.8	923	503.23				
	Total	470812.5	925					
Client-related Burnout	Between Groups	6239.2	2	3119.58	4.874	0.008	0.0210	0.010
	Within Groups	590816.6	923	640.11				
	Total	597055.7	925					

Note. SS = Sum of Squares; MS = Mean Square; FDR = False Discovery Rate; η^2 = Eta Squared

Specific Aim 2B : To determine whether all resources (gender, age, years in nursing, years in hospital, race, marital status, PES-NWI) are related to nurse burnout.

As a result of the multicollinearity check, gender, age, year in current hospital, race, marital status, and the PES-NWI composite score are included as predictors in three models to predict Personal, Work-related, and Client-related Burnout (Table 27). Linear mixed models for nurses nested within hospital were performed for each outcome. For Personal Burnout, the model explains 30.28 % of the variability of the predictors around its mean. Gender, age, years in current hospital, race, and the PES-NWI composite are statistically significant predictors for Personal Burnout ($p < .05$) (Type III test in Table 28). However, only age has a medium effect ($\eta^2_{partial} = 0.06$), and the PES-NWI composite has a large effect ($\eta^2_{partial} = 0.25$) in the model (Table 17). According to the estimated model coefficients, after adjusting for other predictors, a 10-year increase in

age is associated with an average decrease in Personal Burnout of 4.3 points, and a unit point increase in PES-NWI (for example, from a score of 2 to a score of 3) is associated with a 17.22 average decrease in Personal Burnout score.

The model of Work-related Burnout explains 36.94% of the variability of the predictors around its mean. Gender, age, years in current hospital, race, marital status, and PES-NWI composite are statistically significant predictors for Work-related Burnout ($p < .05$) (Type III test in Table 28). However, only age has a medium effect ($\eta^2_{partial} = 0.08$), and the PES-NWI composite has a large effect ($\eta^2_{partial} = 0.32$) in the model (Table 28). According to the estimated model coefficients, after adjusting for other predictors, a 10-year increase in age is associated with an average decrease in Work-related Burnout of 5.1 points, and a unit point increase in PES-NWI is associated with a 20.34 average decrease in Work-related Burnout score.

The model of Client-related Burnout explains 20.42 % of the variability of the predictors around its mean. Gender, age, year in current hospital, race, marital status, and the PES-NWI composite are statistically significant predictors for Client-related Burnout ($p < .05$) (Type III test in Table 28). However, the PES-NWI composite has a large effect ($\eta^2_{partial} = 0.15$) in the model (Table 28). According to the estimated model coefficients, after adjusting for other predictors in the model, a unit point increase in PES-NWI is associated with a 16.26 average decrease in Client-related Burnout score.

The components of the random effect variances are of interest when calculating the intraclass-correlation coefficient (ICC). The ICC is calculated by dividing the between -group-variance (hospital level variance in this case) by the total variance (sum of between-group-variance and within-group variance; sum of hospital level variance and

residual variance in this case). For example, the ICC for Personal Burnout linear mixed model is 6.171/(6.171+312.778) = 0.019 (Table 27). ICC is meaningful to understand how much of the overall variation in the response is explained by clustering. Three ICCs for linear mixed models are 0.019, 0.036, and 0.023 for each burnout outcome; Personal, Work-related, and Client-related Burnout, respectively. These ICC estimates indicate the proportion of the total variance in each Burnout that is accounted for by the clustering (hospital level). Therefore, 1.9% of the variance of the Personal Burnout can be attributed to hospital memberships, 3.6% of the variance of the Work-related Burnout can be attributed to hospital memberships, and 2.3 % of the variance of the Client-related Burnout can be attributed to hospital memberships.

Table 27

Summary of Linear Mixed Model for Variables Predicting Personal, Work-related, and Client-related Burnout (N = 886)

Variable	Personal Burnout			Work-related Burnout			Client-related Burnout		
	B	*SE(B)*	*t value*	*B*	*SE B*	*t value*	*B*	*SE(B)*	*t value*
Intercept	116.53	5.52	21.13***	129.41	5.53	23.42***	100.20	6.99	14.34***
Gender (Prefer not to disclose)	14.58	5.32	2.74**	12.11	5.31	2.28*	15.46	6.74	2.30*
Gender (Female)	6.77	2.01	3.38**	3.86	2.00	1.93	-2.43	2.54	-0.96
Gender (Male)		*Reference*			*Reference*			*Reference*	
Age	-0.43	0.06	-7.07***	-0.51	0.06	-8.36***	-0.44	0.08	-5.62***
Year in Hospital	0.20	0.09	2.26*	0.37	0.09	4.16***	0.36	0.11	3.13**
Race (White)	3.91	2.34	1.67	1.85	2.33	0.796	4.00	2.96	1.35
Race (Black)	-0.97	2.87	-0.34	-5.10	2.86	-1.78	-4.40	3.63	-1.21
Race (Other)		*Reference*			*Reference*			*Reference*	
Marital Status (Married)	-6.90	3.21	-2.15*	-7.52	3.20	-2.35*	-5.70	4.07	-1.40
Marital Status (Single)	-6.10	3.30	-1.85	-5.34	3.29	-1.62	-1.96	4.18	-0.47
Marital Status (Other)		*Reference*			*Reference*			*Reference*	
PES-NWI Composite	-17.22	1.00	-17.17***	-20.34	1.01	-20.22***	-16.26	1.27	-12.79***
Estimate of Covariance Parameters	Estimates	Std. Error		Estimates	Std. Error		Estimates	Std. Error	
Residual	312.778	15.093		309.124	14.97		500.460	24.168	
Intercept (Hospital Level) Variance	6.171	5.010		11.620	7.31		11.632	8.796	
R^2	0.3028			0.3694			0.2042		
ICC for Linear Mixed Model	0.019			0.036			0.023		

*$p < .05$. **$p < .01$ ***p< .0001

Table 28

Type III Test and Effect Size for Multiple Regression (Partial Eta^2) for Burnout

Variable	Personal Burnout		Work-related Burnout		Client-related Burnout	
	F test	Partial Eta^2	F test	Partial Eta^2	F test	Partial Eta^2
Gender	7.305**	0.0163	3.443*	0.0072	4.151*	0.0099
Age	49.929***	0.0596	69.862***	0.0816	31.52***	0.0439
Year in Hospital	5.123*	0.0058	17.284***	0.0185	9.778**	0.0119
Race	4.026*	0.0089	6.298**	0.0131	6.123**	0.0122
Marital Status	2.358	0.0051	3.644*	0.0084	3.068*	0.0084
THE PES-NWI Composite	249.930***	0.2547	409.003***	0.3198	163.59***	0.1495

*p<.05, **p<.01, ***p<.0001

Specific Aim 3: To examine whether there is a relationship between nurse burnout and medication administration errors and patient safety grade among hospital-based nurses

The average number of self-reported medication errors in the last three months reported by the nurses was 2.13 - (*SD* = 3.68) with a median of 1. A majority of nurses reported patient safety grade as very good (*n* = 438, 47.3%). Patient safety grade was grouped into three categories as follows: the two lowest response categories (poor and failing) were combined as negative responses, the two highest response categories (excellent and very good) were combined as positive responses, and the midpoint of the scale was reported as a separate, neutral category (Acceptable) (Sorra et al., 2016). As a combined percentage, the three categories of patient safety grade were classified as positive, neutral, and negative perception. Most nurses rated their patient safety grade as positive (69.5%), while 25.2% and 5.3% rated as neutral and negative, respectively (Table 29).

Table 29

Descriptive Medication Administration Errors and Patient Safety Grades

Characteristics	Mean (SD)	Median	Min - Max
Medication Errors (n = 848)	2.13 (3.68)	1.00	0-40
Patient Safety Grade (n = 926)	**Frequency**	**Percentage**	**Combined Percentage**
Excellent	206	22.2	69.5% Positive
Very Good	438	47.3	
Acceptable	233	25.2	25.2% Neutral
Poor	41	4.4	
Failing	8	0.9	5.3% Negative
Missing	2		

The normality of distribution was assessed by the Shapiro-Wilk test. The medication administration error variable did not meet the normality distribution (*Shapiro-Wilk* test = 0.606, $p < .0001$). The Q-Q plots show that the points are not forming a line that is roughly straight (Figure 11). However, the Central Limit Theorem (CLT) states that given a large sample size from a population with a finite level of variance, the sampling distribution of a sample mean (the parameter of interest) will be normally distributed (Rosner, 2017). This property also applies to regression coefficients from models estimated with maximum likelihood methods. Therefore, violations from the normality assumption are not expected to be problematic due to the large sample size.

