The Effects of a Noise Reduction Program on Noise Levels, Patient Satisfaction, and Perceived Disturbance in an Inpatient Setting: Part II

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Abstract

Excessive noise negatively impacts the hospital experience and patient satisfaction levels. Noise reduction programs using multi-method approaches have been shown to have significant reductions on noise levels in intensive care units. The purpose of this project was to evaluate the effects of a noise reduction program on inpatient medical-surgical units by measuring noise levels, patients’ perceived disturbance due to hospital noise, and patient satisfaction related to noise. The project was carried out in three phases. We assessed the current effects of noise on the units by measuring noise levels, patient satisfaction, and patient’s perceived disturbance with the Topf Disturbance Due to Hospital Noise Scale survey. Once this assessment was complete, interventions were implemented and included staff education, modification of environmental source of noise, and a daily period of quiet time. We re-assessed the units after the interventions through measurement of noise, patient satisfaction, and patients’ perceived disturbance. Prior to statistical analysis, patient satisfaction and measured decibel levels appear to have improved after the intervention of the noise reduction program. My role in this project included the distribution of surveys, measurement of noise levels with the Extech Digital Datalogging Sound Level Meter Model HD600, staff education, and analysis of data. Our results highlight the importance of noise reduction in the hospital setting, to have an effective change in the hospitals locally and possibly the system as a whole.

Keywords: noise, inpatient, hospital, nursing
High levels of noise are common in the acute care setting, particularly in hospitals with large numbers of personnel. Noises can come from physicians rounding in the hallways, nurses communicating via telephones, maintenance staff cleaning the floors, and a variety of other things. While many of these activities are important to the overall functioning of the hospital, they can actually detract from the overall quality of care patients receive. According to research by Dietrick, Kennedy, Cyriax, and Davies-Hathem (2009), “excessive noise in the clinical setting has been shown to have negative effects on patients and staff including lost sleep, higher blood pressure, lower overall patient satisfaction, increased readmission rates, and increased employee stress levels” (27). Not only is patient health directly affected by loud noise levels, patient care is also impacted by the negative consequences noise can have on staff health. Unregulated noise in the acute care setting is a problem that is often not addressed, but should be corrected to promote the best environment possible for patient care.

Although noise is an issue that most hospitals do not directly address, various agencies have produced guidelines for noise levels in these settings. According to Taylor-Ford, Catlin, La Plante, and Weinke (2009), “the sound level recommended by the Environmental Protection Agency to allow for rest in hospitals is 45 decibels (dB).” The World Health Organization also maintains recommendations for noise levels in hospitals, which include that units should have noise levels less than 30 dB at night to reduce patients’ sleep disturbance (Xie H, Kang J, & Mills G., 2009). Constant noise volume above this level can have a variety of negative effects on patient wellness, such as impaired sleep with increased stress levels, delayed rehabilitation to prior activity levels, and an increase in psychiatric symptoms (Johnson P., & Thornhill L., 2006). While a level of 45 decibels might not be realistic for most hospital settings, a more appropriate goal would be between 50 to 60 decibels. However, most hospital environments have average
noise levels in the range between 60 to 70 decibels, which is very detrimental to the health of patients.

The problem of noise in hospitals is not a novel concept; it has been developing over many decades. According to Xie et al (2009), “since the 1960s, the average noise levels inside hospitals have increased by an average of 0.38 dBA (day) and 0.42 dBA (night) per year.” This steady rise in the level of noise within inpatient units has slowly become an increasing problem. Due to the long term nature of this problem, a solution must consider many different facets of the setting in order to be effective. A multi-method noise reduction program is the best option for intervention in the inpatient setting because it addresses many different areas that combine together to produce excessive noise levels (Richardson, A., Thompson, A., Coghill, E., Chambers, I., & Turnock, C., 2009). Most of the existing studies on noise reduction in the hospital setting focus on the intensive care setting and show a decrease in noise as a result of noise reduction program interventions. However, there are few studies that focus on general medical-surgical units and the impact of noise reduction programs in these inpatient areas.

The goal of this research project was to evaluate the impact of a noise reduction program on reducing noise levels on an inpatient medical-surgical unit. The overall project consisted of a noise reduction plan that was broken into three phases and carried out in two acute care units at a local VA Medical Center (VAMC). The project was initiated on ward A, a medical-oncology unit and ward B, a medical-surgical unit. The evaluation phase extended to wards W (originally A) and E (originally B) with their transition to a new unit setting.

Phase one included the assessment of existing noise patterns, patient satisfaction, and patients’ perceptions of disturbance due to hospital noise. This phase was carried out on ward A and ward B in the VAMC. Existing noise levels were measured in three different zones,
including patient rooms, using the noise level meter Extech Digital Datalogging Sound Level Meter Model HD600 and recorded electronically on a spread sheet. Patient satisfaction was evaluated using scores obtained from the VA system’s Survey of Healthcare Experiences of Patients (SHEP) database, whose data is recorded quarterly. The answers to two specific questions were observed, numbers 9 and 47c, which both related to the patient’s perception of noise around their room area. Patients’ perceptions of disturbance due to noise were measured using Margaret Topf’s Disturbance Due to Hospital Noise Scale survey. This survey, slightly modified with permission from Margaret Topf, consists of nineteen questions on a five point likert scale. Subjects were given an explanatory letter and verbal consent was obtained prior to participation. Enrollment was based on specific inclusion and exclusion criteria, and survey completion was voluntary and anonymous. The inclusion criteria for participants included the following: 18 years of age or older, able to provide informed consent, able to read and understand English, and have been on the unit for a minimum of eight hours. The exclusion criteria included the following: on isolation for a communicable disease, and terminally ill and actively dying. The total target number of participants was 75, with 50 from ward A and 25 from ward B.

Phase two consisted of implementing the noise reduction measures. The three main facets of the intervention were educating the staff on the detrimental effects of noise and the results of the initial ward assessments, modifying equipment and altering the environmental sources of noise identified in the assessment phase, and implementing a ‘Quiet Time’ on both of the wards. Staff members were educated by project members during staff meetings and through the posting of noise levels recorded on the units. A sound ear was also used to educate the staff, as it was set up in the nurses’ station and allowed the nurses to see their actual noise levels. The
sound ear has three components: and outer, middle, and inner light system. Once the sound ear is set to a maximum decibel level, the outer ear will light up with green to show that the noise is at an acceptable decibel level. If the noise level increases towards the maximum level, the yellow lights of the inner ear can give a warning to nurses that their noise level should be taken to a quieter level. Once the noise level reaches the maximum decibel level previously set, the inner ear lights up red to tell staff members that the noise level has reached an unacceptable level and needs to be lowered. This is an easy and tactful way to let the staff members know their noise levels and remind them to lower volumes if necessary. Quiet Time involved determining a specific period of time during the day in which the unit staff would dim the lights and minimize noise and patient interruptions. Visitors were also encouraged to adhere to Quiet Time, allowing the patients to rest for the specified time periods.

Phase three included the evaluation of the effects of the noise reduction measures. This phase began on wards A and B, and extended to wards W and E in the VAMC’s new unit settings. Prior to the evaluation of the new units, the staff was re-educated on the importance of decreasing noise levels to improve patient care through two oral presentations during staff meetings and a bulletin board in the nursing lounge. Quiet time was also implemented on the new units, with the hours of 1330-1430 on ward W and 1300-1400 on ward E. Both units also observed Quiet Time between the hours of 2200-0400. The evaluation contained the same components as the initial assessment, with the sound level meter used to measure noise levels, a review of patients’ responses to SHEP survey questions, and evaluating patient’s responses to the Topf Disturbance Due to Hospital Noise Scale survey. Noise levels were measured using the Extech Digital Datalogging Sound Level Meter Model HD600, which was placed in seven different zones on the unit including the two nurses’ stations and five patient rooms. The Extech
Digital Datalogging Sound Level Meter Model HD600 was used to collect decibel level readings for each of these seven zones over a 24 hour period. Patient satisfaction was evaluated using the scores from the same initial two questions of the SHEP survey relating to noise in the patient area. Patients’ perception of disturbance due to noise was measured with Topf’s survey, with a goal of 50 participants from each of the local VAMC’s wards W and E, for a total goal of 100 additional subjects. Participants were given an explanatory letter and verbal consent was obtained prior to their completion of the survey.

This research project is ongoing, and currently in the final stages of phase three on ward E. Prior to statistical analysis, the data collected on ward W appears to supports the effectiveness of the program on noise reduction in the unit. From the pre-intervention phase to the initial post-intervention on units A and B, SHEP survey scores increased. This shows an increase in levels of patient satisfaction in regards to the noise levels around the room area during their stay. The SHEP survey data for patient satisfaction is not yet available through the VA system for the time period of post-intervention data collection on ward W or E.

Pre-intervention noise levels on ward A had an average decibel level of 48.2 dB, while the post-intervention average decibel level was 51.1 dB. While these values show an increase in the overall average decibel level on the unit, there was an improvement in the average decibel levels for the period of time that translated to Quiet Time. The average pre-intervention decibel reading for the time period of 1300-1400 was 52.4 dB, while the average decibel reading after the implementation of Quiet Time was 49.0 dB. Decibel readings decreased upon the transition to ward W, where the overall average reading was 45.3 dB, and the Quiet Time average was 45.7 dB. The decrease in decibel values from pre-intervention to post-intervention follows the implementation of the noise reduction project on the unit.
Data from the Topf Disturbance Due to Hospital Noise Scale survey indicates a decrease in patients’ perception of noise on ward W. The initial post-intervention results from ward A demonstrated a decrease in the number of patients experiencing extremely bothersome noise, with the reduction in pre-intervention troublesome areas such as bedside conversations and equipment alarms. Continuing on to the ward W post-intervention surveys, the numbers of bothersome noises decreased from both of the previous survey administrations, with seven sound types labeled as not bothersome by the entire survey subject population. This was a significant improvement from the pre-intervention survey, where all noise areas were labeled as bothersome by at least a portion of the subject population. Patients also wrote comments on some of the surveys, detailing the source of bothersome noises, such as bed signals for low air pressure. Overall, the noise disturbances perceived by patients decreased over the course of our noise reduction program.

My function in this research project focused on phase three, evaluation of the noise reduction program, on wards W and E. To begin on this project, I had to complete mandatory training for researchers who were involved with human subjects. I also had to complete other online training modules to be able to conduct research within the VA system. