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Fighting Fatigue with Caffeine: Exploring Perceptions on Patient Safety

Camille Quitangon
Dominican University of California

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Fighting Fatigue with Caffeine: Exploring Perceptions on Patient Safety

Abstract

Objective: To examine the association between fatigue and caffeine consumption, and explore nurses' perceptions of the impact of these factors on patient safety.

Background: Many people consume caffeine for its benefits, such as stimulating the central nervous system to feel more awake. Health professionals, such as nurses, commonly experience fatigue and often will drink coffee to get through their long shifts.

Methods: A comprehensive literature review was conducted. Studies were split into two categories - fatigue and patient safety or caffeine's effect on human performance.

Results: Fatigue causes nurses to be impaired; it affects their ability to be alert, vigilant, and safe. A majority of nurses reported being moderately fatigued. Also, they are more likely to report decision regret compared to unimpaired nurses. Nurses often work longer than they're scheduled to and the likelihood of making an error may increase with longer work hours.

Caffeine has been shown to improve cognitive function, enhance alertness, and decrease tiredness.

Conclusion: Caffeine can improve mental performance and decrease feelings of fatigue. While research focuses on the physiological effects of caffeine and the role that fatigue plays in impaired functioning, less is known about potential links between fatigue, caffeine consumption, and patient safety in the healthcare setting. To explore these relationships, a phenomenological qualitative study proposes to answer the following question:

What is the nurses' lived experience of consuming caffeine to fight fatigue and their perception of the impact of this combination, if any, on the safe provision of patient care?

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First Reader

Patricia Harris, PhD, RN

Second Reader

Olivia Catolico, PhD, MS, RN, CNL, BC

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Fighting Fatigue with Caffeine:
Exploring Perceptions on Patient Safety

By

Camille Quitangon

Submitted in partial fulfillment of the requirements of the Nursing Department
and the Honors Program

Dominican University of California
2018

First Reader: Patricia Harris

Department of Nursing

Second Reader: Olivia Catolico

Department of Nursing

Honors Director: Lynn Sondag

Department of Art, Art History, Design

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Introduction

Caffeine is a popular substance that is found commonly in beverages, such as coffee, tea, and energy drinks. Many people consume caffeinated beverages for its benefits, such as stimulating the central nervous system and making them feel more awake. Scientific evidence also proves that caffeine increases energy availability, enhances cognitive performance and short-term memory, increases the ability to make correct decisions, and decreases feelings of fatigue.

Healthcare professionals, such as nurses, may consume caffeinated beverages as a way to combat fatigue throughout their shift—which can be up to twelve hours long. Fatigue may have implications on patient safety, such as, affecting a nurse’s ability to assess patients thoroughly, communicate effectively, and express best clinical judgment. Decreasing fatigue may improve nurses’ overall well-being and patient safety (Kunert, King, & Kolkhorst, 2007). If nurses consume caffeine to combat fatigue, what impact does it have on their perceptions of providing patient safety?

Literature Review

Search Strategy

A review of the literature was conducted using the following academic databases: CINAHL—full-text Nursing and Allied Health Literature Plus Additional Resources, COCHRANE—a collection of high-quality, independent evidence to inform healthcare decision-making, and PubMed Health—information on conditions and treatments from the world's largest medical library. The keywords and search terms used were: nurses, fatigue, patient safety, med errors, caffeine, caffeine consumption, and effectiveness of caffeine.

Road Map

After exploring the available literature, two themes among the research became evident: 1) the relationship between fatigue and patient safety and 2) caffeine's effect on human performance. These themes will serve to act as categories within this paper. Eight primary research studies were selected and categorized based on its findings. Five studies were categorized under the relationship between fatigue and patient safety, and three studies were categorized under caffeine's effect on human performance.

Category 1 - The Relationship Between Fatigue and Patient Safety

This category includes literature that provided evidence of fatigue in nurses, explored factors related to fatigue or patient safety, or examined the effect of fatigue on patient safety.

Rogers, Hwang, Scott, Aiken, & Dinges's study (2004) aimed to examine the work patterns of hospital staff nurses and determine if there is a relationship between hours worked and the frequency of errors. A non-experimental descriptive design was used and data was collected from a sample of 393 registered nurses. The demographics of the sample in the study—in terms of sex, age, marital status, and work environment—did not differ significantly from nurses in the 2000 National Sample Survey of Registered Nurses, meaning data similarly represented nurses on a national level. Data was collected by a spiral-bound notebook that participants were asked to record information about hours worked (both scheduled and actual hours), time of day worked, overtime, days off, and sleep/wake patterns. The data was then analyzed using descriptive statistics and frequency tables.

This study represents one of the first nationwide efforts to quantify hospital staff nurse work hours and work patterns, and to determine if extended staff nurse work hours contribute to

errors and near errors (Rogers et al., 2004). The researchers found that “...hospital staff nurses worked longer than scheduled daily, and generally worked more than forty hours per week” (pg. 205, 2004). In addition, the study revealed that nurses on average, work fifty-five minutes longer than scheduled each day and all nurses worked beyond their scheduled work shift (overtime) at least once during the twenty-eight day data collection period. They also found that half of the shifts that nurses worked, exceeded 10.5 hours (Rogers et al., 2004). In relation to patient safety, there were 199 errors and 213 near errors reported—which were related to medication administration, procedural errors, or charting errors. Rogers and the research team’s analysis of the data showed that work duration, overtime, and number of hours worked per week had significant effects on errors—“...making an error increased with longer work hours and was three times higher when nurses worked shifts lasting 12.5 hours or more” (pg. 206, 2004).

In Association of sleep and fatigue with decision regret among critical care nurses, the researchers examined the association between selected sleep variables, impairment due to fatigue, as well as, clinical decision self-efficacy and regret among critical care nurses (Scott, Arslanian-Engoren, & Engoren, 2014). The model of impaired sleep was the conceptual framework for this study, where sleep loss related to lifestyle factors—such as employment demands—increases a person’s risk for adverse outcomes (Scott et al., 2014). With sleep loss or disrupted sleep, there is the risk for “adverse outcomes in physiological, cognitive-behavioral, emotional, and social responses and affects the ability to engage in effective decision making” (Scott et al., 2014, pg. 14). The primary outcome variable that was looked at, was decision regret—“a negative cognitive emotion that occurs when the actual outcome and the desired or expected outcome differ and reflects concerns that the wrong decision had been made” (Scott et al., 2014, pg. 14).

Scott et al.'s findings illuminate a link between fatigue and the effect on nurses' ability to make clinical decisions—thus implicating patient safety. Nurses who experience impairments due to fatigue, loss of sleep, and inability to recover between shifts are more likely than unimpaired nurses, to report decision regret (Scott et al., 2014). Nurses who worked nights and 12-hour shift were more likely to report decision regret—157 out of the 546 (17%) nurses reported decision regret in the study (Scott et al., 2014). This literature also gathered data that a majority of nurses experience fatigue, sleep deprivation, and daytime sleepiness, which affect their ability to be alert, vigilant, and safe.