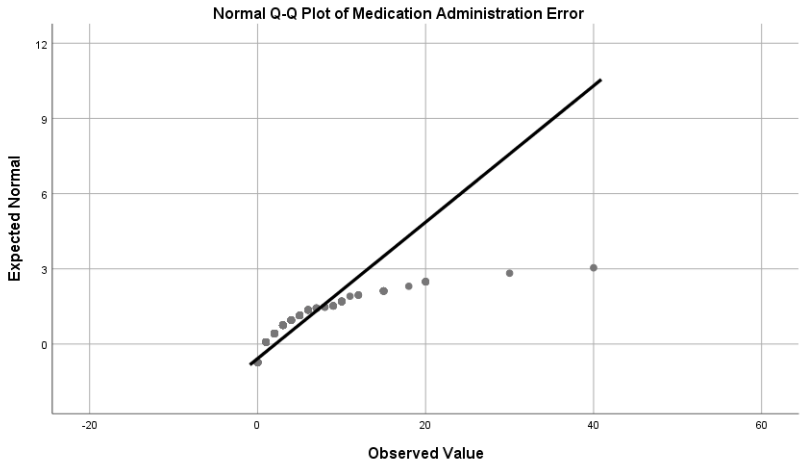

Figure 11. Normal Q-Q Plot for Medication Administration Error

To check collinearity between predictors, the GVIF was performed by having gender, age, years as an RN, years worked in hospital, race, marital status, Personal Burnout, Work-related Burnout, and Client-related Burnout as predictors, and self-reported medication administration errors as the outcome. The findings are shown in Table 30. The GVIF is below 4.0, indicating that the multicollinearity assumption is met. Years in RN and work-related burnout are highly collinear in all predictor models. Also, Personal Burnout, Work-related Burnout and Client-related Burnout are highly positively associated. Therefore, years as an RN was removed from the model, and each burnout dimension was tested separately in three models: revised model A, revised model B, and revised model C (Table 30).

Table 30

The Collinearity Statistics for Overall Model and after Separating each of the CBI Dimensions and Years in RN was Removed from the Models

Outcome / Predictors	All Predictors			Revised Model A			Revised Model B			Revised Model C		
	GVIF*	df	$GVIF^{1/2(p)}$	GVIF*	df	$GVIF^{1/2(p)}$	GVIF*	df	$GVIF^{1/2(p)}$	GVIF*	df	$GVIF^{1/2(p)}$
Medication Administration Error												
Gender	1.29	2	1.07	1.30	2	1.07	1.30	2	1.07	1.30	2	1.07
Age	3.25	1	1.80	1.77	1	1.33	1.80	1	1.34	1.77	1	1.33
Year of Nursing Experience	4.10	1	2.02									
Year in Current Hospital	2.17	1	1.47	1.63	1	1.28	1.64	1	1.28	1.64	1	1.28
Race	1.22	2	1.05	1.24	2	1.06	1.24	2	1.06	1.24	2	1.06
Marital Status	1.37	2	1.08	1.36	2	1.08	1.36	2	1.08	1.37	2	1.08
Personal Burnout	3.96	1	2.00	1.08	1	1.04						
Work-related Burnout	5.18	1	2.28				1.10	1	1.05			
Client-related Burnout	2.25	1	1.50							1.09	1	1.04

Note. GIVF: Generalized Variance Inflation Factor

Specific Aim 3A: To examine whether there is a relationship between nurse burnout and medication administration errors among Alabama hospital-based nurses.

As a result of the multicollinearity check, gender, age, years in current hospital, race, marital status, and personal burnout are included as predictors in Revised Model A to predict nurse-reported unit-based medication administration errors (Table 30). Personal Burnout is statistically a significant predictor of medication administration errors after adjusting for gender, age, years in current hospital, race, and marital status ($t = 3.758$, $p < .0001$) (Table 31). Type III test also supports that Personal Burnout is the only significant predictor of medication administration error ($F_{test} = 14.123$, $p < .001$) (Table 32). For every 10 unit increase in Personal Burnout score, it is expected that medication administration errors will increase by a factor of 0.2 in a three-month period. However, personal burnout has a small effect ($\eta^2_{partial} = 0.02$) on the model.

Gender, age, years in current hospital, race, marital status, and Work-related Burnout are included as predictors in Revised Model B to predict medication administration errors (Table 30). Work-related Burnout is a statistically significant predictor of medication administration errors after adjusting for gender, age, years in current hospital, race, and marital status ($t = 4.229$, $p < .0001$) (Table 31). Type III test results also support that in this model, Work-related Burnout is the most significant predictor of medication administration error ($F_{test} = 17.883$, $p < .001$) (Table 32). For every 10 unit increase in Work-related Burnout score, it is expected that medication administration errors will increase by a factor of 0.3 in a three-month period. However, Work-related Burnout has a small effect (= 0.02) on the model.

Revised Model C includes gender, age, years in current hospital, race, marital status, and Client-related Burnout as predictors to estimate self-reported medication administration error (Table 30). Client-related Burnout is statistically a significant predictor of medication administration error after adjusting for gender, age, year in current hospital, race, and marital status ($t = 2.480$, $p < .05$) (Table 31). Type III test results also support that Client-related Burnout is a significant predictor of medication administration error ($F_{test} = 6.152$, $p < .05$) (Table 32). For every 10 unit increase in Client-related Burnout score, it is expected that medication administration errors will increase by a factor of 0.1 in a three-month period. However, client-related burnout has a small effect ($\eta^2_{partial} = 0.007$) on the model.

ICC is meaningful to understand how much of the overall variation in the medication administration error is explained by hospital level (clustering). Three ICCs for linear mixed models are 0.014, 0.018, and 0.025 for Revised Model A, B and C respectively. These ICC estimates indicate the proportion of the total variance in each model (Revised Model A, B and C) that is accounted for by the clustering (hospital level). Therefore, 1.4 % of the variance of the Revised Model A can be attributed to hospital memberships, 1.8 % of the variance of the Revised Model B can be attributed to hospital memberships, and 2.5 % of the variance of the Revised Model C can be attributed to hospital memberships.

Table 31

Linear Mixed Model Analysis for Medication Administration Errors: Estimates of Fixed Effects

Variable	Revised Model A			Revised Model B			Revised Model C		
	B	*SE(B)*	*t value*	*B*	*SE B*	*t value*	*B*	*SE(B)*	*t value*
Intercept	*1.32*	*1.10*	*1.206*	1.12	1.10	1.025	2.23	1.06	2.103*
Gender (Prefer not to disclose)	-1.82	1.14	-1.601	-1.86	1.13	-1.644	-1.51	1.14	-1.329
Gender (Female)	-0.89	0.44	-2.024	-0.79	0.44	-1.827	-0.71	0.44	-1.619
Gender (Male)		*Reference*			*Reference*			*Reference*	
Age	0.001	0.01	0.64	0.01	0.01	0.769	-0.01	0.01	-0.219
Year in Hospital	0.16	0.02	0.839	0.01	0.02	0.550	0.01	0.02	0.775
Race (White)	0.02	0.51	0.045	0.05	0.51	0.096	0.07	0.51	0.130
Race (Black)	-1.01	0.63	-1.603	-0.93	0.63	-1.479	-0.98	0.63	0.504
Race (Other)		*Reference*			*Reference*			*Reference*	
Marital Status (Married)	0.15	0.69	0.221	0.12	0.68	0.174	0.07	0.69	0.103
Marital Status (Single)	0.47	0.70	0.663	0.39	0.70	0.558	0.36	0.71	0.504
Marital Status (Other)		*Reference*			*Reference*			*Reference*	
Personal Burnout	0.02	0.01	3.758***						
Work-related Burnout				0.03	0.01	4.229***			
Client-related Burnout							0.01	0.01	2.480*
Estimate of Covariance Parameters	Estimates	Std. Error		Estimates	Std. Error		Estimates	Std. Error	
Residual	13.435	.686		13.352	0.681		13.503	0.689	
Intercept (Hospital Level) Variance	0.197	0.311		0.241	0.328		0.344	0.359	
ICC	0.014			0.018			0.025		

*$p < .05$. **$p < .01$ ***p< .0001

Table 32

Type III Test and Effect Size for Multilevel Mixed Model Regression (Partial Eta^2) for Medication Administration Error

Variable	Revised Model A		Revised Model B		Revised Model C	
	F test	Partial Eta^2	F test	Partial Eta^2	F test	Partial Eta^2
Gender	2.537	0.0060	2.290	0.0059	1.684	0.0044
Age	0.004	0.0001	0.086	0.0003	0.048	<0.0001
Year in Hospital	0.703	0.0006	0.358	0.0002	0.601	0.0004
Race	2.832	0.0070	2.531	0.0064	2.864	0.0073
Marital Status	0.677	0.0016	0.501	0.0012	0.514	0.0012
Personal Burnout	14.123***	0.0185				
Work-related Burnout			17.883***	0.0228		
Client-related Burnout					6.152*	0.0071

*$p < .05$. **$p < .01$ ***p< .0001

Specific Aim 3B: To examine whether there is a relationship between nurse burnout and patient safety grade ratings among Alabama hospital-based nurses.

Patient safety grade was organized into three categories of positive, neutral, and negative perceptions. To address whether there is a relationship between nurse burnout and patient safety grade among hospital-based nurses, an ordinal mixed model analysis was conducted with gender, age, years in current hospital, race, marital status, and each burnout dimension as independent variables. Therefore, the results of the three models show as Model I, Model II, and Model III.

