2017

Noise in the ICU

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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2017

Abstract

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by

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MS, Western Governors University, 2013

BS, Western Governors University, 2012

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

November 2017

Abstract

Noise in the Intensive Care Unit (ICU) has been associated with patients experiencing psychological and physical disorders such as anxiety, sleep deprivation, and worsening of hypertension and diabetes. Researchers have suggested that the use of a noise reduction protocol can result in a decrease in noise in the ICU and a subsequent improvement in Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores. The research question for this project examined the effectiveness of a newly developed noise protocol in minimizing noise in the ICU, since the patients at the facility of study reported noise as being a nuisance that was hampering their sleep and healing; this nuisance has also been reflected in the hospital's low HCAHPS scores. The theoretical premise of the project was the theory of comfort, which suggests that engaging in health-seeking behaviors bring patients comfort. The sources of evidence that guided the project included a literature review using the keywords noise in ICU, sleep disruption, and hospital noise; HCAHPS scores over the past 5 years; and the analysis of data obtained from interviews of 48 nurses and 4 intensivists (critical care doctors) who responded to an open invitation to participate. The interviews were analyzed using codes; the emerging themes were that the protocol was useful, did not interfere with work flow, and allowed patients to rest uninterruptedly. The result from the project can be used by the hospital leadership team to advance the noise reduction protocol to areas of the hospital outside of ICU, and as a training tool to educate the hospital staff on the importance of maintaining a noise-friendly environment.

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Acknowledgements

It would have been virtually impossible to undertake the task of completing a DNP degree without the support of my family, friends, coworkers, and the staff of Walden University, especially Dr. Whitehead. A special thank you to my husband, Roberto, whose invaluable support was my motivation from one day to the next. Thank you for taking on the task of being mother and father to our two wonderful daughters while I hibernated for the past year and a half. Thanks to my children Krystal and Kaley for being patient and understanding when I had to choose schoolwork over playtime or any other motherly duty. Dr. Whitehead, you were born to be an educator. Your calm spirit and cheerful demeanor will never be forgotten. I honestly think I would have a greater struggle with the project without your guidance, support, and patience. Thanks Dr. Schumacher for being my second committee member and for your contribution to my oral defense.

Thanks to the staff at my practicum site, a special thanks to my former preceptor, Dr. Payne, and my current preceptor, Dr. Lafleur, for their guidance and unwavering support and for being flexible with my practicum hours. Avery special thanks also to all the staff who participated in the interviews and those who were a part of my project team. I am completely indebted to all of you.

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Section 1: Nature of the Project Introduction

The purpose of this project was to evaluate the response of full-time and contract staff to the implementation of a noise reduction pilot protocol in the Intensive Care Unit (ICU). Attention was drawn to the problem of noise in the ICU through this project, allowing hospital staff to be more cognizant of the fact that they play a vital role in the healing process and well-being of the patient, and they can support the facilitation and maintenance of an acoustically healthy environment.

Patients' health and wellbeing are influenced by their quality of sleep; noise influences both cortical brain activity and cardiovascular function during sleep (Jones & Dawson, 2012). Sleep is essential to healing and repairing heart and blood vessels, and ongoing sleep deprivation is linked to an increased risk of heart disease, kidney disease, high blood pressure, diabetes, and stroke (Buxton et al., 2012; Jones & Dawson, 2012; National Heart, Lung, and Blood Institute, 2012). It is therefore necessary to integrate interventions to reduce noise. The acoustic environment of healthcare facilities should consequently be improved to allow the best quality of care (Buxton et al., 2012; Hammer, Swinburn, & Neitzel, 2014). Based on these arguments, the World Health Organization (WHO) has recommended the maintenance of noise levels of 30 to 35 decibels and the implementation of a monitoring device to ensure compliance (Singh, 2015). It appears patients' mental and physical health is, therefore, subjective to the level of noise they experience.

Noise in the ICU is a nuisance, as researchers have found that a quiet and peaceful acoustic environment improves how patients respond to treatment, leading superior

overall outcomes. This science is dependent on an evidence-based conceptual framework that is guided by empirical inquiry built from several theories that are the root of the practice of nursing (Marqués, Calvo, Mompart, Arias, & Quiroga, 2012; White & Dudley-Brown, 2012). It takes a holistic approach to studying noise and its impact on health, and it is even more important to use this holistic approach if there are already existing comorbidities.

Problem Statement

Noise is a loud or unpleasant sound made by something or someone. It is an annoying sound (The Merriam-Webster dictionary, 2016). Collins, Vanderheide, and McKenna (2014) suggested that too much noise leads to noise overload/noise pollution, which can be detrimental to a patient's recovery. Noise was described as a nuisance by the patients and/or their family in the ICU where the evaluation of the noise reduction protocol was undertaken. It was the focus of this doctoral project. The patients reported their inability to obtain quality or quantity sleep in the unit, and patients and their families voiced their frustration and dissatisfaction. This was the reason the hospital took the initiative to implement a noise reduction protocol, which included the dimming of lights, the grouping of activities, and the reduction of traffic through the ICU at a particular time of the shift.

Noise in the hospital is caused by lack of staff awareness of its effect on patients' hospital experience; there is a strong correlation between sleep and environmental factors such as noise. Noise can cause an alteration in the process of healing and can affect rapid eye movement sleep (Buxton et al., 2012; Fillary et al., 2015; Jones & Dawson, 2012).

According to Long and Stover (2014), in a multicenter trial they conducted, 25% of patients admitted to critical care units had cognitive impairment similar to patients with mild Alzheimer's disease, and 33% had impairment typically associated with traumatic brain injury. The authors concluded, based on this study, that critical care units are the nosiest of all hospital units and that the outcome of the study was the result of a lack of sleep experienced by patients in critical care units. The authors believed that sleep provides the opportunity for patients to heal and improve their functioning and that sleep is critical for wellness (Long & Stover, 2014), Noise has been proven to interfere with the process of wound healing and causes increase weight gain (Buxton et al., 2012). Noise leads to the release of stress hormones with a resulting impairment in immune function (Nicole, 2016) and causes damaging psychosocial effects, including sleep disturbance (Prasher, 2009). The improvement of an acoustic environment can demonstrate an enhancement of patients' health and overall wellness and can improve patient satisfaction.

Purpose

The gap in this practice setting was that noise in the ICU was impacting patients sleep patterns. A noise protocol had been implemented, but its usefulness and effectiveness had not yet been evaluated by the staff. Altering noise in the work environment facilitates healing and improves Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores (Marqués et al., 2012). The project question was as follows: What are the perceptions of full-time and contract staff of the noise reduction pilot program in the ICU? The project(a) demonstrated that stakeholders

and end-users needed to be invigorated to work together to improve patients' satisfaction and patients' health, (b) provided the means for a shift in culture in terms of evidence presented , and (c) allowed for a change in the way patient care was delivered so as to improve the acoustic environment.

Nature of the Doctoral Project

In this project, I evaluated a noise protocol based on standards and established best practices as well as recommendations from stakeholders. The approach that was used to obtain, organize, and analyze the evidence needed to complete the project included conducting a semistructured interview involving the ICU doctors (intensivists) and the ICU nurses. The international recommended noise level in the ICU setting is 45 decibels (Do Carmo da Silveira Neves de Oliveira et al., 2013; Konkani & Oakley, 2012). Consequently, implementing environmental measures such as dimming lights at a certain time of the shift, grouping activities to reduce disturbance, and decreasing activities in patient care areas will allow for the evaluation of the effectiveness of these tools used in the effort to reduce noise. Implementation of a bundle of interventions may reduce the frequency of sleep disturbance in ICU (Sendelbach, Wahl, Anthony, & Shotts, 2015).