Barker & Nussbaum further investigated the presence of fatigue among registered nurses by reporting perceived levels of mental, physical, and total fatigue; investigating the relationships between perceived fatigue and perceived performance; and also, acute and chronic states of fatigue (2011). An online survey was used in this study to measure mental, physical, and total fatigue dimensions, acute and chronic fatigue states, and performance. The instruments used to measure data—five survey instruments to form a “Fatigue in Nursing Survey Set” (FNSS)—each has been shown previously to have acceptable levels of reliability and/or validity (Barker & Nussbaum, 2011).

From a range of healthcare workers, Barker and Nussbaum's data provides more information and insight about registered nurses. Findings from the research show that nurses report “higher levels of mental than physical fatigue and higher levels of acute than chronic fatigue” (Barker & Nussbaum, 2011, pg. 1379). Also, mental fatigue showed a tendency to have negative correlations with the performance measures—which relates to changes in “concentration, mood, and mental energy”—supporting existing evidence that fatigue affects performance on tasks needing vigilance or attention to detail (Barker & Nussbaum, 2011, pg 1378). Work

environment variables are strongly associated with perceived levels of fatigue in registered nurses, such as hours worked per week and shift length.

The effects of sleep loss and fatigue on resident–physicians: a multi-institutional, mixed-method study aimed to look at fatigue and sleep loss from another healthcare occupation, residents and physicians—and identify its effect on their professional lives and personal well-being (Papp, et al., 2004). Although it was a study that had a sample of 149 residents, rather than registered nurses, it adds to the literature quantitative and qualitative data of the effect of fatigue from a different healthcare worker perspective. While qualitative findings depict the effect of fatigue on their job performance—such as reports of increased risk of making mistakes, urge to cut corners, falling asleep on the job, and decrement in fine motor skills—quantitative findings support those effects of fatigue on cognitive function related to professional performance (Papp, et al., 2004).

Han, Trinkoff, & Geiger-Brown examined the association between work and non-work fatigue-producing factors and self-reported acute and chronic fatigue and intershift recovery among nurses who worked 12-hour-shifts (2014). To measure work-related fatigue and recovery between shifts, the Occupational Fatigue Exhaustion Recovery Scale (OFER) with psychometric properties was validated in a sample of nurses and used in this study. Two types of job demands were assessed through questionnaires/surveys. Physical demands consisted of duration, level, and frequency of physical exertion. Psychological demands assessed how often they were required to work “...hard, fast, excessively, with intense concentration, with frequent interruption, and with delays from other individuals or departments” (Han et al., 2014, pg. 411). Psychological demands demonstrated a significant relationship to occupational fatigue and recovery among nurses who worked 12-hour shifts (Han et al., 2014). Nurses who rotated

working shifts reported high levels of acute fatigue compare to those on fixed shifts (Han et al., 2014).

Category 2 - Caffeine's Effect on Human Performance

This category includes literature that provided evidence of caffeine's effect on human performance.

Brunyé, Mahoney, Lieberman, & Taylor investigated the effects of caffeine on a flanker test designed to test Posner's three visual attention network functions: alerting, orienting, and executive function (2010). The test used four levels of caffeine—0mg, 100mg, 200mg, 300 mg, and 400 mg—to assess how caffeine affects visual attention in non-habitual consumers using the Attention Network Test (ANT) (Brunyé et al., 2010). Along with the ANT, self-reported mood state was gathered from the participants.

Brunyé et al. found that "...higher doses of caffeine improve the performance of the alerting and executive control networks, but slightly diminished orienting network performance" (2010, pg. 185). The alerting network is thought to be responsible for maintaining alert throughout a task—200 mg and 400 mg of caffeine was able to improve a participant's ability to take advantage of alerting cues (Brunyé, et al., 2010). There was little known about the caffeine's effect on the orienting network—which is thought to "...attend to particular regions of space and ultimately speed select and respond to visual stimuli" (Brunyé et al., 2010, pg. 185). But with the researchers' study, they found some evidence that "high doses (400 mg) of caffeine can produce decrements" (Brunyé et al., 2010). The executive control network is thought to be responsible for allowing people to be able to identify and stop action-incompatible visual information. The researchers' findings showed that caffeine improved participants' executive function in a dose-response manner, asymptoting at 200mg (Brunyé et al., 2010). In response to

caffeine treatments, there was an increase in ratings of how “lively, peppy, and jittery” as well as, a decrease in ratings of how “drowsy, tired, and calm” they felt (Brunyé et al, 2010, pg. 184).

Wilhelmus, et al. aimed to assess the effect of 60 mg caffeine on sustained attention in healthy adults. The sample of the study was eighty-two healthy male (n=41) and female adults (41) who volunteered and randomized into one of two treatment conditions: caffeine (60 mg) and placebo (mannitol) (Wilhelmus, et al., 2016). The study found that 60 mg of caffeine enhanced sustained attention and alertness, in objective and subjective measures they used (Wilhelmus, et al., 2016). Data also supported that sustained attention performance improved with tasks longer than 5 minutes duration when given the caffeine dose (Wilhelmus, et al., 2016).

The purpose of Kamimori, et al’s study was to examine the effectiveness of repeated administration of 200 mg doses of caffeine to sustain vigilance, reaction time, and high-order cognitive function that requires logical reasoning and live-fire marksmanship during three successive evenings of sustained wakefulness followed by 4 hour afternoon periods for sleep (2014). The sample consisted of twenty Special Forces personnel that were randomly assigned to receive four 200-mg doses of caffeine (n=10) or placebo (n=10) (Kamimori, et al., 2014). The effectiveness of caffeine as a countermeasure to offset impairments in cognitive function that come with consecutive days of reduced sleep was demonstrated in this study. Reaction time, vigilance, and logical reasoning were all maintained with caffeine supplementation and remained close to or at control levels for the duration of the study (Kamimori, et al., 2014). More findings can be found in the literature review table.

Overall Discussion of Literature Review

As a result of reviewing the literature, evidence supports that many nurses report and experience fatigue while on the job. Factors related to fatigue that nurses experience include:

work shifts lasting more than twelve hours, working overtime, and physical/psychological job demands. Nurses' perception of fatigue correlates inversely to perceptions of performance—the more fatigue a nurse feels, the perception of own performance decreases. Fatigue impairs nurses' cognitive function such as, their ability to be alert, vigilant, and safe. The likelihood of making errors increased when nurses worked longer than 12 hours, which is a factor that is associated with fatigue, making them more likely to report decision regret, thus potentially implicating patient safety.

Caffeine may have a positive effect on cognitive function and thus affect human performance. The effect of caffeine has been shown to sustain attention and improve performance on tasks that take longer than five minutes. Caffeine also increases subjective feelings of being more awake and decreases feelings of tiredness.