Model I is an ordinal mixed model with gender, age, year in current hospital, race, marital status, and Personal burnout (Table 33). The overall model significantly predicted patient safety grade (χ_9^2= 140.50, $p < .0001$), and explains 13.3 % of the variability of the

predictors (Table 22). Race and Personal burnout are statistically significant predictors for patient safety grade ($p < .05$). To obtain odds ratios, the estimated coefficient values (*Bs*) were exponentiated. Race(Black): exp(-0.617) = 0.54 (*95%CI* = 0.33-0.88), which means that Black nurses reported lower patient safety than White nurses; i.e., among nurses who were Black, the odds of reporting higher level of patient safety grade were 0.54 times the odds of those who were White, given that all other variables in the model are held constant. Race(Other): exp(-0.573) = 0.56 (*95%CI* = 0.32-0.99), which means that nurses who reported 'Other' race reported lower patient safety than White nurses; i.e., among nurses who were 'Other' race, the odds of reporting higher level of patient safety grade were 0.56 times the odds of those who were White, given that all other variables in the model are held constant. Personal Burnout: exp(-0.045) = 0.96 (*95%CI* = 0.95-0.97) which means that the odds of reporting higher levels of patient safety decrease as Personal Burnout increases. Explained in another way, the odds of reporting higher patient safety levels among nurses with a 10 unit increase from the mean in Personal Burnout [exp(-0.045*10) = 0.64], is 0.64 times the odds of those at the mean Personal Burnout (*OR*=.64), assuming that all other variables in the model are held constant (Table 33). Estimated threshold coefficients show intercepts ($\beta_{0)}$ for the following formulas:

$$\text{Log Odd}\left(\frac{Positive}{Neutral + Negative}\right) \sim \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 \quad (1)$$

Or

$$\text{Log Odd}\left(\frac{Neutral + Positive}{Negative}\right) \sim \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 \quad (2)$$

These intercepts are the log odds of respective outcome categories (Positive, or Neutral + Positive) when all other predictors take the value of zero. Pseudo Eta^2 was calculated for each predictor and shown in Table 34. Personal Burnout has a medium

effect size on patient safety grade (*Pseudo Eta*^{2} = 0.129), whereas other predictors have a lower than small effect size (*Pseudo Eta*^{2} < 0.01).

Model II is an ordinal mixed model consisting of gender, age, years in current hospital, race, marital status, and Work-related burnout (Table 33). The overall model significantly predicts patient safety grade (χ_9^2 = 162.99, p < .0001), and the predictors explain 14.9 % of the variability in patient safety grade (Table 33). Age, years in current hospital, race (Black), and work-related burnout are significant predictors in the patient safety grade model (p < .05). Age: exp(-0.021) = 0.98 (*95%CI* = 0.96-0.99) which means that the odds of reporting higher levels of patient safety decrease as age increases. With an increase of one year working in a hospital is associated with an increase in the odds of 1.03 reporting higher patient safety grade. Race(Black): exp(-0.723) = 0.49 (*95%CI* = 0.30-0.80), which means that Black nurses reported lower patient safety than White nurses; i.e., among nurses who were Black, the odds of reporting higher level of patient safety grade were 0.49 times the odds of those who were White, given that all other variables in the model are held constant.

Finally, Work-related Burnout: exp(-0.047) = 0.954, which means that the odds of reporting higher levels of patient safety decrease as Work-related Burnout increases. Explained in another way, the odds of reporting higher patient safety levels among nurses with a 10 unit increase from the mean in Work-related Burnout [$\exp^{(-0.047\times10)}$) = 0.63], is 0.63 times the odds of those at the mean Burnout (*OR* = 0.63), assuming that all other variables in the model are held constant (Table 33). Estimate threshold coefficients show intercepts ($\beta_{0)}$ for the above formula (1) and (2). Pseudo Eta^2 was calculated for each predictor and is shown in Table 34. Work-related Burnout and race have a medium effect

size on patient safety grade (*Pseudo Eta*^{2} = 0.145, 0.01 respectively), whereas other predictors have a lower than small effect size (*Pseudo Eta*^{2} < 0.01).

Model III is an ordinal mixed model with gender, age, years in current hospital, race, marital status, and client-related burnout. The overall model significantly predicts patient safety grade (χ_9^2= 88.16, $p < .0001$), and explains 7 % of the variability of the patient safety grade (Table 33). Race (Black) and Client-related Burnout are significant predictors in the patient safety grade model ($p < .05$) (Type III test in Table 34). Race(Black): exp(-0.654) = 0.52 (*95%CI* = 0.32-0.84), which means that Black nurses reported lower patient safety than White nurses; i.e., among nurses who were Black, the odds of reporting higher level of patient safety grade were 0.52 times the odds of those who were White, given that all other variables in the model are held constant.

Furthermore, Client-related Burnout: exp(-0.026) = 0.97 (*95%CI* = 0.96-0.98). which means that the odds of reporting higher levels of patient safety decrease as Client-related Burnout increases. Explained in another way, the odds of reporting higher patient safety levels among nurses with a 10 unit increase from the mean in Client-related Burnout [exp(-0.026*10)= 0.77], is 0.77 times the odds of those at the mean Burnout (*OR* = 0.77), assuming that all other variables in the model are held constant (Table 33). Estimate threshold coefficients show intercepts ($\beta_{0)}$ for the above formula (1) and (2). Pseudo Eta^2 was calculated for each predictor and shown in Table 34. Client-related burnout has a small to medium effect size on patient safety grade (*Pseudo Eta*^{2} = 0.066), while other predictors have a lower than small effect size (*Pseudo Eta*^{2} < 0.01).

Table 33

Ordinal Mixed Model Analysis for Patient Safety Grade: Estimates of Fixed Effects

Variable	Model I				Model II				Model III			
	B	*SE(B)*	*OR*	*z value*	*B*	*SE B*	*OR*	*z value*	*B*	*SE(B)*	*OR*	*z value*
Gender (Prefer not to disclose)			*Reference*				*Reference*				*Reference*	
Gender (Female)	0.066	0.580	1.068	0.113	-0.066	0.580	0.936	-0.113	0.174	0.577	1.190	0.301
Gender (Male)	-0.362	0.625	0.696	-0.579	-0.331	0.624	0.718	-0.531	0.130	0.613	1.139	0.212
Age	-0.014	0.013	0.986	-1.730	-0.021	0.008	0.979	-2.495*	-0.008	0.008	0.992	-1.012
Year in Hospital	0.024	0.01	1.024	1.849	0.033	0.012	1.034	2.523*	0.024	0.013	1.024	1.889
Race (White)			*Reference*				*Reference*				*Reference*	
Race (Black)	-0.617	0.250	0.540	-2.464*	-0.723	0.252	0.485	-2.865**	-0.654	0.246	0.520	-2.655**
Race (Other)	-0.573	0.289	0.564	-1.984*	-0.549	0.290	0.578	-1.891	-0.538	0.281	0.584	-1.914
Marital Status (Married)			*Reference*				*Reference*				*Reference*	
Marital Status (Single)	-0.254	0.175	0.776	-1.447	-0.187	0.177	0.829	-1.057	-0.192	0.172	0.825	-1.119
Marital Status (Other)	0.181	0.423	1.198	0.428	0.301	0.428	1.351	0.704	0.129	0.411	1.138	0.313
Personal Burnout	-0.045	0.005	0.956	-10.137***								
Work-related Burnout					-0.047	0.004	0.954	-10.954***				
Client-related Burnout									-0.026	0.003	0.974	-8.080***
Threshold Coefficients:	*Estimate*		*Std.Error*	*z value*	*Estimate*		*Std.Error*	*z value*	*Estimate*		*Std.Error*	*z value*
Positive| (Neutral + Negative)	-3.944		0.775	-5.092	-4.284		0.775	-5.526	-1.908		0.706	-2.703
(Neutral + Positive)| Negative	-6.277		0.797	-7.873	-6.647		0.799	-8.323	-4.158		0.722	-5.763
Log-likelihood	-587.771				-576.530				-613.796			
Efron's Pseudo R^2, $\chi 2_{(df)}$	0.133, χ_9^2= 140.50***				0.149, χ_9^2 = 162.99***				0.070, χ_9^2= 88.16***			

*$p < .05$. **$p < .01$ ***p< .000

Table 34

Z Test/ $\chi^2(df)$ Test and Effect Size for Multilevel Ordinal Mixed Model (Pseudo Eta^2) for Patient Safety Grade

Variable	Model I		Model II		Model III	
	Z Test/ $\chi^2(df)$	Pseudo Eta^2	Z Test/ $\chi^2(df)$	Pseudo Eta^2	Z Test/ $\chi^2(df)$	Pseudo Eta^2
Gender	2.54 (2)	0.003	1.01 (2)	0.001	0.11 (2)	0.001
Age	1.73	0.006	2.5*	0.008	1.01	0.003
Year in Hospital	0.98	0.004	-2.52*	0.007	-1.89	0.005
Race	8.59 (2)*	0.009	10.19 (2)**	0.010	9.19 (2)*	0.008
Marital Status	2.53 (2)	0.002	1.91 (2)	0.001	1.91 (2)	0.001
Personal Burnout	10.14***	0.129				
Work-related Burnout			10.95***	0.145		
Client-related Burnout					8.08***	0.066

$^{*}p < .05$. $^{**}p < .01$ $^{***}p < .0001$

Summary

Chapter four of the dissertation study demonstrates validity and reliability of measurements of CBI and PES-NWI and contains the findings of the statistical analysis of to the three specific aims. Chapter five will include the summary for the analysis and discussion of the findings of the three specific aims.

CHAPTER 5

CONCLUSIONS, DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

A correlational design using a cross-sectional survey was used to investigate the influence of age, years of nursing experience, years in current hospital, race, marital status, gender, and the PES-NWI on nurse burnout and the association between nurse burnout and medication administration errors. This chapter presents an examination of the results of the study in the following sections: a) conclusion of the findings, b) discussion, c) implications, and d) recommendations.

Conclusion

A majority of Alabama nurses reported high Personal Burnout (60%), high Work-related Burnout (54%), and low to medium Client-related Burnout (72%). Burnout scores in each dimension are statistically different among hospitals and between rural and urban hospitals; however, there is no statistical difference in burnout scores between hospital regions and hospital sizes. All burnout dimensions are statistically correlated to age, years of nursing experience, years in current hospital, the five subscales of the PES-NWI (Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nurse Manager Ability, Leadership, and Support, Staffing and Resource Adequacy, Collegial Nurse-Physician Relations), the PES-NWI composite score, gender, and marital status. Race is only statistically significantly correlated with Work-related and Client-related

Burnout, but not with Personal Burnout. After performing the model analysis on each burnout dimension, the gender group that reported ‘prefer not to disclose’ younger age, longer hospital tenure, White race, ‘other’ marital status (neither married nor single group), and low PES-NWI composite scores, all are statically significant predictors of high burnout.

The average of medication administration errors occurring in participating units in the last three months was 2.13. Most participants rated positive perceptions (70%) of patient safety grade. Each burnout dimension is a statistically significant predictor of medication administration errors and patient safety grade after controlling for gender, age, years in current hospital, race, and marital status. High scores in each burnout dimension is associated with a higher number of medication administration errors reported in the last 3 months, along with a lower patient safety grade after including the control variables.

Discussion

The major findings of the study are discussed in this section along with findings related to research questions. This discussion includes sample characteristics, including age, gender, marital status, race, years of nursing experience; and burnout levels, including Personal, Work-, and Client-related Burnout; hospital characteristics, comprising regions, rural versus urban, and hospital size by bed count; and finally workplace characteristics, consisting of Nurse Participation in Hospital Affairs, Nursing Foundations for Quality Care, Nursing Manager, Ability, Leadership, and Support , Staffing and Resource Adequacy, and Collegial Nurse-Physician Relations. The second

section discusses reliability, including Cronbach's alpha and correlated item dimension correlation, as well as validity (confirmatory factor analysis). Finally, findings related to research questions are discussed.

Sample Characteristics.

Descriptive Findings of Participating Nurses. A total of 928 nurses were included in the study. The average age of nurses in this study is 39.49 years, which is younger than the national-level survey on the U.S. nursing workforce that reported the average age of RNs as 51 years (National Council of State Boards of Nursing, 2017). This average age is also younger than that of nurses who work in Florida (average age of 47 years) (Neff, Cimiotti, Heusinger, & Aiken, 2011), and younger than nurses who work in California (average age of 45 years) (California Board of Nursing, 2016). The national nursing workforce study recruited 148,684 RNs (National Council of State Boards of Nursing, 2017), while the Florida study recruited 10,832 nurses (Neff et al., 2011), and 4,178 nurses were recruited for the California nurse staff survey (California Board of Nursing, 2016). The majority of Alabama RNs are women (88%), but 10% are male, consistent with the national-level survey. The National Council of State Boards of Nursing (2017) reported that the number of male RNs grew from 6.6% in 2013, 8.0% in 2015, and 9.1% in 2017. So based upon these figures, Alabama has slightly more male RNs than the national average. Only 20% of RNs in this study reported belonging to minority groups, which includes 'other' and 'two or more races' and Black or African American. This is similar to the national nursing workforce study, which reported that 19% of RN respondents were minorities (National Council of State Boards of Nursing,

2017). The percent of Alabama RNs who are minorities is much smaller than of the overall minority population in the state. In Alabama, minorities comprise 31.6% of the state population. Of those, 26.5% of Black and 5.1% are 'other' (World Population Review, 2018). The average number of years employed in nursing is 12.11 years, which is lower when compared to a Pennsylvania state-wide nursing study that reported the average number of years in nursing as 13.8 (Aiken et al., 2002). Approximately two-thirds of California nurses were married or remarried (67%), and 33% were single or divorced (California Board of Nursing, 2016). Similarly, the majority of Alabama nurses are married or remarried (58%) and 37% are single or divorced.

Descriptive Findings of Hospitals. The American Hospital Association reported that 3,387 U.S. hospitals (64%) are urban hospitals and 1,875 U.S. hospitals (36%) are rural hospitals (American Hospital Association, 2019). In Alabama, out of a total of 125 acute care hospitals, 66 hospitals are considered as rural (52.8%) and 59 hospitals are urban (47.2%). In this study, urban hospitals (n = 32, 76%) outnumber rural hospitals (n = 10, 24%). In a Texas workforce study, 79% of nurses worked in urban areas and 21% worked in rural areas (McBride, Tietze, Hanley, & Thomas, 2017), whereas in this study, 95% of nurses worked in urban hospitals and only 5% worked in rural ones. This could be because the largest medical centers in Alabama are all located in urban-designated counties, and they employ many more nurses than do rural hospitals.

In a Pennsylvania state-wide study, there were 41 small hospitals (24%), 95 medium hospitals (57%), and 32 large hospitals (19%) (Aiken et al., 2002), while in Alabama, there are 8 small hospitals (19%), 11 medium hospitals (26%), and 23 large hospitals (55%). Most Pennsylvania nurses in the Aiken (2002) study worked for medium

hospitals (48%) and large hospitals (43%), whereas 83% of Alabama nurses in this study work for large hospitals, and 14% work for medium hospitals.

Descriptive Findings of the Workplace. For the overall study, the work environment subscales and composite scores are at or above the midpoint of 2.50 (Nurse Participation in Hospital Affairs: mean = 2.73, *SD* = 0.72; Nursing Foundations for Quality Care: *mean* = 3.08, *SD* = 0.60; Nurse Manager Ability, Leadership, and Support: *mean* = 2.82, *SD* = 0.86; Staffing and Resource Adequacy: *mean* = 2.50, *SD* = 0.87; Collegial Nurse-Physician Relations: *mean* = 3.07, *SD* = 0.70; and the composite: *mean* = 2.84, *SD* = 0.62). These mean scores are higher than the mean scores for nurses in Pennsylvania hospitals (Lake & Friese, 2006), nurses in military hospitals (Patrician et al., 2010), and Canadian nurses (Leiter & Laschinger, 2006); however, they are lower than the mean scores for nurses in Chinese Hospitals (Zhang et al., 2015), and vary in the Thai nurses' study (Table 24). This could represent cultural differences in perception of work environment or that the work environment in these countries is actually better. Even the mean scores for work environment varied differently compared with other states or countries; staffing adequacy and resources was consistently rated with the lowest scores in every study. This could be interpreted as the nurses' major concern with their respective work environments.

Table 35

Comparing Sample and PES-NWI Mean Scores for Each Subscale and Composite with Other Studies

Author	Sample (Nurse)	n	Nurse Participation in Organization Affairs	Nursing Foundation for Quality Care	Nurse Manager Ability, Leadership and Support	Staffing and Resources Adequacy	Collegial Nurse-Physician Relations	PES-NWI Composite Score
This Study	**Alabama**	**928**	**2.73**	**3.08**	**2.82**	**2.50**	**3.07**	**2.84**
Lake & Friese, 2006	Pennsylvania	10,962	2.30	2.81	2.36	2.18	2.75	2.48
Patrician et al., 2010	U.S. Military Hospitals	955	2.52	2.85	2.57	2.61	2.99	2.71
Lashinger & Leiter, 2006	Canada	8,560	2.38	2.71	2.46	2.24	2.82	NR
Zhang et al., 2015	China	9,698	3.18	3.35	3.37	3.14	3.50	NR
Nantsupawat et al., 2011	Thailand	5,247	2.81	2.94	2.80	2.70	3.09	2.87

Notes. NR = Not Reported

Reliability and Validity of Measurements.

CBI. Given the current study aims to explore the interrelationship of burnout, medication administration errors, and patient safety in practicing staff nurses, careful consideration needed to be given to the selection of a burnout measurement. The Maslach Burnout Inventory (MBI) is a popular measurement in the field, but is only available commercially (Maslach, 2001). The MBI aims to measure the experience of individuals who provide human services, and reflects symptoms related to Emotional Exhaustion, Depersonalization, and Personal Accomplishment (Maslach, Jackson, Leiter, Schaufeli, & Schwab1986). However, other researchers argue that the domains of Depersonalization and Personal Accomplishment do not pertain to burnout (Kristensen, Borritz, Villadsen, & Christensen, 2005). Furthermore, the MBI is unclear if burnout is a state of being, a coping strategy, or an effect (Kristensen et al., 2005).