In connecting the gap in practice to the anticipated findings from the analysis, I demonstrated that sleep is a restorative process vital to human functioning, and lack of sleep in the ICU can lead to derangement in mental functioning and ICU psychosis. Consequently, with improvement in sleep quantity and quality resulting from the implemented strategies to reduce noise, patients should be able to heal and return to normal functioning at a faster rate. The suggested strategies were very economical, but

the effects of their use could save the hospital significant gain in patient satisfaction and improvement of HCAHPS scores. White and Dudley-Brown (2012) believed that care supported by science improves quality, reduces the risk of adverse events, and closes gaps in transferring knowledge to practice. These are the tools necessary to motivate individuals towards making necessary changes for the improvement of an organization.

Significance

Stakeholders are people or organizations invested in the hospital where the study was conducted. The stakeholders involved in this project included the nurse manager, the doctors, the hospital administrators, and the end users. The nurse manager provided feedback on reports, reviews, and summaries shared, and assisted in the dissemination of the information obtained from the study. The nurse manager provided guidance and stipulation for the evaluation of the program, and was helpful in providing direction for the evaluation of the project. The doctors, and more specifically the intensivists, provided information regarding their response to the new changes, such as the restrictions of ordering procedures, example labs, and x-rays, outside of stipulated quite times. The hospital administrators were responsible for running/ managing the hospital; consequently, it was vital to have them on board and ascertain their willingness to change practice based on the result of the evaluation of the noise protocol. It was important to ensure that their interest was considered and included. They were able to provide input on implementing effective measures to prevent noise, identify options, and recommend solutions. They were also able to help identify gaps in practice and help formulate policies and methods to aid in fixing them. In addition, the administrators helped in

setting the precedence for a health care delivery system that is acoustically friendly. The end users, that is, the nurses, nurse's aide, and secretaries, were actively involved in the maintenance of the protocol and the reporting of noncompliance.

In identifying a potential contribution of the doctoral project to nursing, the doctoral project included the new evidence-based practice strategies that may help to alleviate the problem of noise in the ICU. It includes the evaluation of a noise protocol such as dimming lights, decreasing unit activities, and decreasing alarm sensitivity to ascertain staff response to its use. According to West, Abbott, and Probst (2014), there is a need for a clear and common understanding of the concept to assist in the development of effective strategies and policies to eradicate the alarm fatigue phenomena phenomenon affecting the nursing practice arena. These are the activities necessary to promote a quiet, peaceful, and therapeutic environment in the ICU and were evaluated in this project.

There is the potential for social change in undertaking this project, Fillary et al. (2015) believed the interventions to reduce noise should be targeted at staff education, behavior modification, care organization, and environmental solutions. There are significant opportunities existing to improve methodologies to study noise levels and to reduce noise in hospitals. Hence, the hospital of study has undertaken the task of implementing a noise protocol. The program was relatively new, and its evaluation was necessary to provide feedback for those actively involved in upholding and maintaining the protocol.

Summary

Noise in the ICU is a problem that was causing distress to the patients and their families at the facility where the study was conducted. The study was conducted to bring urgency to the problem and to determine the response of full-time and contract staff to the implemented protocol. The result of the study may be used for a quality improvement project. The study also included necessary theories and models. The emphasis of the relevance of the study to nursing practice was brought into focus, and my role and the project team was highlighted.

Section 2: Background and Context

Introduction

The practice problem for this project relates to noise in the ICU. The WHO recommended that the noise level range is 35 to 45 decibels (Darbyshire & Young, 2013). Although the noise level had not been measured in the ICU where the study took place, the current noise level is a deterrent to patients' rest and healing, causing patients and their families distress and dissatisfaction. It is a problem that interrupts sleep and is disruptive to hospitalized patients (Stafford, Haverland, & Bridges, 2014). The project question was as follows: What are the perceptions of full-time and contract staff of the noise reduction pilot program in the ICU?

Concepts Models and Theories

Attempts at noise reduction are influenced by the middle range theory of comfort, introduced by Kolcaba (2001). The theory was built on the premise that comfort results when patients are engaged in health-seeking behaviors and that in stressful healthcare circumstances, unmet comfort needs are met by nurses. The concept of the theory referred to nurses identifying unmet comfort needs in their patients and developing interventions to address those needs while being humanistic and holistic. The theory focuses on psychosocial and environmental needs as well as interventions to address those needs, making it pivotal in addressing environmental issues such as noise in the ICU. The major tenets of Kolcaba's theory of comfort includes: the health team identifying comfort needs of patients and their families, the health team designing interventions to address comfort needs, the health team enhancing comfort by delivering

interventions in a caring manner, the health team providing comfort care that enhances patient and family satisfaction (adapted from McEwen & Wills, 2014)

The principles of the theory were considered in providing an environment that promotes optimal healing and a framework necessary to integrate new approaches to solving the problem of noise in patient care areas. The theory embodied structural and functional components that work to cause environmental changes (McEwin & Wills, 2014) and provided guidance in the implementation and evaluation of actions necessary to reduce noise in the ICU (Chau, 2011).

Relevance to Nursing Practice

The project was embedded in the problem of low patient satisfaction at the hospital of study. The HCAHPS scores were low, resulting in lost revenue. Furthermore, a lack of sleep is associated with psychosomatic changes such as delirium and an increase in blood sugar levels (Buxton et al., 2012). Sleep deprivation is associated with an increase in norepinephrine and cortisol levels, a decrease in growth hormone levels, and an increase in insulin resistance (Buxton et al., 2012). Reduction in sleep quality may also result in a decrease in inspiratory muscle endurance and can be detrimental to patients in the ICU setting (Darbyshire & Young, 2013). Consequently, understanding the mechanisms of sleep deprivation is critical to the care of patients in the ICU and may help clinicians modify factors necessary to promote a better quality of sleep.

New evidence has suggested that dimming lights at nights help workers speak softly and become more mindful of the need for patients to rest. Moreover, according to a study conducted by Linder and Christian (2012), it is important that lights are dimmed, as

lights affect onset and duration of sleep. Earplugs are also useful in improving patients' ICU experience and reducing noise exposure. Although these were currently not being used at the facility of study, it is hoped that this evaluation of the current noise reduction protocol and the evaluation of current evidence on the subject of noise reduction will lend itself to the implementation of further noise reduction measures such as the use of earplugs and eye mask. Alway, Halm, Shilhanek, and Pierre (2013) conducted a study on the use of ear plugs and eye masks in preventing noise and recounted that the participants reported that the earplugs were comfortable, easy to use, and effective against noise. Jones and Dawson (2012) conducted a similar study and concluded that simple interventions such as eye masks and earplugs might be invaluable in helping patients attempting to sleep in a critical care unit.

In the past, efforts to reduce noise and assist patients in resting and healing included rigorous education policies, behavioral modification using sound detection equipment, and low as well as high cost environmental alterations; however, these did not appear to be adequate in minimizing noise to levels accepted by international agencies (Konkani & Oakley, 2012). Current practices have been helpful in achieving the goal of noise reduction in patient care areas. Sendelbach et al. (2015) conducted a study on noise in the ICU and concluded that the implementation of a bundle of interventions could reduce the frequency of nuisance alarm signals and other noise related factors in the critical care areas.