A strength of this literature review is that findings in both categories were supportive of existing research in regards to their conclusions. But with all studies, there are some limitations. Since fatigue is a subjective experience, it will vary from person to person and differ from studies depending on which instrument was used to measure fatigue. While there were many studies that focused on the positive effects of caffeine consumption, there was limited evidence that focused on potential negative effects of caffeine or caffeine withdrawal on human performance. Also, research on caffeine's effect on human performance was limited to specific cognitive functions rather than actual tasks related to the medical field.

This literature review provides evidence of the many factors that affect nurses and contributes to fatigue, which is a concern for patient safety. Healthcare providers can use this evidence of fatigue in nurses to structure the work environment—such as work hours and

scheduling—for the safety of both the nurse and the patient. The benefits of caffeine consumption can also influence healthcare employers to provide caffeine products for their employees.

Research Study

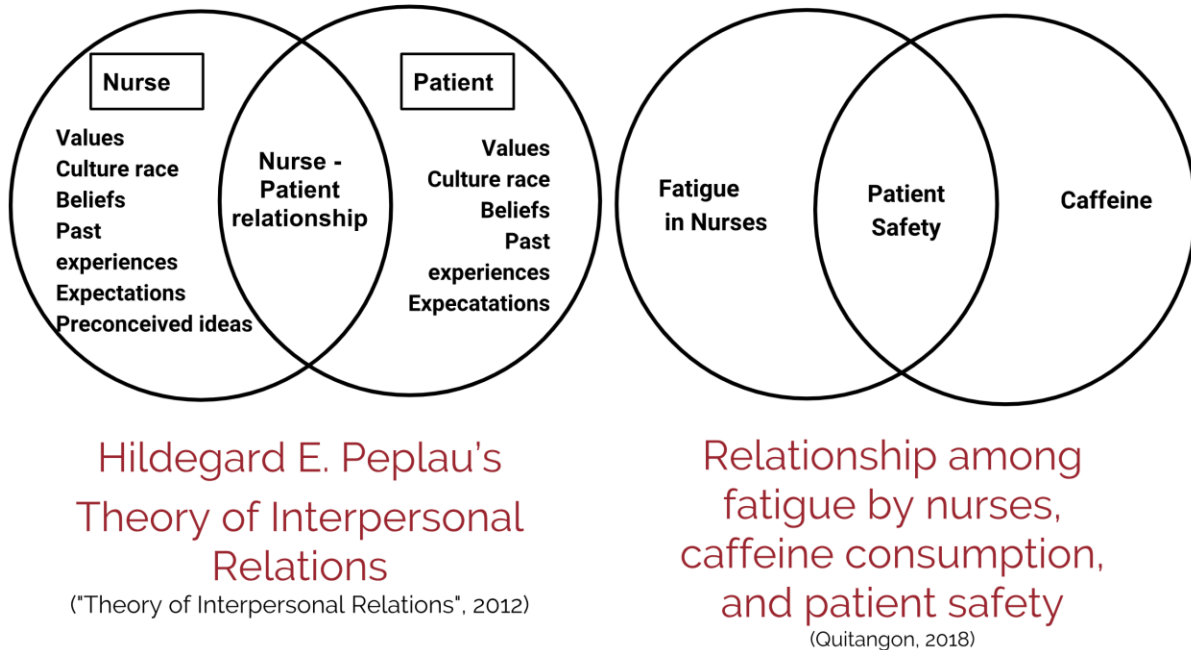
While research focuses on the physiological effects of caffeine and the role that fatigue plays in impaired functioning, less is known about potential links between fatigue, caffeine consumption, and patient safety in the healthcare setting. More research is needed to explore the effects of caffeine as a fatigue countermeasure and if it's effective to prevent errors in a healthcare setting.

Theoretical Framework

The theoretical framework for this investigation is based on Hildegard. E. Peplau's theory of Interpersonal Relations in which describes the three phases of the nurse-patient relationship that overlap and occur during the time of the relationship—orientation, working, and termination ("Theory of Interpersonal Relations", 2012). The orientation phase describes when a health problem is identified by the patient and there is a need for help ("Theory of Interpersonal Relations", 2012). During the working phase, this is when the patient figures out who can help and allows a relationship to form with that person ("Theory of Interpersonal Relations", 2012). The termination phase refers to when the patient no longer needs help from the nurse ("Theory of Interpersonal Relations", 2012).

Peplau's Theory of Interpersonal Relations addresses how people relate to one another when they require healthcare services. In a nurse-patient relationship, if the nurse is affected by fatigue, then in turn, it may have an effect on the patient during the working phase (Quitangon, 2018). The theoretical framework for this study, depicted in the image below, is based on the

similar nurse-patient relationship, but aims to explore the potential relationship among fatigue in nurses, caffeine consumption, and patient safety (Quitangon, 2018).



To explore these relationships, a phenomenological qualitative study proposes to answer the following question: What is the nurses' lived experience of consuming caffeine to fight fatigue and their perception of the impact of this combination, if any, on the safe provision of patient care? The purpose of this study is to explore the relationship between caffeine consumption by nurses and its effect on their perception of patient safety.

Methods

An application was submitted to the Dominican Institutional Review Board for the Protection of Human Participants (IRBPHP) and was approved in May 2018 to conduct the study. In this qualitative phenomenological study, participants were recruited through convenience and snowball sampling, face-to-face, phone contact, and/or handing out written materials which can be referenced in Appendix B. Five nurses were interviewed and included in

this study. Inclusion criteria were as followed: consumes caffeinated beverages on the job, speaks English and are full-time (36 hours a week) hospital bedside nurses.

Participants were informed about the purpose of the study and signed consent forms. The consent form is provided in Appendix C. Participants were assured of confidentiality and gave permission to record interviews and publish the transcripts. Laptops and phones that were used for research had password protection. Recorded interviews and transcripts did not have personal identifiers. Names were not used in participant interviews and the interviews were coded with a number.

Demographic information and data about caffeine consumption was collected by a survey that participants were asked to complete prior to an informal interview. The interview guide is included in Appendix D. Interviews were conducted in a private setting in a convenient location for the participant such as their within their own home.

The interview was structured using an interview guide with open-ended questions pertaining to their perceptions of fatigue, caffeine consumption, and their perceptions of effect on patient safety. For example, one question asked was “What is your perception of caffeine consumption in relation to patient safety and patient care?” The questions used in the interview were the same for each participant and clarifying questions were also added as needed. The interview guide can be found in Appendix E. Each interview was limited to 30 minutes long. Data from the interviews was recorded and transcribed by the researcher and a colleague and a content analysis was performed.

Participants

The demographics of the five nurses who participated in the study varied. The age of participants ranged from 22 -31 years old, three of which were women and two were men. Four

out of the five nurses worked 12 hour shifts, while one worked eight hour shifts. The units that the nurses worked on were emergency department, medical surgical, and pediatrics. All of the nurses that participated had experience working night shift. The four participants that were interviewed, currently works the night shift, while one participant works day shift.

The participants self-reported their caffeine consumption during a shift and the results ranged from one to five cups. The sources of caffeine was not limited to coffee, but also included tea, energy drinks, and caffeinated gum and pills.

Results and Content Analysis

First, direct quotes from the transcript were selected as “meaning units.” The meaning units were then reworded to “condensed meaning units” which shortened the text while still preserving the core meaning. A “code” was then added to label what the condensed meaning unit is about. A “category” was then formed to group together codes that were related together in their context. After looking at two or more categories, a “theme” was determined that expressed an underlying meaning in the data. After analyzing the data, four themes were found in this research: nurses experience fatigue in the workplace, caffeine affects work behavior, the good and bad effects of caffeine consumption, and the perceived relationship among nurses, caffeine consumption, and patient care. The content analysis table is included in Appendix F.

Theme 1: Nurses Experience Fatigue in the Workplace. This theme illustrates the lived experience of nurses being tired and fatigued at work. In this study, working the night shift was a common cause of fatigue. The demands of the job and nurses not being able to take breaks is another factor of fatigue in the workplace. The following participant statements exemplify this theme:

“I work the night shift from 11pm to 7am, and it is not easy to stay up when you factor in my irregular sleep schedule.....Coming to work at the time I do, always makes me feel fatigued naturally" (Participant 5)

“....night shift, because the environment was a little, I don't wanna say slower, but like, you know there's not as much foot traffic, it was a little dimmer, you know sometimes when you're sitting there charting, you find yourself feeling more sleepy and tired" (Participant 1)

“...in a busy trauma ER, nurses often get pulled away from breaks and end up in trauma or critical rooms to help out critical patients. I found many nurses have to continue with patient care without a single break sometimes. The workplace can be physically tiring as well as, mentally" (Participant 2).

Theme 2: Caffeine Affects Work Behavior. All five participants reported consuming caffeine during work for its effects, such as feeling more awake, as a way to counter fatigue, and/or as a source of energy. This is expressed through the following participant's examples:

“There are numerous days when I wake up tired or unmotivated. Drinking a cup of coffee before work stimulates my attitude in working. It helps me to stay awake instead of complaining of how tired I am" (Participant 2)

"For the most part, I always consume one cup of black coffee prior to work. It keeps me energized, focused, and my mood is more positive when I consume a cup of coffee prior to work" (Participant 4).

One participant even viewed drinking caffeine to have a social aspect by saying "Drinking coffee is social and therapeutic. I am able to interact with my co-workers during my short coffee break" (Participant 2).

Theme 3: The Good and Bad Effects of Caffeine Consumption. The nurses who participated in this study had positive and negative perceptions about the effects of caffeine consumption.

Good Effects. The positive perceptions of caffeine consumption effects—such as having an energy boost, positive mood and feeling more awake—can be seen in the following statements:

"I do feel a little bit of a surge of an energy boost when I do have it, so I guess it is positive that you know you feel a little more peppy, you move a little faster, maybe thought process is a little clearer" (Participant 1)

"Drinking coffee gives me a motivated feeling and keeps me happy and positive at work" (Participant 4).

"...the effect of caffeine in moderate use, has helped me to stay awake, alert and focused" (Participant 2).

Bad Effects. The negative effects of caffeine consumption perceived by the participants were about physical symptoms, potential dependence, and health concerns. This can be seen in the following participant expressions:

"Some of the side effects that I personally experienced were sweating, shaking, and jitteriness" (Participant 2)

"I would experience, uhm, headaches if I didn't consume any caffeine, so now I try not to be dependent on tea or coffee" (Participant 1)

"Although my caffeine consumption is large, I have tried to moderate it to where it is not as deficient for my health" (Participant 4).

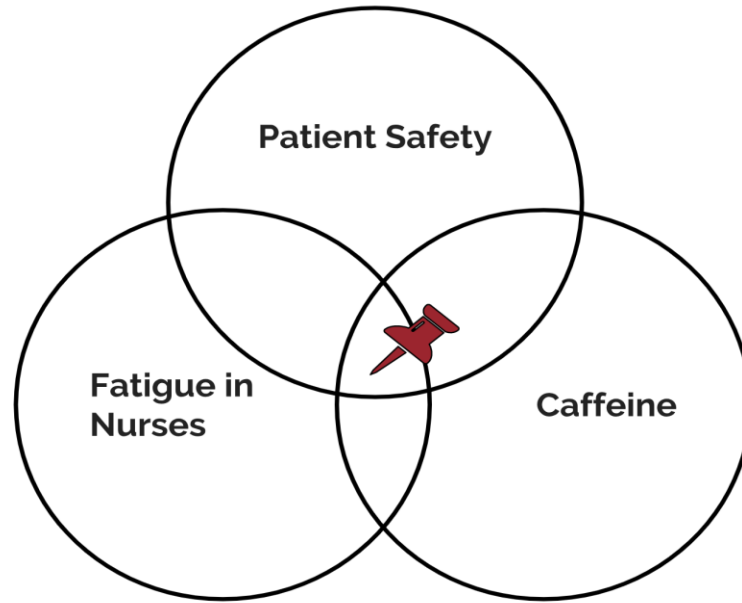
Theme 4: The Perceived Relationship Among Nurses, Caffeine Consumption, and Patient Care. A majority of the participants—three out of five participants—felt that caffeine consumption affects patient safety and care. When nurses drink caffeine, the effects of caffeine impact the nurse's thought process and ability to perform nursing responsibilities. The relationship can be seen in the following statements:

"My two cents here... consuming caffeine does affect patient care and safety. It actually helps me to get through my strenuous 12 hour shifts. By being more alert and awake, I am able to prioritize my tasks and get tasks done in timely manner " (Participant 2)

"Caffeine consumption keeps me focused at work. It helps me multitask and stay on top of all the tasks I need to complete " (Participant 4).

One participant felt that caffeine consumption had no role in patient safety or care; this participant felt that it "...doesn't it really changes my way of caring for patient whether or not I have caffeine." (Participant 1).

Discussion As shown in the diagram above, this study adds to the body of research that there is a



(Quitangon, 2018)

relationship among fatigue in nurses, patient safety, and caffeine. Fatigued nurses consume caffeine for energy because their perception is that it helps them to function and feel capable to do their job; this is related to patient safety because the care that nurses give, directly affects patients. A nurse who is awake and alert is less likely to make a mistake or an error, than a nurse who is feeling sleepy and tired. Unlike the majority of participants, one participant felt that caffeine did not have a role in affecting patient care. This may be related to the participant working day shift and not feeling fatigued as much during the day, therefore not dependent on caffeine, since the work environment is busier.

Fatigue at the workplace was a common experience among the participants. One participant mentioned the work environment and pace of the unit sometimes did not allow for

nurses to take a break, which contributed to fatigue in nurses. All participants had experience working the night shift, and expressed more fatigue and needing more caffeine consumption working that shift compared to day shift. Factors that led to this perception are: the work pace is slower at night, the environment is quieter and has dimmed lights, and working at night affects goes against the body's natural circadian rhythm.

Overall in this study, caffeine consumption is used because it helps nurses fight fatigue and stay awake and alert during their shift. Most of the nurses in this study worked 12 hour shifts and expressed that caffeine consumption helps them get through it. Though there are pros and cons to consuming caffeine, the positive effects of caffeine consumption outweigh the negative effects, such as headaches, sweating, and being jittery. One of the participants expressed that drinking too much caffeine inhibited his ability to start an IV because of jittery and shaky hands (Participant 2). The negative effects of caffeine consumption were related to drinking too much caffeine. Consuming caffeine often can lead to dependency—which in turn causes headaches when caffeine is not consumed, a symptom of caffeine withdrawal. This problem can be easily managed by controlling the amount of caffeine intake, which was mentioned by a couple of the participants.

Limitations

The limitation of this research study is the small number of participants. Having only five participants is not enough to represent the general demographic of nurses who consume caffeine.

Conclusion

The problem of fatigued nurses poses a risk to patients and the care that they receive. Although there is no direct evidence showing that caffeine has an impact on patient safety, current literature supports there are potential benefits to consuming caffeine to enhance cognitive function, which is affected by fatigue. Fatigue can impair a nurse's ability to sustain attention, decrease mental performance abilities, and increase the likelihood of making a mistake—which will have an impact on patient safety. It is evident that fatigue is a problem among healthcare occupations like nurses, which is associated with many personal and work related factors and caffeine use as a fatigue countermeasure, may be beneficial.

Although, my research findings are similar to what has been studied, more research is needed to assess caffeine consumption by nurses and its effect on the care that is provided to patients. It is still unknown what disadvantages of caffeine consumption—like withdrawal effects from caffeine dependent consumers—will affect patient care and job performance.

In conclusion, the prevalence of fatigue in nurses suggest a link to poor working conditions and a threat to patient safety. Healthcare employers need to be aware of the environmental factors of fatigue—like work hours and scheduling of nurses—because it may affect the safe and diligent care given to patients. Caffeine consumption can be advised and utilized for its enhancement of cognitive effects, but more research is needed to create guidelines and recommendations. Healthcare employers can also support their employees in fighting fatigue by providing diverse caffeine products in break rooms or the cafeteria.

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Theory of Interpersonal Relations. (2012, January 31). Retrieved March 22, 2018, from http://currentnursing.com/nursing_theory/interpersonal_theory.html

Wilhelmus, M. M., Hay, J. L., Zuiker, R. G., Okkerse, P., Perdrieu, C., Sauser, J., Silber, B.Y. (2016). Effects of a single, oral 60 mg caffeine dose on attention in healthy adult subjects.

Journal of Psychopharmacology,31(2), 222-232. doi:10.1177/0269881116668593

Appendix

Appendix A - Literature Review Table

Category 1: The Relationship Between Fatigue and Patient Safety

Purpose	Authors/Citation	Sample	Type of Study/Design	Major Finding(s)	Strengths	Limitations
To quantify, among registered nurses (RNs), the perceived dimensions and states of fatigue present, to investigate the relationships between perceived fatigue and perceived performance, and to identify differences in perceived fatigue levels and dimensions across demographic and work environment variables.	Barker, L. M. and Nussbaum, M. A. (2011), Fatigue, performance and the work environment: a survey of registered nurses. <i>Journal of Advanced Nursing</i> , 67: 1370–1382. doi:10.1111/j.1365-2648.2010.05597.x	1006 registered nurses (RN) completed some portion of survey, of those, 745 RNs completed entire survey 94.2% female 85.9% Caucasian and married	Non-experimental survey design	Nurses in the current study reported levels of mental, physical, and total fatigue that were quite high. They also perceived mental fatigue to be higher than physical fatigue. Nurses reported higher levels of acute fatigue than chronic fatigue Perceptions of fatigue dimensions and stated in RNs are inversely correlated with perceptions of performance Work environment variables (shift length, shift schedule, hours worked per week) are strongly associated with perceived levels of fatigue in RNs	Data was collected via scales that have been shown previously to have acceptable levels of reliability and/or validity The Nurse Performance Instrument that was developed was tested and researched for its appropriateness, clarity, readability and piloted it before use	Current results may not be generalizable to other nursing groups or other healthcare worker populations There was no way to ensure repeated participation in the sample There may be recovery or recall biases in reported fatigue levels depending on when the nurses took the survey
The purpose of this study was to examine the association between work and non-work fatigue-producing factors and self-reported acute and chronic fatigue and intershift recovery among hospital nurses working 12-hour-shifts.	Han, K., Trinkoff, A. M., & Geiger-Brown, J. (2014). Factors Associated with Work-Related Fatigue and Recovery in Hospital Nurses Working 12-Hour Shifts. <i>Workplace Health & Safety</i> , 62(10), 409-414. doi:10.3928/21650799-20140826-01	80 Nurses who provided full-time (≥ 36 hours per week) direct patient care on medical-surgical and critical care units at a large teaching hospital. Average age was 37 years old (range: 23 to 64 years) and	Nonexperimental Research Design	Psychological job demands (e.g., work load and social support from supervisor or coworker) were significantly associated with acute and chronic fatigue and intershift recovery. Rotating shifts were significantly related to acute fatigue. Psychological job demands are significantly related to occupational fatigue	Data was collected using instruments with strong validity and rigor Data provided statistical significance	The sample size might be too small to have sufficient power to examine the effects of various factors on nurse fatigue and recovery, and the generalizability of study findings may be limited to nurses in similar work situations. Data were based on nurses' self-reported responses, which could be affected by recall bias or denial.