In contrast, the three subscales of the CBI (Personal, Work-related, and Client-related Burnout) reflect an overarching concept of emotional and physical exhaustion according to its source, without introducing the concepts of depersonalization and personal accomplishment (Kristensen et al., 2005). Comparing MBI and CBI measurements, the CBI more accurately conceptualized burnout as a fatigue phenomenon, distinguishing among personal, work, and client factors, and is more suitable for use with health professionals because of the inclusion of client-related burnout, and has also had good reliability and validity (Winwood, & Winefield, 2004).

In the current study, the internal consistency of the three scales have Cronbach's alpha value of 0.91 for Personal Burnout, 0.89 for Work-related Burnout, and 0.92 for Client-related Burnout. These Cronbach's alphas are very similar to the Project on

Burnout, Motivation and Job Satisfaction (PUMA) study (N = 1,914), which was a comprehensive study that included a large number of psychosocial work environment factors evaluated by the Copenhagen Psychosocial Questionnaires, and which included a number of different jobs with varying degrees and types of client work (Kristensen et al., 2005). The Cronbach's alphas in the PUMA study were 0.87 for Personal Burnout, 0.87 for Work-related Burnout, and 0.85 for Client-related Burnout. The CBI also was validated in other countries, including Spain. The Cronbach's alphas in Spanish workers, including those in educational centers, social work centers, healthcare centers, and workers in the industry sectors (N = 479) were 0.90 for Personal Burnout, 0.83 for Work-related Burnout, and 0.82 for Client-related Burnout (Molinero-Ruiz, Gomez-Quintero, & Lluis, 2013). Adjusted item total correlations in the current study (range = 0.40 – 0.86) are also similar to the Spanish worker study (range = 0.39-0.83). The lowest correlation in both studies is item 10, "Do you have enough energy for family and friends during leisure time?" (corrected item in this study = 0.40; in Spanish workers study = 0.39). However, after deleting item 10 from the CBI measurement, Cronbach's alpha was not improved, and the CFA model fit deteriorated. Therefore, item 10 is maintained in all analyses. In conclusion, the internal consistency and factor structure of the 19-item set of the CBI are considered adequate for examining among staff nurses.

PES-NWI. The internal consistency of the five scales have Cronbach's alpha value of 0.90 for Nurse Participation in Hospital Affairs and Nurse Manager Ability and Leadership, 0.89 for Nursing Foundation for Quality of Care and Staffing and Resources Adequacy, and 0.87 for Collegial Nurse-Physician Relations. These Cronbach's alphas are higher than the Cronbach's alphas reported in the Development of the Practice

Environment Scale of the Nursing Work Index study that validated the PES-NWI among 1,610 nurses from Pennsylvania hospitals (Lake, 2002). Lake (2002) reported a Cronbach's alpha value of 0.83 Nurse Participation in Hospital Affairs, 0.80 for Nursing Foundations for Quality Care, 0.84 for Nurse Manager Ability, Leadership, and Support, 0.80 for Staffing and Resource Adequacy, 0.71 for Collegial Nurse-Physician Relations, and 0.82 for the PES-NWI composite. Furthermore, the PES-NWI was tested in other languages; for example, in Japanese (*Cronbach's alpha* = 0.78 – 0.86) (Ogata, Sasaki, Yumoto, Yonekura, Nagano, & Kanda, 2018), Chinese (*Cronbach's alpha* = 0.65 – 0.87) (Chiang, & Lin, 2009), and Icelandic (*Cronbach's alpha* = 0.67 – 0.82) (Gunnarsdottir, Clarke, Rafferty, & Nutbeam, (2009)) languages.

Lake (2002) also tested the CFA for 31 items of the PES-NWI. Even though one item (item 30 "Patient care assignments that foster continuity of care, i.e., the same nurse cares for the patient from one day to the next") in Lake's study (2002) had a low R^2 with its own subscale of $R^2 = 0.21$, however, all items were well represented within their separate subscale. In conclusion, the internal consistency and factor structure of the 31-item set of the PES-NWI are considered adequate for examining the practice environment among staff nurses.

Specific Aim 1:

To Describe Burnout Levels among Alabama Nurses Overall, by Hospital, Hospital Size (Bed Counts), Region, and Rural versus Urban

In this study, the majority of nurses report medium to high burnout in all dimensions (64% – 89%). Nurses had the highest burnout scores compared to physician assistants, physicians, administrative staff, and medical technicians in hospital-based

study with a total of 1,329 medical professionals in a regional hospital (Chou, Li, & Hu, 2014). Nurses who worked for U.S. hospitals seem to have had higher burnout scores (Personal burnout: *mean* = 56.26; Work-related burnout: *mean* = 54.40; Client-related burnout: *mean* = 38.75). The findings of this study can be compared to nurses who worked in Canadian hospitals (Personal burnout: *mean* = 50.20; Work-related burnout: *mean* = 51.70; Client-related burnout: *mean* = 21.33) (Bellicoso, Ralph, & Trudeau, 2014), Australian hospitals (Personal burnout: *mean* = 55.90; Work-related burnout: *mean* = 44.69; Client-related burnout: *mean* = 19.32) (Creedy, Sidebotham, Gamble, Pallant, & Fenwick, 2017), Mongolian hospitals (Personal burnout: *mean* = 45.39; Work-related burnout: *mean* = 44.45; Client-related burnout: *mean* = 32.46) (Bagaajav, Myagmarjav, Nanjid, Otgon, & Chae, 2011), and Indian hospitals (Personal burnout: *mean* = 36.33; Work-related burnout: *mean* = 28.25; Client-related burnout: *mean* = 24.61) (Divinakumar, Pookala, & Das, 2014). Therefore, nurses in current study seem to report higher burnout compare to nurses from Canadian, Australian, Mongolian, and Indian hospitals.

In general, the different nurse burnout mean scores between hospitals could be due to various organizational factors, including different shift length, different patient care requirements, and different work environments (Keyrel 2018). In this study, nurse burnout scores were different between hospitals, but not different between regions of the state. However, there are limited studies on the differences in nurse burnout scores between regions. Lindqvist, Smeds Alenius, Griffiths, Runesdotter, & Tishelman (2015) found that smaller hospitals were more positive about their work environments and quality of nursing care, which could lead to lower burnout scores in emotional exhaustion

and depersonalization; however, they claimed that these differences were also small. On the other hand, this study finds there are no differences in nurse burnout mean scores by hospital size in all three subscales of the CBI because the differences are very small; in this study, hospital size had a very small impact on nurse burnout. However, all dimensions of nurse burnout were significantly different based on urbanicity versus rurality in the current study. Rural nurses reported lower Personal, Work-related, and Client-related burnout. The Rural Nurse Job Satisfaction's study (Molinari & Monserud, 2008) reported that rural nurses indicated appreciation for work flexibility and scheduling independence, in addition to valuing autonomy and opportunities to make decisions regarding patient care. Baernholdt and Mark (2009) found that rural hospitals offered less complex technological procedures and equipment that urban hospitals which may lead to less work complexity. More work complexity was correlated to higher turnover rate which might be because nurses had less control over the patients assigned to them (Baernholdt & Mark, 2009). Furthermore, rural nurses had positive feelings about, and were satisfied with, their respective work environments (Molinari & Monserud, 2008). It could be that in rural hospitals, there is more of a sense of community among the staff.

Specific Aim 2:

To Determine Whether Resources (Condition and Personal Characteristics) are Related to Nurse Burnout

The main finding for this Aim is that gender, age, years in current hospital, race, and work environment are important predictors of all three nurse burnout dimensions. Marital status predicts work-related and client-related burnout but does not significantly

predict personal burnout. Work environment (PES-NWI composite) has the greatest impact on three nurse burnout dimensions. A study among nurses in Southeast Nigeria on burnout and related sociodemographic factors reported that sex, age, work environment, and work experience were not significantly related to nurse burnout. The reasons for different findings in this study and in the Ifeyinwa, et al. study (2019) could be that different measures were used with regard to burnout and the work environment. The Oldenburg Burnout Inventory (OLBI) was used to measure burnout based on exhaustion and disagreement dimensions in both work and academic contexts, whereas Personal Accomplishment was not included (Halbesleben, & Demerouti, 2005). The work environment in Ifeyinwa et al. study (2019) was defined as by public versus private hospital. The sample size is also different between studies. In this study, there are 928 nurses, whereas the Ifeyinwa et al. study (2019) included 393 nurses. More discussion on each predictor is below.

Gender. Gender is a significant predictor in each dimension of nurse burnout after adjusting for age, race, marital status, years in current hospital, and work environment; however, gender has a small impact in the model (*Partial eta*$^2 \leq 0.01$). Male nurses reported lower burnout for personal and work-related burnout than female nurses; however, male nurses reported higher client-related burnout than female nurses. This finding is similar to Cañadas-De et al. (2018) who reported that male gender was an important predictor of high burnout, and that male nurses seem to show more negative attitudes towards patients. Furthermore, male nurses were more likely than female nurses to experience high levels of burnout on the MBI (OR 1.39, 95% CI 0.483 to 3.99);

however, that gender difference was not statistically significant (Chernoff, Adedokun, O'Sullivan, McManus, & Payne, 2018). Majority of previous studies classified gender into two categorical including male or female (Cañadas-De et al., 2018; Chernoff et al., 2018; Escribà-Agüir, Martín-Baena, & Pérez-Hoyos, 2006), therefore, it is difficult to compare burnout on 'prefer not to disclose' gender group with previous studies.

Age. This study found that age is negatively related to burnout in all three dimensions, with younger nurses reporting greater burnout than older nurses, which is congruent with many studies (Erickson & Grove, 2007; Lee, Yen, Fetzer, & Chien, 2015; Padilla Fortunatti et al., 2017). Younger nurses seem to have higher emotional exhaustion scores on the MBI (Padilla Fortunatti et al., 2017). Also, Ang et al. (2016) reported that nurses younger than 30 years in Singapore tertiary hospital are at increased risk of burnout including emotional exhaustion, depersonalization, and personal accomplishment. Erickson and Grove (2007) found that nurses below the age of 30 experienced higher burnout than those over age of 30, and also indicated that nurses under 30 were less likely to hide their true emotions than those over 30.

Years in Current Hospital. Nurses with more experience in their current hospital had lower scores on Personal, Work-related, and Client-related Burnout. These findings conflict with a study that reported either years of work in current institution or years of work in current department were significant predictors of nurse burnout (N =3,100) (See et al., 2018). This could be a result of using different burnout measures (this study used the CBI; See et al. used the MBI), different nurse population (in this study included all in-

patient staff RNs in Alabama hospitals; See et al. included only ICU nurses in 16 Asian countries and regions). However, the findings of this study are congruent with the Queiros et al. (2013) study where more experience in the current hospital was significantly and positively related to the personal accomplishment dimension of the MBI. This finding could be explained by the fact that nurses with more experience may have more confidence about their jobs and more meaningful, developed relationships with co-workers, both in the nursing profession and with other professions at work. Nurses with more experience in their current hospital are more likely to have previously experienced most scenarios. As a result, they are more likely to understand and manage problems or potential ambiguous situations at work with more confidence and certainty (Patrick, & Lavery, 2007).

Race. Work-related and Client-related Burnout, but not Personal Burnout, are significantly correlated to race (White, Black or African American, and other, including Asian). White nurses reported higher Personal Burnout; however, other races reported higher Work-related and Client-related Burnout. Studies examining the differences in burnout by race are sparse, and most burnout studies do not report a race comparison of the study population. A study in a pediatric health care system reported that Black participants reported higher Personal Burnout, whereas White participants reported higher Work-related Burnout, and Asian nurses reported higher Client-related Burnout (Jacobs, Nawaz, Hood, & Bae, 2012). Kern and Grandey (2010) hypothesized that customer incivility or microaggressions against racially diverse employees may contribute to higher burnout in a retail environment. This hypothesis could support the

findings that other races reported higher Work-related and Client-related burnout in Alabama hospitals.

Marital Status. A marital status of 'Other' reported the highest Personal and Work-related Burnout in this study; however, comparing married with single status, single nurses reported significantly higher Personal, Work-related, and Client-related burnout. These findings coincide with the Cañadas-De et al. (2018) study. Marital status was positively and significantly correlated to Depersonalization using the MBI as the burnout measure (Cañadas-De et al., 2018). Nurses without a partner had higher levels of burnout. In addition, single parents reported higher burnout levels than those parents who lived with partners (Rizo-Baeza et al., 2017). This could be due to the fact that the family environment of a couple's lifestyle is a factor that provides security and support, and which protects nurses from developing impersonal, cynical, and negative attitudes towards patients and/or colleagues in the workplace (Cañadas-De et al., 2018).

PES-NWI. All three dimensions of burnout are significantly negatively correlated with all five subscales of the PES-NWI. The strongest correlation of all three dimensions of the CBI (personal, work-related, and client-related burnout) is with the Staffing and Resources Adequacy subscale. This coincides with the finding of a hospital-based nurse study in Canada (Spence Laschinger & Leiter, 2006). All five subscales of the PES-NWI were statistically significant as related to the emotional exhaustion dimension of the MBI (Spence Laschinger & Leiter, 2006). Organizational and management characteristics influencing nurse burnout have included the lack of supportive clinical supervision, lack of adequate resources to accomplish the work, excessive workloads, staff shortages, and a

low nurse to patient ratio (Awa, Plaumann, & Walter, 2010; Bakker & Heuven, 2006). Interpersonal relationship problems and management issues most importantly predicted nurse burnout, accounting for 11.3% of the variance in burnout scores (Sun, Bai, Li, Lin, Zhang, & Cao, 2017). Furthermore, Van Bogaert et al. (2010) found that emotional exhaustion in the MBI was a significantly negative predictor of Nurse-Physician Relationships, nurse management at the unit level, and hospital management and organizational support after adjusting for years of nursing experience, years in current unit, gender, additional degrees or certification, and work schedule. A lack of hospital management and organizational support for nursing has been shown to have an effect on both dissatisfaction in the nursing profession and nurse burnout (Aiken et al., 2002). Moreover, both organizational support and Staffing and Resources Adequacy subscale scores were directly and indirectly related to nurse-assessed quality of care (Aiken et al., 2002). In addition, a psychiatric nurse study in the U.S. found a significant relationship between a better nurse work environment and lower nurse reports of Emotional Exhaustion and Depersonalization after adjusting for hospital characteristics (teaching status, technology status, and number of beds) and nurse characteristics (years of experience and education at the baccalaureate level) (Hanrahan, Aiken, McClaine, & Hanlon, 2010). According to Aiken et al. (2008), significant changes or improvements in all aspects of the nurse practice work environment might not be realistic; however, small changes in the quality of work environment would reduce nurse burnout. Additionally, research demonstrated that the overall quality of the work environment in nursing was associated with patient outcomes including patient safety (Aiken et al., 2008; Kirwan, Matthews, & Scott, 2013; Stalpers, Brouwer, Kaljouw, & Schuurmans, 2015).

Specific Aim 3:

To Examine Whether There is a Relationship Between Nurse Burnout and Medication Administration Errors and Patient Safety Grade among Hospital-based Nurses

The overall finding of this specific aim is that all three dimensions of burnout (Personal, Work-related, and Client-related burnout) are statistically significantly predictors of medication administration errors and patient safety grades after adjusting for gender, age, years in current hospital, race, and marital status.

Medication Administration Errors. Studies examining the relationship between burnout and self-reported medication administration errors among nurses are sparse, and most burnout studies do not include medication administration errors in the prediction modeling. Medication errors are common; one study found one error for every five medications administered (Agency for Healthcare Research and Quality, 2019). Medication errors were observed in 36 institutions, 605 out of 3,216 doses were witnessed as medication errors by observation and verified by a research pharmacist (19%) within 1 to 4 observation days. The most frequent errors were wrong time (259 doses, 43%), omission (183 dose, 30%), and wrong dose (103 dose, 17%) (Barker, Flynn, Pepper, Bates, & Mikeal, 2002). A total of 50 from 284 nurses (17.6%) stated they had experienced medication administration errors: 42% of those were wrong drugs, and another 42% were the wrong dose (Kiymaz & Koç, 2018). Nurses reported the cause of these medical errors were excessive workload (91.2%), insufficient number of nurses (85.1%), fatigue, exhaustion, and burnout (75.4%) (Kiymaz & Koç, 2018).

The current study did not find any associations between nurse characteristics and medication administration errors; however, all dimensions of burnout were significantly predictors of medication administration errors. This finding is congruent with a Kiymaz and Koç study (2018) on medical errors and sociodemographic factors. Age range, gender, marital status, and years of work experience were not statistically related to medical errors; however, it should be noted that medication administration errors were considered within the category of all medical errors (Kiymaz & Koç, 2018).

Both physicians and nurses who were involved in a patient safety incident that led to more severe harm to the patient reported higher odds of burnout risk than those causing a patient safety incident with less harm (*OR* = 2.07) (Van Gerven et al., 2016). Adverse events were statistically related to the emotional exhaustion dimension of the MBI (Laschinger, & Leiter, 2006). However, Laschinger and Leiter found that burnout and the engagement process plays a mediating role in the association between the nursing practice work environment and patient adverse events.

Patient Safety Grade. Safety climate is the perception of the state of safety among individuals at a point in time (Zhang et al., 2002). Organizations such as the Joint Commission and the National Health Service in the United Kingdom, either require or encourage hospitals to measure and improve their safety climate (Ginsburg, Gilin, Tregunno, Norton, Flemons, & Fleming, 2009). Nurses frequently report on safety climate. The concept encompasses specific elements of the organization that are thought to increase or decrease the incidence of adverse events and errors (Olds, Aiken, Cimiotti, & Lake, 2017). Approximately 70% of Alabama RNs in this study rated their patient safety grade as excellent and very good and 5% rated as poor and failing. This study

found that race and burnout were statistically associated with the reported patient safety grade across three prediction models. An observational across-sectional study used a data on 177 hospitals in the four U.S. states reported 60% of nurses rated their hospital less than excellent grade on patient safety (Lake et al., 2018). A total of 61,168 nurses from 488 acute care hospitals in 12 European counties and 617 hospitals in the U.S. were responded to a patient safety, satisfaction, and quality of hospital care study (Aiken et al., 2012). Approximately 7.5% of nurses reported poor or failing safety grade in their hospitals (4,512 out of 60,064) (Aiken et al., 2012).