Local Background and Context

Patient dissatisfaction has caused a decrease in HCAHPS scores. A pilot protocol for noise reduction was implemented in the ICU. The purpose of this project was to evaluate this pilot protocol, and based on feedback, make recommendations for additional changes. West et al. (2014) argued that the problem of alarm fatigue was a significant contribution to the problematic noise in the ICU, a problem of enormous proportion in this ICU, and small steps are being taken to eradicate the problem.

The institution that was addressed in this doctoral project was a 20-bed ICU in a local 350-bed community hospital. The hospital provides a range of in-patient, out-patient, and community services for the residents of the region. The hospital is part of a network that serves 20 other facilities and is governed by the state regulatory board and other national regulatory boards such as the Joint Commission on Accreditation of Healthcare Organizations.

Role of the DNP Student

I am an ICU nurse at the facility where the project was conducted and had experienced patient and family frustration with noise in the ICU. My role was to evaluate the noise reduction protocol and disseminate the findings. I was motivated to evaluate the protocol after hearing noise complaints from patients and families for over 11 years, with no attempts to decrease or eradicate this noise problem. Since I am also an employee in the ICU, the project was undertaken during clinical field experience hours.

Role of the Project Team

The project team with whom I worked consisted of the clinical field experience preceptor, the nurse manager of the ICU, the ICU doctors (intensivist), and four ICU nurses. The team also indirectly included the hospital administrator. The team I led was responsible for evaluating the noise reduction protocol and suggesting ways of improving the acoustic environment in the ICU. In the role of the project manager, I was responsible for delegating responsibilities to the team members, ensuring the members understood the requirements of the project, and ensuring that the members were willing and able to carry out their functions. I ensured that the team stayed motivated and dedicated to completing the project. It was also my responsibility to secure acceptance and approval from the stakeholders and end users. The field experience mentor provided guidance and feedback regarding the direction of the project. The nurse manager and administrator provided approval for the project. The nurse manager helped in disseminating the information obtained from conducting the project to the relevant stakeholders and end users. The intensivist will assist in the implementation of further protocols to reduce noise in the ICU. The Four nurses helped to keep me on target by reminding the staff of the interview and scheduling them for it.

Summary

In Section 2, I discussed the problem of noise in the ICU and patients' response to this phenomenon. Focus was placed on the theory of comfort as it relates to noise in the ICU and how the theory helped me understand the effect of noise on the wellbeing of a patient. The function of the DNP student and the project team was discussed, to include,

the relevance of the practice problem to nursing practice, and the background and context of the practice problem. The study also included the sources of evidence used in the project and the analysis and synthesis of information.

Section 3: Collection and Analysis of Evidence

Introduction

The problem I addressed related to noise in the ICU. This noise was causing patients to complain and resulted in poor HCAHPS scores. Byrne (2013) referred to noise as a nuisance that is detrimental to someone's health. The purpose of the project was to evaluate the existing noise protocol in the facility of study and to make recommendations on how to continue to improve the acoustic environment in the ICU, with the hope of bringing awareness to the problem and causing a positive shift in culture regarding employees' response to noise. In Section 2, I focused on the theory of comfort as it related to noise in the ICU, the relevance of the theory in helping nurses work with patients to address unmet comfort needs, and my role and project team in this project. Section 3 addresses the sources of evidence used in the project and the analysis and synthesis of information.

Practice-Focused Question

The problem of noise in the ICU is supported by findings that suggested that an acoustically friendly environment improves patients' response to treatment and allows better patient outcome. Such evidence includes concepts guided by empirical inquiry built from several theories that are the underpinning of nursing practice (Marqués et al., 2012; White & Dudley-Brown, 2012). The gap in practice about noise indicated that noise in the ICU was impacting patients' sleep patterns and HCAPHS scores. The project question was as follows: What are the perceptions of full-time and contract staff of the noise reduction pilot program in the ICU? The purpose of the project was to explore staff

responsiveness to the implemented protocol and develop recommendations for the improvement of the existing protocol.

Sources of Evidence

The sources of evidence that guided the practice focus question included conducting a literature review using keywords related to the topic. Additional evidence included organizational evidence such as HCAPHS scores that spanned over a 5-year period and the analysis of interviews with staff related to their perceptions of the recently instituted pilot protocol on noise reduction in the ICU. The evidence provided in the reviewed literature was crucial in providing the evidence-based practice needed to allow staff to understand the significance of an acoustically friendly environment (Chow & Shellhaas, 2016). The project involved semi structured interviews with staff regarding the recently implemented noise protocol in ICU. The responses were analyzed for common themes. Recommendations for changes to the protocol were presented to the nurse manager who will disseminate the information to the staff and the hospital leadership team.

Published Outcomes and Research

The databases and search engines that were used to find outcomes included CINHAL, PubMed, and Medline. The project question was as follows: What are the perceptions of full-time and contract staff of the noise reduction pilot program in the ICU? Keywords for the literature review included *noise in ICU, sleep disruption*, and *hospital noise*. To expand the search, Boolean terms such as noise and hospital, and noise and healing were used. To narrow the search, Boolean terms such as, “hospital noise, not

outside of patient care areas" were used. A literature review was conducted, and peer-reviewed articles from 2011 to 2016 were retrieved from CINAHL, Medline, and PubMed. The key term *noise and hospital* yielded over 150 articles. The pool was further narrowed to noise in the ICU and yielded 55 articles that were retained for the literature review. The literature demonstrated that noise influences patients' health and wellbeing (Jones & Dawson, 2012) and that noise interrupts sleep, which in turn affects a person's health and healing (Buxton et al., 2012; Jones & Dawson, 2012; NHLBI, 2012). An acoustically friendly environment is important in helping patients to respond to provided treatment (Bazuin & Cardon, 2011; Eggerton, 2012; Mazer, 2012; Pisani et al., 2015). According Singh (2015), the WHO recommended that noise levels should be between 30 to35 decibels. It is on this premise that noise reduction protocols became the focus of this project. Though Buxton et al. (2012) and West et al. (2014) believed that most sleep disturbances came from electronic sound, Johansson, Knutsson, Bergbom, and Lindahl (2016) argued that noise is caused by the physical layout of the environment, and Marqués et al. (2012) spoke about the human component to noise in the ICU.

Always et al. (2013) suggested that the solution for noise reduction is an environmental modification to include ear plugs and eye masks while Bazuin and Cardon (2011) and Murphy, Bernardo, and Dalton (2013) believed the solution is in the architectural design of the environment. In a study conducted by Jongerden et al. (2013), the authors concluded that based on their study, single rooms as opposed to multi-bed rooms improved patients' experience in the ICU setting. This concept was embraced by Kol, Aydın, and Dursun (2015) and Liu (2012). According to Simons et al. (2014), the

literature on noise alluded to the fact that it is the adaptation of human behavior that will aid in noise reduction, but Konkani, Oakley, and Penprase (2014) argued that noise reduction protocols involved more than just behavioral modification. Keogh (2014) recommended that nurses should help in maintaining low noise levels by lowering their voices and wearing shoes that minimize noise. Environmental modification plays an important part in noise reduction (Always et al., 2013; Bazuin & Cardon, 2011; Jones & Dawson, 2012; Jongerden et al., 2013; Kol et al., 2015). A quiet time protocol allows healthcare individuals to have the same objective in noise reduction (Long & Stover, 2014; McAndrew et al., 2016; Murphy et al., 2013; Sendelbach et al., 2015). Sendelbach et al. (2015) recommended the use of a bundle approach for interventions to reduce noise. The aim to reduce noise and improve rest in patients perpetuates a resultant increase in HCAHPS scores (Haupt, 2012).

The model chosen for grading the literature was the model recommended by Melnyk and Fineout-Overholt (2011). Appendix A provides the reviewed summary of literature used for this project. Each article was evaluated, and the level of evidence identified was documented using the hierarchy of evidence suggested by Melnyk and Fineout-Overholt. The analysis of evidence yielded five summaries at Level I, two summaries at Level II, two summaries at Level III, five summaries at Level IV, five summaries at Level V, 16 summaries at Level VI, and 13 summaries at Level VII.

Table 1

Hierarchy of Evidence

Level	Evidence
Level I	Evidence from a systematic review or meta-analysis of randomized controlled trials (RCTs) or clinical practice guidelines based on systematic reviews of RCTs
Level II	Evidence from at least one well-designed RCT
Level III	Evidence from well-designed controlled trials without randomization
Level IV	Evidence from well-designed case-control and cohort studies
Level V	Evidence from systematic reviews of descriptive or qualitative studies
Level VI	Evidence from a single descriptive or qualitative study
Level VII	Evidence from authority opinions/reports from experts

Archival and Operational Data

Hospital data involved the HCAHPS scores. The HCAHPS scores were very pertinent to the evaluation of the practice problem that was studied, as it is patients' perceptions of environmental factors such as noise. HCAHPS scores are national standardized survey instrument and data collection methodology for measuring patients' perspectives on hospital care and are publicly reported on an annual basis. HCAPHS scores allow objective and meaningful comparisons between hospitals on domains that are important to consumers. They point out deficiencies and aid in placing focus on improving situations to achieve better outcomes (Kennedy, Craig, Wetsel, Reimels, & Wright, 2013). Acute care hospitals are required to collect and submit HCAHPS score

results to receive full annual payment update from Medicare (HCAHPS Fact Sheet, 2015). The HCAHPS score is public hospital information; consequently, there was no need for a formal request of the information. The HCAHPS scores examined over the past five years demonstrated that the area of the report that relates to noise "quiet at nights" was a problem for the facility. The state average was 56% in 2012 and 57% from 2013 to 2016. The hospital of study had below average scores during this period of 52%, 53%, 52%, 51%, and 50% respectively, from 2012 to 2016 (Mhccmaryland.gov, 2016) (See Figure 1).

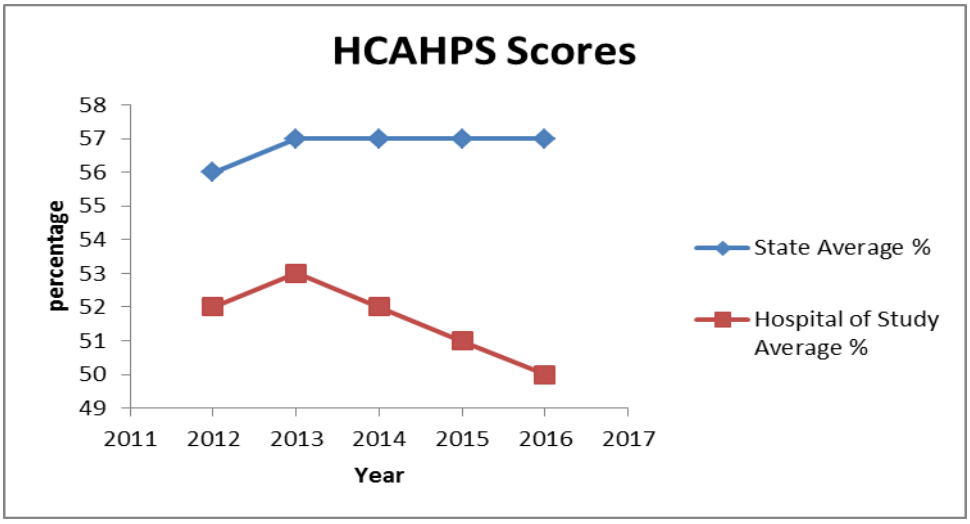

Figure 1. HCAPHS scores showing patients' response to noise.

The limitation of the data was, the participants did not verbalize their true feelings regarding the protocol being used for fear that the interviewer may report their response.

Evidence Generated for the Doctoral Project Participants

The ICU registered nurses and the intensivists contributed evidence to address the practice-focused question through semi-structured interviews with the DNP student. An

open invitation was sent by email and a flyer was posted in the ICU inviting all nurses and intensivists to participate in the interview (Appendix D). All staff on all shifts was invited. The invitation yielded 48 of 50 nurses and 4 of 4 intensivists. The participants were informed that

- There were no incentives associated with doing the project.
- Their response was voluntary.
- They could refuse to participate.
- They could withdraw at any point.

Procedures

I prepared the interview questions, which were then reviewed by the preceptor. Semi structured interview questions included the following:

- What are the benefits of the current noise protocol?
- What are the barriers to your ability to implement the noise protocol?
- What recommendations do you have for changes in the noise protocol?
- What else would you like to share about the current noise protocol?

The interviews were conducted by the student in the private office of her preceptor. The participants were asked to provide an alias. The responses were audiotaped. The audiotapes were transcribed by the DNP student. The audiotapes and transcripts will be stored in the student's private home office for the next three years.

Protections

Before implementing this project, approval from the Institutional Review Board (01 23 170580109) at Walden University was obtained. All materials related to the

project will be kept in the private home office of the DNP student for three years after completion of the project.

Analysis and Synthesis

The interviews were analyzed and codes identified. Examples of text analyzed included responses that describe behaviors, events, activities, strategies, relationships, interactions, constraints, or meanings (Gibbs, 2007). From these codes, categories or themes were identified. Based on the themes identified from the interviews, and using evidence-based literature, recommendations for changes to the noise protocol were developed and presented to the nurse manager.

Summary

The purpose of the project was to explore staff responsiveness to the implemented protocol and develop recommendations for the improvement of the existing noise protocol. The project question was: What are the perceptions of full-time and contract staff of the noise reduction pilot program in the ICU? All registered nurses and intensivists working in the ICU were invited to participate in a semi-structured interview related to the current noise protocol. Interviewees were provided an alias for the audiotaped interviews. Interviews were transcribed by the DNP student. The audiotapes and transcripts will be stored in the DNP student's private home office. The transcripts were analyzed for codes. The codes were reviewed and themes identified. Based on the themes identified from the interviews, and using evidence-based literature, recommendations for changes to the noise protocol were developed and presented to the nurse manager.

Section 4: Findings and Recommendations

Introduction

The purpose of this project was to evaluate the response of full-time and contract staff to the implementation of a noise reduction pilot protocol in the ICU. The gap in this practice setting was that noise in the ICU was impacting patients' sleep patterns. A noise protocol was implemented, but its usefulness and effectiveness was not evaluated until now for this project. Altering noise in the work environment facilitates healing and improves HCAHPS scores (Marqués et al., 2012). The project question was as follows: What are the perceptions of full-time and contract staff of the noise reduction pilot program in the ICU? My intention was to focus on the problem of noise in the ICU, thus allowing the staff to be mindful of the fact that their role in creating an acoustically friendly environment and the well-being and healing of a patient is vital. As stated by Jones and Dawson (2012), patients' health and wellbeing are influenced by their quality of sleep; noise influences both cortical brain activity and cardiovascular function during sleep. Sleep is essential to healing and repairing the heart and blood vessels, and ongoing sleep deprivation is linked to an increased risk of heart disease, kidney disease, high blood pressure, diabetes and stroke (Buxton et al., 2012; Jones & Dawson, 2012; NHLBI, 2012). These statements were the pillow for the integration of interventions used to reduce noise as this is a public health agenda. Quality of care is dependent on a healthy acoustic environment, and healthcare facilities should strive to allow for such (Buxton et al., 2012; Hammer et al., 2014). For this reason, the WHO recommended the

maintenance of noise levels of 30 to 35 decibels and the implementation of a monitoring device to ensure compliance (as cited in Singh, 2015).