Purpose	Authors/Citation	Sample	Type of Study/Design	Major Finding(s)	Strengths	Limitations
		<p>had 10 years of nursing experience.</p> <p>Regarding work schedules, 41% worked night shifts only and 23% routinely rotated shifts (e.g., days vs. nights). Almost 30% of nurses provided some child or elder care when at home.</p>		<p>and recovery among hospital nurses working 12-hour shifts.</p> <p>Nurses with high levels of acute fatigue also had higher psychological demands at work</p>		
To identify and model the effects of sleep loss and fatigue on resident-physicians' professional lives and personal well-being.	Papp, K. K., Stoller, E. P., Sage, P., Aikens, J. E., Owens, J., Avidan, A., . . . Strohl, K. P. (2004). The Effects of Sleep Loss and Fatigue on Resident-Physicians: A Multi-Institutional, Mixed-Method Study. <i>Academic Medicine</i> , 79(5), 394-406. doi:10.1097/00001888-200405000-00007	149 residents at five U.S. academic health centers and from six specialties (obstetrics-gynecology, emergency medicine, family medicine, internal medicine, pediatrics, surgery)	Mixed-methods design	<p>More residents perceived that sleep loss and fatigue had major impact on their personal lives during residency, leaving many personal and social activities and meaningful personal pleasures deferred or postponed.</p> <p>Sleep loss and fatigue also had major impact on residents' abilities to perform their work.</p>	<p>The sample included residents from six different specialties</p> <p>Sites were selected to represent a range of geographic locations as well as public and private institutions</p> <p>Anonymized, unedited focus group transcripts as well as questionnaire data was forwarded to an external party for data analysis and interpretation</p>	Data was collected over a year, different times in individuals lives could have played a role on how much sleep the subjects were getting
To examine the work patterns of hospital staff nurses and to determine if there is a relationship between hours worked and the frequency of errors.	Rogers, A., Hwang, W., Scott, L., Aiken, L., & Dinges, D. (2004). The working hours of hospital staff nurses and patient safety: both errors and near errors are more likely to occur when hospital staff nurses work twelve or	Sample of 393 registered nurses (RNs) was predominantly female (92 percent), Caucasian (79 percent), middle-aged (mean	Non Experimental descriptive design	<p>Hospital nurses worked longer than scheduled daily, and generally worked more than 40 hours a week</p> <p>Half of the shifts worked exceeded 10.5 hours</p>	Sample did not differ significantly from those of nurses in the 2000 National Sample Survey of Registered Nurses in terms of sex, age, marital status, and	<p>Results depend on the truthfulness of self reports by participants</p> <p>Definition of error was not specified in the survey instrument, thus it was up to participant's own interpretation.</p>

Purpose	Authors/Citation	Sample	Type of Study/Design	Major Finding(s)	Strengths	Limitations
	more hours at a stretch. <i>Health Affairs</i> , 23(4), 202-212.	age 44.8 +8.8 years, range 22-66), and experienced (mean 17.2 ±10.0 years)		<p>Overall, our participants worked, on average, fifty-five minutes longer than scheduled each day, and all workers worked beyond their scheduled work shift (overtime) at least once during the twenty-eight day data gathering period</p> <p>There were 199 errors and 213 near errors reported during the data-gathering period.</p> <p>Work duration, overtime, and number of hours worked per week had significant effects on errors—likelihood of making an error increased with longer work hours and was three times higher when nurses worked shifts lasting 12.5 hours or more.</p>	<p>work environment (urban/rural location).</p> <p>Pilot tested the logbook format</p> <p>first nationwide effort to quantify hospital staff nurse work hours and work patterns</p> <p>Anonymous error reporting system made nurses feel more comfortable to self-report errors.</p>	Data of self-reports off a relatively small number of hospital staff nurses and may not be representative of the work schedules and clinical practices of other U.S. hospital nurses.
To examine the association between selected sleep variables, impairment due to fatigue, and clinical-decision self-efficacy and regret among critical care nurses.	Scott, L. D., Arslanian-Engoren, C., & Engoren, M. C. (2014). ASSOCIATION OF SLEEP AND FATIGUE WITH DECISION REGRET AMONG CRITICAL CARE NURSES. <i>American Journal Of Critical Care</i> , 23(1), 13-23. doi:10.4037/ajcc2014191	Full-time critical care nurses practicing as staff nurses. 3500 nurses were mailed a questionnaire packet. 737 questionnaires were returned (21% return rate). 605 questionnaire packets (17%) were used for analysis.	Non Experimental, survey design	<p>Nurses who experience impairments due to fatigue, loss of sleep, and inability to recover between shifts are more likely than unimpaired nurses to report decision regret.</p> <p>Acute and chronic sleep deprivation affects cognitive function, most noticeably working memory, alertness, attention, vigilance, and decision making.</p> <p>Majority of nurses reported moderately high fatigue, significant sleep deprivation, and daytime sleepiness, all of which affect their ability to be alert, vigilant, and safe.</p>	<p>The study got a typical response rate for non incentivized, mailed surveys among health care professionals.</p> <p>Instruments used to gather were valid</p> <p>Data and statistics were explained to explain meaning and importance</p> <p>Data is supported and is consistent with previous studies</p> <p>Conceptual framework was provided and defined clearly</p>	<p>The data was self-reported based on answers from the questionnaires, thus varying due to subjective nature</p> <p>It was not specified if work location (urban/rural) had an effect</p> <p>Instruments and sample size may limit generalizability of findings</p>

Category 2: Caffeine’s Effect on Human Performance

Purpose	Authors/Citation	Sample	Type of Study/Design	Major Finding(s)	Strengths	Limitations
To investigate the effects of caffeine on a flanker test designed to test Posner’s three visual attention network functions: alerting, orienting, and executive function.	Brunyé, T., Mahoney, C., Lieberman, H., & Taylor, H. (2010). Caffeine modulates attention network function. <i>Brain & Cognition</i> , 72(2), 181-188. doi:10.1016/j.bandc.2009.07.013	36 Tufts University undergrad students (16 male, 20 female) low caffeine users (M= 42.5 mg/day)	placebo-controlled, double blind study using repeated measures designs	Self reported mood-states after caffeine consumption showed an increase in how lively, peppy, and jittery they felt, as well as, a decrease in how drowsy, tired, and calm they felt. Caffeine improved participants’ alerting and executive control function in a dose-response manner, asymptoting at 200mg Caffeine can improve participants’ ability to take advantage of alerting cues Caffeine has differential effects on visual attention networks as a function of dose	Consistency of findings support previous studies, study design implemented measures to provide consistency in data collection, used standardized scales as wells as a test (Attention Network Test) that has much evidence that supports its reliability and validity	Mostly all female sample, participants were not habitual caffeine consumers which thus may require lower doses of caffeine to exhibit effects
To examine the effectiveness of repeated administration of 200mg doses of caffeine to sustain vigilance, reaction time, high-order cognitive function that requires logical reasoning and live-fire marksmanship during three successive evenings of sustained wakefulness	Kamimori, G. H., McLellan, T. M., Tate, C. M., Voss, D. M., Niro, P., & Lieberman, H. R. (2015). Caffeine improves reaction time, vigilance and logical reasoning during extended periods with restricted opportunities for sleep. <i>Psychopharmacology</i> , 232(12), 2031–2042. http://doi.org/10.1007/s00213-014-3834-5	20 male special forces personnel who volunteered.	double blind experimental design	800mg of caffeine provided during overnight periods of wakefulness is a effective strategy to sustain cognitive function when less optimal sleep periods are provided during the afternoon. Reaction time, vigilance, and logical reasoning were all maintained with caffeine supplementation and remained close to or at control levels for duration of study.	Reanalyzed data by removing outliers and compared data to explain differences in data, control data was taken before study was designed to compare data to	Small sample of all males, 5 participants were nonusers of caffeine, deterioration in cognitive performance could also be due to circadian effect, caffeine was delivered through a gum rather than a pill

Purpose	Authors/Citation	Sample	Type of Study/Design	Major Finding(s)	Strengths	Limitations
followed by 4-h afternoon periods for sleep.				When an individual does not receive enough sleep during the day and has to work at night, caffeine supplementation at night should be considered to help maintain workplace productivity and safety		
To assess the effect of 60 mg caffeine on sustained attention in health adults	Wilhelmus, M. M., Hay, J. L., Zuiker, R. A., Okkerse, P., Perdrieu, C., Sauser, J., & ... van Gerven, J. M. (2017). Effects of a single, oral 60 mg caffeine dose on attention in healthy adult subjects. <i>Journal Of Psychopharmacology</i> , 31(2), 222-232. doi:10.1177/0269881116668593	82 healthy adults (n=41 male and n = 41 female) Aged between 40-60 years old (mean = 47.8 years) Mean Average weight of 73.1 kg Abstinent or moderate caffeine users	Randomized, double blind, placebo-controlled, cross-over randomized trial	60 mg elicited a clear enhancement of sustained attention and alertness, which was consistent in multiple objective performance measures as well as subjective ratings Sustained attention performance improved with tasks longer than 5 minutes duration (i.e. RVIP 12 minutes, Mackworth Clock 45 minutes) Performance on the central nervous system tasks also improved. Participants reported significantly increased feelings of alertness, contentment, overall mood, relaxation, and decreased reports of tiredness, mental fatigue, and headaches at 70 and 120 minutes post treatment.	Saliva was tested for compliance and that participants did not consume caffeine within last 24 hours of study. Involved a training session before actual experiment to gather reliable control data. Tests used in data have been used in previous research to measure human sustained attention	Does not take into effect of caffeine withdrawal symptoms, habitual caffeine users may require a higher caffeine dose to experience similar effects in this dose

Appendix B - Flyer /Handout

**DRINK****CAFFEINATED BEVERAGES AT WORK?**

**LOOKING FOR FULL-TIME NURSES (36 HOURS OR MORE A WEEK)
TO PARTICIPATE IN A RESEARCH STUDY DESIGNED TO EXPLORE
PERCEPTIONS OF CAFFEINE CONSUMPTION RELATED TO PATIENT SAFETY.**

This research is part of Camille Quitangon's Senior Thesis research project at Dominican University of California, San Rafael, California.

**PARTICIPATION IN THIS RESEARCH WILL INVOLVE TAKING PART IN A THIRTY MINUTE INTERVIEW,
WHICH WILL INCLUDE QUESTIONS ABOUT EXPERIENCES WITH FATIGUE AS WELL AS THOUGHTS AND
FEELINGS ON THE TOPIC OF CAFFEINE CONSUMPTION AND PATIENT SAFETY.**

Participants will be given \$5 gift card to Starbucks after completion of interview.

IF INTERESTED IN PARTICIPATING, PLEASE CONTACT CAMILLE QUITANGON

PHONE: (707) 608-xxxx

EMAIL: CAMILLE.QUITANGON@STUDENTS.DOMINICAN.EDU

Appendix C - Consent Form

CONSENT FORM TO BE A RESEARCH PARTICIPANT



1. I understand that I am being asked to participate as a Participant in a research study designed to explore perceptions of caffeine consumption related to patient safety. This research is part of Camille Quitangon's Senior Thesis research project at Dominican University of California, California. This research project is being supervised by Patricia Harris, Assistant Professor, Nursing Department, Dominican University of California.
2. I understand that participation in this research will involve taking part in a thirty-minute interview in a private setting, which will include questions about experiences with fatigue as well as thoughts and feelings on the topic of caffeine consumption and patient safety.
3. I understand that my participation in this study is completely voluntary and I am free to withdraw my participation at any time.
4. I have been made aware that the interviews will be recorded. All personal references and identifying information will be eliminated when these recordings are transcribed, and all participants will be identified by numerical code only; the master list for these codes will be kept by Camille Quitangon on another document separate from the transcripts. Coded transcripts will be seen only by the researcher and her faculty advisors. One year after the completion of the research, all written and recorded materials will be destroyed.
5. I am aware that, if requested and contact information provided, I may be furnished with a written summary of the relevant findings and conclusions of this project. Such results will not be available until December 31, 2018.
6. I understand that I may refuse to answer any question. I also may elect to stop the interview at any time.
7. I understand that my participation involves no physical risk, but in the unlikely event that the interview causes psychological discomfort, I may request a list of local psychological health services.
8. I understand that loss of privacy is a risk associated with recordings and every effort will be made to ensure confidentiality is maintained.
9. I understand that if I have any further questions about the study, I may contact Ms. Camille Quitangon at camille.quitangon@students.dominican.edu or her research supervisor, Patricia Harris at patricia.harris@dominican.edu. If I have further questions or comments about participation in this study, I may contact the Dominican University of California Institutional Review Board for the Protection of Human Participants (IRBPHP), which is concerned with the protection of volunteers in research projects. I may reach the IRBPHP Office by calling (415) 482-3547 and leaving a voicemail message, by FAX at (415) 257-0165 or by writing to the IRBPHP, Office of the Associate Vice President for Academic Affairs, Dominican University of California, 50 Acacia Avenue, San Rafael, CA 94901
10. All procedures related to this research project have been satisfactorily explained to me prior to my voluntary election to participate.

I HAVE READ AND UNDERSTAND ALL OF THE ABOVE EXPLANATION REGARDING THIS STUDY. I VOLUNTARILY GIVE MY CONSENT TO PARTICIPATE. A COPY OF THIS FORM HAS BEEN GIVEN TO ME FOR MY FUTURE REFERENCE.

Signature _____ Date _____

Appendix D - Demographic Information

1. **AGE:** _____
2. **GENDER:** _____
3. **NUMBER OF YEARS WORKING AS A BEDSIDE NURSE:**

4. **SHIFT LENGTH IN HOURS:** _____
5. **HOSPITAL UNIT**
 - MEDICAL SURGICAL
 - EMERGENCY DEPARTMENT
 - INTENSIVE CARE UNIT
 - MATERNITY/ LABOR DELIVERY
 - OPERATING ROOM
 - POST- ANESTHESIA CARE UNIT
 - PEDIATRICS
 - OTHER: _____
6. **PRIMARY SHIFT WITHIN THE LAST YEAR (CIRCLE ONE):**
 - DAY / EVENING / NIGHT
7. **CAFFEINE CONSUMPTION**
 - **ESTIMATED NUMBER OF CAFFEINATED BEVERAGES CONSUMED PER SHIFT(IN CUPS)** _____
 - **HOW FREQUENT DO YOU CONSUME CAFFEINATED BEVERAGES IN A WEEK?**
 - COUPLE (1-2) TIMES A WEEK
 - SEVERAL (3-6) TIMES
 - DAILY
8. **TYPES OF CAFFEINATED BEVERAGES CONSUMED (SELECT ALL THE APPLY)**
 - COFFEE
 - TEA
 - ENERGY DRINKS
 - SODA
 - Other: Please identify _____

Appendix E - Structured Interview Guide

QUESTIONS FOR INTERVIEW

1. *How do you feel about your caffeine consumption?*
2. *Tell me more about how caffeine plays a role in your work behavior?*
3. *Tell me about your experience with fatigue in your workplace?*
4. *Tell me about your experiences with countering fatigue with caffeine consumption?*
5. *What is your perception of caffeine consumption in relation to patient safety and patient care?*
6. *Tell me about your positive perceptions of caffeine consumption at work?*
7. *Tell me about your negative perceptions of caffeine consumption at work?*
8. *Do you have anything more to add?*
9. *Do you have any questions for me and if so, what are they?*

Appendix F - Content Analysis Table

Theme	Category	Code	Condensed Meaning Unit	Meaning Unit
Nurses Experience Fatigue in the Workplace	Lack of breaks	Work Flow	Trauma ER nurses commonly are unable to take full breaks and continue on with patient care. Work environment is physically and mentally demanding.	"In a busy trauma ER, nurses often get pulled away from breaks and end up in trauma or critical rooms to help out critical patients. I found many nurses have to continue with patient care without a single break sometimes. The workplace can be physically tiring as well as, mentally." (P2)
	Night Shift	Work Flow	Night shift work conditions, such as slower foot traffic and dimmer lights, contribute to nurses feeling more tired and sleepy. Also nurses may drink more coffee when working night shift vs day shift.	"...night shift, because the environment was a little, I don't wanna say slower, but like, you know there's not as much foot traffic, it was a little dimmer, you know sometimes when you're sitting there charting, you find yourself feeling more sleepy and tired." (P1)
	Night Shift	Time of Shift	Working the night shift, I always feel fatigued and its not easy to stay up because of my irregular sleep pattern	"I work the night shift from 11pm to 7am, and it is not easy to stay up when you factor in my irregular sleep schedule.....Coming to work at the time I do, always makes me feel fatigued naturally." (P4)
Caffeine Affects Work Behavior	Need for caffeine to function	Energy	Drinking coffee, helps stimulate my attitude, to stay awake instead of complaining of how tired I am	"There are numerous days when I wake up tired or unmotivated. Drinking a cup of coffee before work stimulates my attitude in working. It helps me to stay awake instead of complaining of how tired I am." (P2)
	Need for caffeine to function	Energy	I always consume one cup of black coffee before work. It keeps me energized, focused, and my mood is more positive.	"For the most part, I always consume one cup of black coffee prior to work. It keeps me energized, focused, and my mood is more positive when I consume a cup of coffee prior to work." (P4)
	Need for caffeine to function	Energy, Habit	Caffeine helps me wake up in the morning and part of my morning ritual	" [Caffeine] helps me wake up in the morning and part of my morning ritual" (P5)
	Break Time	Social Aspect	Drinking coffee is seen as a social and therapeutic action	"Drinking coffee is social and therapeutic. I am able to interact with my co-workers during my short coffee break" (P2)

Theme	Category	Code	Condensed Meaning Unit	Meaning Unit
The Good and Bad Effects of Caffeine Consumption	Positive Perceptions	Physical Symptoms	Gives energy boost, feel more peppy, move faster, clearer thought process	"I do feel a little bit of a surge of an energy boost when I do have it, so I guess it is positive that you know you feel a little more peppy, you move a little faster, maybe thought process is a little clearer" (P1)
		Physical Symptoms	Drinking coffee gives me a motivated feeling and keeps me happy and positive at work. "	Drinking coffee gives me a motivated feeling and keeps me happy and positive at work" (P4)
		Physical Symptoms	Helps stay awake, alert and focused	"Ever since I started my job that requires to work 7p-7a, consuming caffeine has had a positive impact. As long as I limit myself from drinking too much coffee, the effect of caffeine in moderate use, has helped me to stay awake, alert and focused " (P2)
	Negative Perceptions	Physical Symptoms	Headaches when not drinking caffeine	"I would experience, uhm, headaches if i didn't consume any caffeine, so now I try not to be dependent on tea or coffee"....." I remember I used to study a lot, I definitely wanted to stay awake and I would drink 3 cups of coffee a day. And anytime I would come home for the holidays, or whatever and I didnt have to study and I wouldn't' drink coffee, it would be headache all day. And I didn't really like that feeling so that's why I stopped doing it." (P1)
		Physical Symptoms	Consuming large amounts of caffeine to counter fatigue can cause side effects like sweating, shaking, and jitteriness.	"When I am feeling more fatigue than usual, I will load my body with extra caffeine, sometimes chewing caffeine gums while drinking coffee. I have experienced more of side effect of consuming caffeine when I try to counter fatigue by taking extra caffeine consumption... Some of the side effects that I personally experienced were sweating, shaking, and jitteriness." (P2)
		Health concern	Although my caffeine consumption is large, I have tried to moderate it to where it is not as deficient for my health	"Although my caffeine consumption is large, I have tried to moderate it to where it is not as deficient for my health." (P4)

Theme	Category	Code	Condensed Meaning Unit	Meaning Unit
The Perceived Relationship Among Nurses, Caffeine Consumption, and Patient Care	Caffeine consumption affects patient safety and patient care	Thought process	Caffeine consumption helps to organize thoughts and patient care	"A simple two-minute coffee break has helped me to re-organize my thoughts and patient care... It helped me recenter myself and what I need to do." "The benefits of short coffee breaks are therapeutic in terms of de-briefing and interacting with co-workers, which encourages productivity as well as patient interaction. " (P2)
		Nursing Responsibilities	Symptoms of too much caffeine consumption, such as jitteriness and shaking, affected patient safety and care by making it hard for the nurse to start an IV	"I think in terms of patient safety, and patient care, I have not experienced anything extremely bad clinically.... I have experienced one time when my caffeine level was over the board, I was having hard time starting an IV due to jitteriness and shaking in my hands"(P2)
		Nursing Responsibilities	Caffeine consumption affects patient care and safety. It helps a nurse function physically and mentally through a 12 hour strenuous shift.	"My two cents here... consuming caffeine does affect patient care and safety. It actually helps me to get through my strenuous 12 hour shifts. By being more alert and awake, I am able to prioritize my tasks and get tasks done in timely manner" (P2)
		Nursing Responsibilities	Coffee during the night shift is reasonable to help us stay awake and care for our patients	"I see many of my coworkers consume coffee and in the night shift... it seems reasonable for us to stay awake and care for our patients" (P3)
		Nursing Responsibilities	Caffeine consumptions keeps me focused and helps me multitask and stay on top of all the tasks I have to complete	"Caffeine consumption keeps me focused at work. It helps me multitask and stay on top of all the tasks I need to complete" (P4)
	No relationship among caffeine consumption, patient safety, and patient care	No effect/ no role	My patient care is not affected by caffeine use	"I don't think it really changes my way of caring for patient whether or not I have caffeine" (P1)