Among nurse characteristics, gender was significantly different in patient safety culture, which was the overall measured work and unit environment, attitude of supervisor, communication process, frequency of event reported, patient safety grade, and hospital management for patient safety (t = 212, p = .035) (Moon & Lee, 2017). Female nurses reported better patient safety culture (M = 3.41, SD = 0.39) than male (M = 3.00, SD = 0.21) (Moon & Lee, 2017). This finding is similar to the current study, which shows that males reported greater odds of a poorer patient safety grade than the reference group (prefer not to disclose) and female; however, gender has very small effect and is not a statistically significant predictor of patient safety grade. Age was not significant different in the report of patient safety culture (p = .703) (Moon & Lee, 2017) which is supporting the findings of this study. With an increase of one year of age, the odds of a poorer patient safety grade is between 0.97 and 0.99; however, age has a very small effect and is not a statistically significant predictor of patient safety grade.

Moon and Lee (2017) also reported that unmarried nurses and having more than 10 years of nursing experience rated better patient safety culture. This finding is similar to this study. With an increase of 10 years of work experience, the odds of reporting a better patient safety grade is 1.27 [exp (10×0.024) = 1.27]. You et al. (2013) also upheld the findings that 38% of nurses in China experienced a high level of burnout, and a significant percentage of nurses rated their work environment as poor (36%), and graded their patient safety in the hospital as low (36%). A complex work environment could predispose nurses to burnout and subsequently impact their job performance and quality of care (Poghosyan et al., 2010). In a study of nurse burnout and quality of care in six countries, most nurses stated that burnout in all three dimensions including emotional exhaustion, depersonalization, and personal accomplishment affected their ability to take good care of patients, thereby increasing the risks of poor patient safety (Poghosyan et al., 2010).

Summary of Nurse Burnout and Patient Outcomes

The findings are consistent with the notion that patient safety outcomes are associated with nurse burnout, and that the nursing practice work environment plays an important role in nurse burnout. The findings also suggest that when nurses perceive that their work environment supports their professional practice, they are less likely to experience burnout, thereby ensuring safe patient care and better patient safety outcomes.

Limitations of the Study

There were several limitations in this study. The first is the inability to support causal inferences (Polit & Beck, 2012). The study could not draw any cause and effect relationship between nurse burnout and medication administration errors because this study design is a predictive correlational research design. Predictive correlational research designs explore the association between predictors and outcome variables. This study aimed to examine the relationship between burnout and medication administration errors in a cross-sectional manner.

Second, a self-reporting bias could have occurred because the subjects may have attempted to protect themselves by answering in a socially desirable manner. Subjects may present themselves in a positive manner when information is provided via self-report (Polit & Beck, 2012).

Third, there might be other factors that contribute to burnout and are also related to medication administration errors that were not included in this study. Therefore, the findings were limited to explaining nurse burnout and medication administration errors only with regard to the factors that were included in this study. Also, many factors in the real world, including behaviors, attitudes, and personal characteristics, are correlated with burnout in complex ways, and all of these factors impact how researchers interpret the findings (Polit & Beck, 2012).

Fourth, this study was not able to explain the mediation of job performance in establishing the relationship between nurse burnout and medication administration errors because nursing job performance was not measured, and a longitudinal study would be needed to test nursing job performance. Finally, because the study group consists of

Alabama inpatient staff RNs, the generalizability of the results to nurses around the world or even in the U.S. is limited. Also, there is no state-wide study that can compare if nurses in this study represent an Alabama nurse population.

Implication

Clinical Setting.

Overall, this study contributes to the development of theoretical knowledge in the area of burnout, medication administration errors, and patient safety among Alabama nurses. Because hospital-based staff nurses take care of the most vulnerable patients in the health care system, their psychological well-being should be of great concern to hospital and nursing executives, patients, policy makers, and the public. A nursing leadership is a key to prevent nurse burnout by being proactive. Leadership should have an open-door policy provides the support when nurses need to support them and create a better nursing work environment. Also, leaders should be able to recognize burnout before it comes an issue in the hospital setting. The first step to address nurse burnout is to measure burnout. CBI is an important tool to measure burnout among nurses because it is important for nurse leaders to understand where their nurses experience burnout the most such as personal, work, or client, so they can decide how to deal with the issue.

These findings may provide baseline data for actionable interventions to improve the effectiveness of nursing care delivery at the worksite, and ultimately health care as a whole. It is important to build a wellness program directly addresses their issues on nurse burnout. In this study, we know that nurses have high burnout on personal and work-

related burnout subscales; therefore, the priorities of a wellness program should include approaches that can help to reduce personal and work-related burnout.

The findings have important implications for occupational psychology, applied practitioners, and administrative managers working in a hospital context. Particularly, the results should be used to shed light on possible applied interventions among nurses, such as helping to create a better work environment, including Nurse Participation in Hospital Affairs, Nursing Foundations for Quality of care, and Collegial Nurse-physician Relations. At the organizational level and for policy makers, interventions should include factors related to an improved work environment, including Nurse Manager Ability, Leadership and Support of Nurses, and Staffing and Resource Adequacy. The recommendations to improve nurse work environment for the nurse manager and the staff include the following: 1) for nurse manager including improve communication with staff, be more visible on the unit, assist staff in finding solutions to problems, acknowledge hard work and focus on the positive, involve staff in unit decision making, and foster a culture of teamwork; and 2) for nurse staff including bring concerns to the nurse leaders or managers immediately, maintain accountability for practice, and give the manger and coworkers the benefit of the doubt until all facts are heard (Schloffman & Ver Hage, 2012).

As shown in the results for predicting nurse burnout, personal characteristic variables such as age, gender, marital status, race, and years in hospital are related to nurse burnout. Regarding the implications of the findings, nurse managers should take into account that younger, male, single, White, or recently hired nurses may be more prone to burnout. Thus, these nurses should be a primary target population for burnout

prevention programs, and for hospital initiatives to promote better well-being at work. Nurse managers should also be aware of the physical, mental, and emotional effort required of a nursing professional, and, if necessary, provide support from among nurses' peers, supervisors, and other professionals to explain how they feel or to request interventions for burnout treatment or prevention. Also, improving staffing and resources adequacy can create favorable work environment, which could be reduce nurse burnout levels.

Education and Research Setting.

Nursing school curriculum at the undergraduate and graduate program levels should include content related to nurse burnout prevention. The findings of this study support the need for nursing students to understand that personal characteristics such as age, gender, years of nursing experience, race, and marital status can be linked to burnout in all three dimensions, including personal, work-related, and client-related burnout. To prevent burnout among nurses, nursing students should have the knowledge and skills to evaluate themselves or their co-workers, and the CBI instrument could be used to classify burnout levels, especially this tool is free of cost and can be accessed via the internet. Nursing students also should be aware that incidence of medical errors, including medication administration errors, occur regularly, and thus they need to be very careful as well as prepared for if they have experience in the future.

As discussed in the limitations of the study, further work is necessary to examine the causal relationship among nurse burnout, medication administration errors, and patient safety grade, as well as examine the mediation of job performance in establishing the relationship between nurse burnout and medication administration errors in a

longitudinal study. This study, being of an exploratory and interpretive nature, raises a number of opportunities for future research, particularly in interventions. Future research should explore more interventions or programs that will help to reduce nurse burnout and medication administration errors and improve patient safety grades. Furthermore, whether the practice nurse work environment can be either moderate or mediate of burnout and medication administration errors and patient safety grade should be examined in the future studies.

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APPENDIX A

COVER LETTER

ALABAMA HOSPITAL STAFF NURSE STUDY

Dear Nurse Colleague,
We are asking you to take part in a research study that systematically collects standardized information on several nursing indicators. The purpose of this study is to refine methods of nurse staffing effectiveness assessment in an effort to address quality of patient care and safety issues.

This study is being conducted in Alabama hospitals. Registered nurses who work on inpatient units at these facilities are eligible for participation in this study. We are examining the relationship among nursing work environment characteristics, nurse-related quality of patient care, and patient safety. There are approximately 50,000 inpatient registered nurses (RNs) on the mailing list we obtained from the AL Board of Nursing. We are asking all 50,000 to participate.