The sources of evidence that directed the practice focus question for this project were as follows: a literature review that used key words from the topic, organizational evidence that was the HCAHPS scores that spanned over a 5-year period, and the analysis of semi-structured interviews with staff, regarding their perceptions of the recently instituted pilot protocol on noise reduction in the ICU. The responses were analyzed for common themes, patterns, relationships, and deference.

Findings and Implications

The interviews of the 48 nurses and four intensivists were analyzed for emerging themes. The most common themes that emerged were that (a) the noise protocol did not interfere with workflow, (b) the protocol was being maintained most of the time, (c) the strength of the protocol related to patients' ability to get uninterrupted rest periods, and (d) the nurses' ability to get caught up with their work.

Table 2

Relationship of Theory to Analysis

Relationship to theory	Themes	Supporting narratives
Intervening variables considered when designing the intervention	Uninterrupted workflow	*- the protocol not only worked for the patients but for the staff.* *-while the patients are undisturbed the staff is also undisturbed and the nurses can get caught up with their work*
Nurses design and coordinate the intervention to address a comfort need	Consistent use of protocol	*- dimming of the lights made the patients more comfortable and more relaxed and that this could facilitate the process of healing*
Outcome of enhanced comfort is achieved	Patients able to get uninterrupted sleep	*- patients are verbalizing that they are achieving periods of comfort at least for the 2 hours on the morning shift and the 2 hours on the evening shift when the protocol is in use.*
Acknowledgement of the intervention helps the institution remain viable	Nurses able to complete work	*-interventions are therapeutic for the patients* *- the protocol needed tweaking and should include restriction of visitors.*

Through the interviews, I identified that staff had low theoretical knowledge concerning sound and noise in the ICU. Nevertheless, the staff was able to discuss issues and barriers of the noise reduction protocol and suggest ways to improvement it. The implications resulting from the findings will be significant in pointing out that all hospital

employees must make a concerted effort to reduce noise in patient care areas in order to improve patients' health and HCAHPS scores. The project has the potential to positively impact social change as the findings can be used to demonstrate that all healthcare workers have a critical role to play in maintaining an environment that is acoustically friendly, one that promotes optimal health, healing, and wellbeing.

Recommendations

Based on the review of literature and current practices, the main recommendation to the noise reduction protocol is to include an eye mask and earplugs. Researchers have demonstrated that these are very helpful in noise reduction, thus helping patients to rest and heal. Another suggestion is to ensure that the HCAHPS score for 2017 is examined in July 2017 when it will be available in order to ascertain the effectiveness of the noise reduction protocol. The solution to the gap in practice regarding noise in the ICU is that there should be at least an annual review of the noise protocol to determine its usefulness in improving HCAHPS scores and overall patient satisfaction.

Contribution of the Doctoral Project Team

I led the doctoral project team and included the clinical field experience preceptor, the nurse manager of the ICU, the ICU intensivists, four ICU nurses, and indirectly, the hospital administrator. The motivated team was very instrumental in offering suggestions, guidance, and feedback to me and following up on delegated assignments. The approval for the project was granted almost instantaneously by the leadership team as they had an interest in the outcome of the project. The nurse manager worked with me to disseminate the information obtained from conducting the project to

the relevant stakeholders and end users. It is my intention; with permission from the hospital cooperate office, to expand the project to include all 12 ICUs in the hospital network.

Strengths and Limitations of the Project

The strengths of the project were that the interviews were manageable around the staff work schedules. The review of literature was important in demonstrating evidence of the need for an acoustically friendly environment and the need to disseminate information related an acoustically friendly to same. Through the project, I demonstrated the integration of all relevant factors and intentions to present guidelines for changing the working practices and behaviors of the ICU staff. The project also revealed that there was no one fixed way to reducing noise; instead, a noise reduction bundle that includes behavior modification, quiet-time protocol, and reducing the volume of televisions, telephones, pagers, and overhead speakers should be used (Long & Stover, 2014). Data on objective findings such as HCAHPS scores or subjective findings such as staff response to questions asked during an interview were important components of the project.

The limitation of the project was that the information was obtained through interviews with the staff supervised by me during work hours. As a result, the staff may not have been completely truthful with their responses. The project demonstrated that significant opportunities exist to improve methodologies to study noise levels and to reduce noise in hospital ICUs. The results also revealed that the most commonly applied low-cost method for reducing noise was behavior modification with educational sessions

that provided information related to noise pollution, the effects of noise on patients' health and the work environment, and methods to reduce the noise levels in the ICU (Johansson et al., 2016). Further projects should include evaluation of the noise protocol to demonstrate the lack of consistency in maintaining an acoustically friendly environment in order to establish the need to have all stakeholders and end users continuously on the "same page" to persistently maintain a noise free atmosphere. This should include education on noise reduction programs, behavioral modification using sound detection equipment, and environmental alterations (Darbyshire & Young, 2013).

Section 5: Dissemination Plan

The format used for disseminating the findings on the ICU noise protocol was an oral presentation with the use of a PowerPoint. The findings were presented to the hospital leadership team who will present it to the staff.

The project could also be disseminated to the broader nursing profession by nursing journal publication. Another means of dissemination is a poster presentation at a nursing conference or other professional settings.

Analysis of Self

The skills and the knowledge gained by undertaking a DNP degree and more specifically a DNP project have helped me to evolve as a person and as a professional. As a practitioner, my understanding of the role of a leader has developed, and my leadership style has matured to the point where I will be able to respond to challenges of organizational and system issues in the healthcare industry and will be able to form interprofessional teams to address those issues. As a scholar, I have developed the proficiency of creating and applying scholarly work in the promotion of the nursing profession and am able to act as an agent of change in the advancement of institutions, organizations, cultures, and the society as a whole so that human and social conditions can be improved. This scholarly project has allowed me to act in the capacity of a project manager, thus allowing me to develop the professional foundation needed to be a team leader in promoting quality improvement and advocating and rallying for change at the organizational and policy levels.

The completion of the DNP project, though challenging, was very rewarding. One of the major challenges was conducting the interviews. It was very difficult to be able to have one-on-one time with the nurses and doctors, as no one was willing to come in on their day off to participate. The nurses had to cover each other to allow for participation, and the staff always seemed to be rushing to get back to their patients. I had to be present at the change of shift to have access to the off going intensivist and had to be present on all shifts to be able to interview all the nurses who indicated their interest in participating in the project. However, the insights gained from undertaking this journey were priceless. I will be able to translate research findings to impact evidence-based practice, apply healthcare technology to a wide spectrum of healthcare settings, advocate and collaborate for advancement in the nursing profession to include the creation of healthcare policies, and become an active leader in rallying and facilitating interdisciplinary teams in the improvement of patient and population health outcomes.

Summary

Evidence supports that the acoustic environment in the ICU is poor and stressful. Consequently, the aim of this project was to investigate staff knowledge concerning noise in the ICU and to obtain staff suggestions for improving it. The analysis of the interviews revealed that more work needs to be done to bring awareness to the staff that their response to noise does affect patient outcomes. Science has demonstrated that a quiet and peaceful acoustic environment improves how patients respond to treatment and will allow for superior overall outcomes. In this project, I was able to demonstrate that there must be a holistic approach in studying noise and its impact on health.

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Appendix A: Literature Summary with Level of Evidence

Reference	Research Method	Main Findings	Level of Evidence
Alway, A., Halm, M. A., Shilhanek, M., & Pierre, J. S. (2013). Do earplugs and eye masks affect sleep and delirium outcomes in the critically Ill?. *American Journal Of Critical Care*, *22*(4), 357-3604p. doi:10.4037/ajcc2013545	Evidence from systemic review of descriptive studies.	Interventions and modifications such as earplug and eye masks have the power to transform the ICU from a potentially hostile environment into an optimal healing environment.	Level V
Bazuin, D., & Cardon, K. (2011). creating healing intensive care unit environments: physical and psychological considerations in designing critical care areas. *critical care nursing Quarterly*, *34*(4), 259-267.	Report from experts	Architecture, interior design, and behavior contribute to a healing ICU environment.	Level VII

table continues

Reference	Research Method	Main Findings	Level of Evidence
Buxton, O., Ellenbogen, J., Wang, W., Carballeira, A., O'Connor, S., Cooper, D., & ... Solet, J. (2012). Sleep disruption due to hospital noises: A prospective evaluation. *Annals Of Internal Medicine*, *157*(3), 170-179 10p. doi:10.7326/0003-4819-157-3-201208070-00472	Clinical practice guidelines based on systematic reviews of RCTs N= 232,849	The most potent sleep disruptors were electronic sounds.	I
Byrne, G. (2013). noise abatement society. *nursing standard*, *28*(7), 32-32 1p. doi:10.7748/ns2013.10.28.7.32.s36	Evidence from the opinion of authorities	Noise is a nuisance that affects the wellbeing of patients.	Level VII
Chau, A. (2011). use of phototherapy in circadian rhythm regulation in the intensive care unit: Application of the	Evidence from expert opinion	The use of phototherapy has been demonstrated to effectively shift the natural	VII

table continues

Reference	Research Method	Main Findings	Level of Evidence
symptom management theory. *Dynamics*, *22*(2), 47-48 2p.		circadian rhythm,	
Chow, V. Y., & Shellhaas, R. A. (2016). acoustic environment profile of the neonatal intensive care unit: High ambient noise and limited language exposure. *Journal Of Neonatal Nursing*, *22*(4), 159-162 4p. doi:10.1016/j.jnn.2016.03.003	Quantitative Case method N = 40	interventions to optimize the NICU acoustic environment should focus on minimizing facility noise.	Level VI
Collins, A., Vanderheide, R., & McKenna, L. (2014). Hearing, listening, action: Enhancing nursing practice	Evidence from systemic review n= 48 graduate nursing students	Music education activities can assist nursing students to develop their aural	Level I

table continues

Reference	Research Method	Main Findings	Level of Evidence
through aural awareness education. *contemporary Nurse*, *47*(1-2), 108-118. doi:10.5172/conu.2014.47.1-2.108		awareness and help them change action within the clinical environment to improve the patient's experience of noise.	
Cordova, A., Logishetty, K., Fauerbach, J., Price, L., Gibson, B., & Milner, S. (2013). noise levels in a burn intensive care unit. *Burns (03054179)*, *39*(1), 44-48. doi:10.1016/j.burns.2012.02.033	Evidence from a single descriptive study	Noise levels were above those recommended by regulatory bodies.	Level VI
Costa, S. d., & Ceolim, M. F. (2013). factors that affect	Systemic Review 13 RCT n= 116	The results of the study show the	Level I

table continues

Reference	Research Method	Main Findings	Level of Evidence
inpatients' quality of sleep. *Revista Da Escola De Enfermagem Da USP*, *47*(1), 46-52. doi:dx.doi.org/S0080-62342013000100006		importance of nursing intervention planning in order to improve the sleep quality of hospitalized patients, to change the environmental factors that cause loud noises and excessive lighting during the night.	
Darbyshire, J. L., & Young, J. D. (2013). an investigation of sound levels on intensive care units with reference to the WHO guidelines. *Critical Care*, *17*(5), R187.	Evidence from a systematic review or meta-analysis of Randomized controlled trials (RCTs) or clinical practice	All ICUs had sound levels greater than WHO recommendations, but the WHO recommended levels are so low	Level I

table continues

Reference	Research Method	Main Findings	Level of Evidence
http://doi.org/10.1186/cc12870	guidelines based on systematic reviews of RCTs	they are not achievable in an ICU.	
Do Carmo da Silveira Neves de Oliveira, F. M., Barbosa de Paiva, M., Aparecida de Luca Nascimento, M., Marinho Rezende, V., Sousa da Silva, A., & Lyra da Silva, C. R. (2013). noise levels in a pediatric intensive care unit: an observational and correlational study. *Online Brazilian Journal Of Nursing*, *12*(3), 431-441 11p.	Evidence from the opinion of experts	Nursing panel of nurses across Brasil identified best practice for noise reduction in a pediatric setting and can be applied to adult settings	Level VII
Eggertson, L. (2012). hospital	Evidence from	The health effects	Level VII

table continues

Reference	Research Method	Main Findings	Level of Evidence
Noise: Increasingly, it hinders communication and puts patients at risk. *Canadian Nurse*, *108*(4), 28-31.	the opinion of expert	of noise on patients documented that patients in noisier environments require more pain and sleep medication and that hospital noise increases hypertension and ischemic heart disease in patients.	
Eliassen, K. M., & Hopstock, L. A. (2011). Sleep promotion in the intensive care unit—a survey of nurses' interventions. *intensive & critical care nursing*, *27*(3), 138-142.	Quantitative survey research of ICU nurses	ICU nurses report an overall interest and awareness in sleep-promoting interventions.	IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
doi:10.1016/j.iccn.2011.03.001			
Elliott, R., & McKinley, S. (2014). the development of a clinical practice guideline to improve sleep in intensive care patients: A solution focused approach. *Intensive & Critical care nursing*, *30*(5), 246-256. doi:10.1016/j.iccn.2014.04.003	Evidence from systematic review of descriptive study.	Organizational changes should be made to maximize the opportunity for sleep.	Level V
Fillary, J., Chaplin, H., Jones, G., Thompson, A., Holme, A., & Wilson, P. (2015). noise at night in hospital general wards: A mapping of the literature. *British Journal of Nursing*, *24*(10), 536-	Review of literature	Key issues identified in the literature included noise levels and causes, impact on patient experience, and lack of staff	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
540 5p. doi:10.12968/bjon.2015.24.10.536		awareness.	
Haupt, B. (2012). instituting quiet hour improves patient satisfaction. *Nursing*, *42*(4), 14-15.doi:10.1097/01.NURSE.0000412941.66125.C6	Evidence from a descriptive study	Noise reduction in patient care areas improves HCAHPS scores.	Level VI
Hammer, M., Swinburn, T., & Neitzel, R. (2014) environmental noise pollution in the United States: Developing an effective public health response. *Environmental Health Prospective, 122(2),* 11-12 doi:10.1289/ehp.1307272	Evidence from the opinion of authorities	Overview of environmental noise pollution and its effect	Level VII
Hazardous Workplace Noise	Evidence from	Summary of	LevelVII

table continues

Reference	Research Method	Main Findings	Level of Evidence
Affects 22 Million U.S. Workers. (2016). *ASHA Leader*, *21*(5), 8-8 2/3p.	the opinion of authorities	information on the hazard of noise from the American-Speech language-Hearing-Association	
Hewart, C., & Fethney, L. (2016). improving patients' sleep: reducing light and noise levels on wards at night. *nursing management - UK*, *22*(9), 18-23.	Integrative review of evidence from the audit of 27 adult wards	Nurses are fully engaged with strategies that aim to reduce noise and light levels, and that they are implementing their own solutions by focusing on their patients' specific needs.	LevelV
Hui, X., Jian, K., & Mills, G. H. (2013). behavior observation of major noise	A qualitative study of behavioral	More occurrences of noises along with longer	Level VI

table continues

Reference	Research Method	Main Findings	Level of Evidence
sources in critical care wards. *Journal Of Critical Care*, *28*(6), 1109.e5-1109.e18. doi:10.1016/j.jcrc.2013.06.006	response to noise in multi bed versus single bed units	duration were observed in multiple-bed wards rather than single-bed wards, except for the duration of ventilator's alarm, which tended to last longer in single-bed wards.	
Johansson, L., Knutsson, S., Bergbom, I., & Lindahl, B. (2016). Noise in the ICU patient room - Staff knowledge and clinical improvements. *intensive & critical care nursing*, *3*51-9. doi:10.1016/j.iccn.2016.02.005	Quantitative Survey n = 1047 staff members in 9 intensive care unit.	Three categories emerged: improving staff's own care actions and behaviour; improving strategies requiring staff interaction; and improving physical space and	Level VI

table continues

Reference	Research Method	Main Findings	Level of Evidence
		technical design.	
Jones, C., & Dawson, D. (2012). Eye masks and earplugs improve patient's perception of sleep. *nursing In Critical Care, 17*(5), 247-254 8p. doi:10.1111/j.1478-5153.2012.00501.x	Evidence obtained from well-designed controlled trials without randomization, quasi-experimental	Simple interventions such as eye masks and earplugs may be useful to patients attempting to sleep in the ICU.	Level III
Jongerden, I. P., Slooter, A. J., Peelen, L. M., Wessels, H., Ram, C. M., Kesecioglu, J., & ... van Dijk, D. (2013). effect of intensive care environment on family and patient satisfaction: A before-after study. *intensive care medicine, 39*(9), 1626-1634. doi:10.1007/s00134-013-2966-0	Quantitative survey n=709 discharged patients to determine patient and family response to private rooms vs a ward experience in the ICU after been exposed to	In both groups, satisfaction with overall ICU experience increased by 6 % in a new, single-room ICU, as compared with an old, ward-like ICU with multi-bed areas.	Level VI

table continues

Reference	Research Method	Main Findings	Level of Evidence
	both experience		
Kennedy, B., Craig, J. R., Wetsel, M., Reimels, E., & Wright, J. (2013). three nursing interventions' impact on HCAHPS Scores.*Journal Of Nursing Care Quality*, *28*(4), 327-334 8p. doi:10.1097/NCQ.0b013e31828b494c	Report from experts	A quality improvement study	Level VII
Keogh, K. (2014). hospital nurses told to do their bit to cut down on night-time noise. *nursing Standard*, *28*(43), 10. doi:10.7748/ns.28.43.10.s9	Evidence from opinion of expert	Nurses should lower their voices and stop wearing noisy footwear at night so patients' sleep is not disrupted.	LevelVII
Kol, E., Aydın, P., & Dursun, O. (2015). The effectiveness of environmental strategies on noise	Quantitative Survey research before and after	Creating single-patient intensive care rooms and	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
reduction in a pediatric intensive care unit: creation of single-patient bedrooms and reducing noise sources. *Journal For Specialists In Pediatric Nursing*, *20*(3), 210-217. doi:10.1111/jspn.12116	the unit was moved and reconstructed(a four-bed ICU ward versus a private room ICU)	removing noise sources from the unit considerably decreased the noise levels.	
Konkani, A., & Oakley, B. (2012). noise in hospital intensive care units--a critical review of a critical topic. *Journal Of Critical Care*, *27*(5), 522.e1-9. doi:10.1016/j.jcrc.2011.09.003	Review of the literature	Review of evidenced base literature demonstrated that many past salutary interventions--including educational noise r eduction programs, behavioral modification using sound detection equipment, and	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
		low- as well as high-cost environmental alterations--do not generally appear to be adequate to minimize noise to levels for hospital rooms specified by international agencies.	
Konkani, A., Oakley, B., & Penprase, B. (2014). reducing hospital ICU noise: A behavior-based approach.*Journal Of Healthcare Engineering*, *5*(2), 229-246. doi:10.1260/2040-2295.5.2.229	Quantitative RTC Organized intervention for noise reduction n=272 nurses from 17 ICU in 7 hospitals	Behavioral modification alone is not adequate to control excessive noise. There is a need for further research	Level II

table continues

Reference	Research Method	Main Findings	Level of Evidence
		involving the supportive involvement by clinicians, ICU staff, along with effective medical device alarm management, and continuous process improvement methods.	
Liu, W. F. (2012). comparing sound measurements in the single-family room with open-unit design neonatal intensive care unit: The impact of equipment noise. *Journal Of Perinatology*, *32*(5), 368-373.	Evidence from systematic review comparing single family room and open wards	Single family room sound measurements were quieter compared with the open unit, except when high-	Level I

table continues

Reference	Research Method	Main Findings	Level of Evidence
doi:10.1038/jp.2011.103		frequency ventilation was used.	
Linder, L. A., & Christian, B. J. (2012). nighttime sleep disruptions, the hospital care environment, and symptoms in elementary school-age children with Cancer. *Oncology Nursing Forum*, *39*(6), 553-561 9p. doi:10.1188/12.ONF.553-561.	Evidence from an exploratory descriptive, multiple-case study.	Multiple factors, especially high sound level, compromise sleep quality and quantity throughout the night.	Level VI
Long, T., & Stover, P. (2014). a culture of quiet: Caring for patients by creating an environment for healing. *International Journal For Human Caring*, *18*(2), 45-46 2p.	Report from experts	Review of the effect of a quiet environment on healing	LevelVII

table continues

Reference	Research Method	Main Findings	Level of Evidence
Mackrill, J., Jennings, P., & Cain, R. (2014). exploring positive hospital ward soundscape interventions. *applied ergonomics, 45*(6), 1454-1460. doi:10.1016/j.apergo.2014.04.005	Qualitative response of 24 participants to hospital noise	Exploring different ways to improve the sounds of a hospital offers subjective benefits that move beyond sound level reduction.	Level VI
Mazer, S. E. (2012). creating a culture of safety: Reducing hospital noise. *Biomedical Instrumentation & Technology, 46*(5), 350-355. doi:10.2345/0899-8205-46.5.350	Evidence from the opinion of experts	A culture of quiet is one that is in balance with all patient or hospital activities, has compensated for what cannot be avoided, and has made intentional and conscious decisions that	Level VII

table continues

Reference	Research Method	Main Findings	Level of Evidence
		contribute to comfort and care for the patient and family.	
McAndrew, N. S., Leske, J., Guttormson, J., Kelber, S. T., Moore, K., & Dabrowski, S. (2016). quiet time for mechanically ventilated patients in the medical intensive care unit. *intensive & critical care Nursing*, *35*22-27. doi:10.1016/j.iccn.2016.01.003	Evidence from well design control trial of a quiet time protocol n=72 adult patients on mechanical ventilation.	Quiet time may be a potential strategy to decrease the need for sedative medications in the ICU.	Level III
Murphy, G., Bernardo, A., & Dalton, J. (2013). quiet at Night: Implementing a nightingale principle. *American*	Evidence from descriptive study of a quiet at night initiative	The Quiet at Night initiative illustrates how many small changes in care practices and	LevelVI

table continues

Reference	Research Method	Main Findings	Level of Evidence
Journal Of Nursing, *113*(12), 43-51. doi:10.1097/01.NAJ.0000438871.60154.a8		environment can have a cumulative effect that promotes rest, sleep, and healing. While our work is ongoing.	
Nicole, W. (2016). noise and body fat. *environmental health Perspectives*, *124*(3), A57-A571p. doi:10.1289/ehp.124-A57	Review of literature	The review of literature demonstrated that noise may disturb sleep, which is associated with increased food intake, possibly due to dysregulation of hunger-related hormones, including leptin	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
		and ghrelin.	
Pilkington, S. (2013). causes and consequences of sleep deprivation in hospitalised patients. *Nursing Standard*, *27*(49), 35-42.	Review of the literature	The environmental and bio-cognitive consequences of sleep deprivation on the health and recovery of hospital inpatients are detrimental.	Level IV
Piña, l. L., Cohen, P. D., Larson, D. B., Marion, L. N., Sills, M. R., Solberg, L. I., & Zerzan, J. (2015). a framework for describing health care delivery organizations and systems. *American Journal Of Public Health*, *105*(4), 670-679 10p.	Review of literature	The literature provided a framework necessary for understanding and improving of the health of people in the United States.	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
doi:10.2105/AJPH.2014.301926			
Pisani, M. A., Friese, R. S., Gehlbach, B. K., Schwab, R. J., Weinhouse, G. L., & Jones, S. F. (2015). sleep in the intensive care unit. *American Journal Of Respiratory And Critical Care Medicine, 191*(7), 731-738. doi:10.1164/rccm.201411-2099CI	Evidence from systemic reviews of descriptive studies.	Poor sleep may contribute to the larger problem of brain dysfunction in the ICU, of which delirium is a manifestation. A multidisciplinary approach to understanding and treating the problem will require commitment on the part of ICU practitioners and hospital	Level V

table continues

Reference	Research Method	Main Findings	Level of Evidence
		administrators, which in turn may lead to significant improvement in ICU care and patient outcomes.	
Pope, D. S., Gallun, F. J., & Kampel, S. (2013). effect of hospital noise on patients' ability to hear, understand, and recall speech. *Research In Nursing & Health*, *36*(3), 228-241. doi:10.1002/nur.21540	Quantitative RCT n=82 From 4 medical/surgical hospital wards	In a hospital environment, patients may be less successful in hearing, understanding, and remembering new information secondary to noise	Level II
Prasher, D. (2009). is there evidence that environmental noise is immunotoxic? *Noise & Health*, *11*(44), 151-155 5p. doi:10.4103/1463-1741.53361	Review of literature	The review examined the current available data on the effects of chronic	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
		environmental noise exposure on immune function	
Sendelbach, S., Wahl, S., Anthony, A., & Shotts, P. (2015). stop the noise: A quality improvement project to decrease electrocardiographic nuisance alarms.*critical care nurse*, *35*(4), 15-23 9p. doi:10.4037/ccn2015858	Evidence from a single descriptive study	Implementation of a bundle of interventions can reduce the frequency of nuisance alarm signals in patients in the ICU.	LevelVI
Simons, K. S., Park, M., Kohlrausch, A., van den Boogaard, M., Pickkers, P., de Bruijn, W., & de Jager, C. C. (2014). noise pollution in the ICU: Time to look into the mirror. *Critical Care (London, England)*, *18*(4), 493. doi:10.1186/s13054-014-0493-1	Review of literature	Review of evidence based literature and clinical guidelines showed that strategies involving the adaptation of human behavior	Level IV

table continues

Reference	Research Method	Main Findings	Level of Evidence
		may prove to be very effective at reducing noise pollution in the ICU.	
Stafford, A., Haverland, A., & Bridges, E. (2014). noise in the ICU. *The American Journal Of Nursing*, *114*(5), 57-63. doi:10.1097/01.NAJ.0000446780.99522.90	Evidence from opinion of experts	To create a therapeutic environment, continued efforts are needed to decrease background noise and to modify behavior and factors that cause peak noise events. Interventions to protect patients	Level VII

table continues

Reference	Research Method	Main Findings	Level of Evidence
		from noise in the ICU, such as earplugs, may be beneficial in optimizing outcomes.	

Reference	Research Method	Main Findings	Level of Evidence
Tegnestedt, C., Günther, A., Reichard, A., Bjurström, R., Alvarsson, J., Martling, C., & Sackey, P. (2013). levels and sources of sound in the intensive care unit - an observational study of three room types. *Acta Anaesthesiologica Scandinavica*, *57*(8), 1041-1050. doi:10.1111/aas.12138	Quantitative patient evaluation of noise impact and room accommodation	Single-bed rooms do not guarantee lower sound levels but may imply less frequent disruptive sounds. Most disruptive sounds were avoidable, indicating that sound reducing	Level VI

table continues

		strategies for ICU patients are necessary.	
West, P., Abbott, P., & Probst, P. (2014). Alarm Fatigue: A Concept Analysis. *Online Journal Of Nursing Informatics*, *18*(2), 1-1 1p.	Evidence from authority opinions	The problem of alarm fatigue takes a multidimensional approach.	Level VII

Appendix B: Interview Questions

1. Does the implementation of the noise protocol interfere with your workflow?

_____

_____

_____

2. Do you believe the noise protocol is being maintained?

   Yes

   No

   a. If no, what are the main reasons it is broken?

_____

_____

_____

3. In your opinion, what are the strengths and weaknesses of the noise protocol?

   Strengths:

_____

_____

_____

   Weaknesses:

_____

_____

_____

4. Do you think the noise protocol will enhance the Hospital Consumer Assessment of Healthcare Providers & Systems (HCAHPS) scores?

_____

_____

_____

5. What recommendations do you have for changes in the noise protocol?
6. What else would you like to share about the current noise protocol?

Thank you for participating.

Appendix C: Letter of Invitation to Participate in a Project Interview

Current Date

Participant's Name

Participant's Address

Dear _____

I use this medium to invite you to participate in an interview I will be conducting as partial fulfilment of the requirement for obtaining a Doctor of Nursing Practice Degree from Walden University.

In July 2016, a noise protocol was initiated in your unit (the ICU) in response to patients' complain of noise and in response to low HCAPHS scores. It is my intension to evaluate the usefulness of the protocol and the staff response to this protocol. The information obtained will be shared with the nurse manager who intern will share it with the hospital's leadership team.

Your participation in the interview will be voluntary and will involve at least one personal audiotaped interview. The session should last for approximately one hour and will take place in the confidential setting of the office of the director of education (my preceptor). The interview will be audiotaped solely for the purpose of facilitating the collection and transcribing of information and for preventing errors in analysis.

As a participant you may decline to answer any question you desire and may withdraw at any time without negative consequences. The interview has no foreseeable risk to you. The information will be held in highest confidence and your name will be replaced with an alias. The information obtained will be kept in the privacy of my own

home office and can be shared with you after it is decoded, to ensure accuracy of interpretation.

Please allow me the opportunity to consult with you and to set up a meeting regarding the project in the next _____ days, by contacting me at XXX(C) XXX (H) or by email at XXX@waldenu.edu. I look forward to your contribution to my project. Thanks in advance.

Yours respectfully,

Fay Goode

Doctor of Nursing Practice Student

Walden University