We are asking you to take approximately 25-30 minutes to complete an electronic survey. In this postcard is an online-link and ID number. Please follow the link and enter your ID number to access the survey. Your responses will be kept strictly confidential - your name will not appear on the survey. Instead, the ID number on the survey will match with your name. When you submit the survey, your response will be directly sent to the principal investigator, and your survey will not be linked to your name in any way. Completing the questionnaire will signify your consent to participate in this study. You may be inconvenienced by taking this survey; however, the potential benefits of the study include an improved knowledge of work environments of AL nurses who work in hospitals.
The greatest risk in completing this survey is breach of confidentiality. The study staff will protect your records so that your name, address, and phone number will be kept private. They will not release this information to anyone other than authorized personnel. The chance that this information will be given to someone else is very small. Your alternative is not to participate in this study.
Information obtained about you from this study will be kept confidential to the extent allowed by law. However, research information that identifies you may be shared with the UAB Institutional Review Board (IRB) and others who are responsible for ensuring compliance with laws and regulations related to research and the
Office for Human Research Protections (OHRP). The information from the research may be published for scientific purposes; however, your identity will not be give out.
Whether or not you take part in this study is your choice. There will be no penalty if you decide not to be in the study. You are free to withdraw from this research at any time. Your choice to leave the study will not affect your relationship with the institution. If you are a UAB student or employee, taking part in this research is not part of your UAB class work or duties. You can refuse to participate with no effect on your class standing, grades, or job at UAB. You will not be offered or receive any special consideration if you take part in this research. There will be no cost to you for taking part in this study and you will not receive any payment for participation in this study.
We thank you in advance for participating in this important study. Results from the surveys will be aggregated before any reports are written. If you have any questions concerning the research

study, please call Dr. Patricia A. Patrician at (205) 996-5211 or contact her via e-mail at ppatrici@uab.edu.
If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the UAB Office of the IRB (OIRB) at (205) 934-3789 or toll free at 1-855-860-3789. Regular hours for the OIRB are 8:00 a.m. to 5:00 p.m. CT, Monday through Friday.

Sincerely,

Dr. Patricia A. Patrician, PhD, RN, FAAN

LINK: XXXXXXX.XX.XX
UNIQUE ID: XXXXXX

Version:11152017

[This cardstock paper will be folded over and the address labels placed on the outside, creating a large postcard]

APPENDIX B

INSTITUTIONAL REVIEW BOARD FOR HUMAN USE APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Office of the Institutional Review Board for Human Use

470 Administration Building
701 20th Street South
Birmingham, AL 35294-0104
205.934.3789 | Fax 205.934.1301 | irb@uab.edu

APPROVAL LETTER

TO: Patrician, Patricia A

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance # FWA00005960
IORG Registration # IRB00000196 (IRB 01)
IORG Registration # IRB00000726 (IRB 02)

DATE: 21-Nov-2017

RE: IRB-300000916
Alabama Hospital Staff Nurse Study

The IRB reviewed and approved the Initial Application submitted on 20-Nov-2017 for the above referenced project. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services.

Type of Review: Expedited (Category 7)
Determination: Approved
Approval Date: 21-Nov-2017
Approval Period: One Year
Expiration Date: 20-Nov-2018

The following apply to this project related to informed consent and/or assent:

- Waiver of Consent Documentation

APPENDIX C
INSTRUMENTS

Section A. Individual Characteristics: This section asks questions about your characteristics. Please place an "x" in the box next to the appropriate response to each question or, where indicated, fill in the blanks.

1. What is your gender?

☐ Male

☐ Female

☐ Prefer not to disclose

2. What is your age?_____years old

3. What is your marital status?

☐ Single

☐ Married

☐ Prefer not to disclose

4. What is your race?

☐ White

☐ Black or African-American

☐ American Indian or Alaska Native

☐ Asian/Pacific Islander

☐ Hispanic or Latino

☐ Other

5. How many years have you worked as an RN_____Years

as an RN at your present hospital?_____Years

Section B. Patient Safety: This section asks for your opinions about patient safety issue, medication error, and event reporting in your unit. Please place an "x" in the box next to the appropriate response to each question or, where indicated, fill in the blanks.

> An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm.
>
> "Patient safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.
>
> "Medication administration error" is defined as any difference between what the patient received or was supposed to received and what the prescriber intended in the original order.

1. Please give your work area/unit in this hospital on overall grade on patient safety.

☐ Excellent

☐ Very good

☐ Acceptable

☐ Poor

☐ Failing

2. Approximately how many medication administration errors occurred on your unit in the last 3 months?_____ # of medication errors

Section D. Copenhagen Burnout Inventory (CBI): This section distinguishes between burnout related to personal, work, and patients. If you have never had this feeling, place an "x" in the box "Never." Otherwise, indicate how often you feel like this by placing an "x" in the box that best describes how frequently you feel that way.

How often	Never/ Almost never	Seldom	Sometimes	Often	Always
1. How often do you feel tired?	☐	☐	☐	☐	☐
2. How often are you physically exhausted?	☐	☐	☐	☐	☐
3. How often are you emotionally exhausted?	☐	☐	☐	☐	☐
4. How often do you think: "I can't take it anymore"?	☐	☐	☐	☐	☐
5. How often do you feel worn out?	☐	☐	☐	☐	☐
6. How often do you feel weak and susceptible to illness?	☐	☐	☐	☐	☐
7. Do you feel worn out at the end of the working day?	☐	☐	☐	☐	☐
8. Are you exhausted in the morning at the thought of another day at work?	☐	☐	☐	☐	☐
9. Do you feel that every working hour is tiring for you?	☐	☐	☐	☐	☐
10. Do you have enough energy for family and friends during leisure time?	☐	☐	☐	☐	☐
11. Are you tired of working with clients?	☐	☐	☐	☐	☐
12. Do you sometimes wonder how long you will be able to continue working with clients?	☐	☐	☐	☐	☐
How much	To a Very High Degree	To a High Degree	Somewhat	To a Low Degree	To a Very Low Degree
13. Is your work emotionally exhausting?	☐	☐	☐	☐	☐
14. Do you feel burnt out because of your work?	☐	☐	☐	☐	☐
15. Does your work frustrate you?	☐	☐	☐	☐	☐
16. Do you find it hard to work with clients?	☐	☐	☐	☐	☐
17. Do you find it frustrating to work with clients?	☐	☐	☐	☐	☐
18. Does it drain your energy to work with clients?	☐	☐	☐	☐	☐
19. Do you feel that you give more than you get back when you work with clients?	☐	☐	☐	☐	☐

Section C. The Practice Environment Scale of the Nursing Work Index (PES-NWI): For each item in this section, please indicate the extent to which you agree that the following items are present in your current job. Indicate your degree of agreement by placing an "x" in the box that best describes your agreement/disagreement with each statement

The following are present in your current job:	Strongly Agree	Somewhat Agree	Somewhat disagree	Strongly disagree
1. Adequate support services allow me to spend time with my patients.	☐	☐	☐	☐
2. Physicians and nurses have good working relationships.	☐	☐	☐	☐
3. A supervisory staff that is supportive of the nurses.	☐	☐	☐	☐
4. Active staff development or continuing education programs for nurses.	☐	☐	☐	☐
5. Career development/ clinical ladder opportunity.	☐	☐	☐	☐
6. Opportunity for staff nurses to participate in policy decisions.	☐	☐	☐	☐
7. Supervisors use mistakes as learning opportunities, not criticism.	☐	☐	☐	☐
8. Enough time and opportunity to discuss patient care problems with other nurses.	☐	☐	☐	☐
9. Enough registered nurses to provide quality patient care.	☐	☐	☐	☐
10. A nurse manager who is a good manager and leader.	☐	☐	☐	☐
11. A chief nursing officer who is highly visible and accessible to staff.	☐	☐	☐	☐
12. Enough staff to get the work done.	☐	☐	☐	☐
13. Praise and recognition for a job well done.	☐	☐	☐	☐
14. High standards of nursing care are expected by the administration.	☐	☐	☐	☐
15. A chief nursing officer equal in power and authority to other top-level hospital executives.	☐	☐	☐	☐
16. A lot of team work between nurses and physicians.	☐	☐	☐	☐
17 Opportunities for advancement.	☐	☐	☐	☐
18. A clear philosophy of nursing that pervades the patient care environment.	☐	☐	☐	☐
19. Working with nurses who are clinically competent.	☐	☐	☐	☐
20. A nurse manager who backs up the nursing staff in decision-making, even if the conflict is with a physician.	☐	☐	☐	☐
21. Administration that listens and responds to employee concerns.	☐	☐	☐	☐
22. An active performance improvement program.	☐	☐	☐	☐
23. Staff nurses are involved in the internal governance of the hospital (e.g., practice and policy committees).	☐	☐	☐	☐
24. Collaboration (joint practice) between nurses and physicians.	☐	☐	☐	☐
25. A preceptor program for newly hired RNs.	☐	☐	☐	☐
26. Nursing care is based on a nursing rather than a medical model.	☐	☐	☐	☐
27. Staff nurses have the opportunity to serve on hospital and nursing committees.	☐	☐	☐	☐
28. Nurse managers consult with staff on daily problems and procedures.	☐	☐	☐	☐
29. Written, up-to-date nursing care plans for all patients.	☐	☐	☐	☐
30. Patient care assignments that foster continuity of care, i.e., the same nurse cares for the patient from one day to the next.	☐	☐	☐	☐
31. Use of nursing diagnoses.	☐	☐	☐	☐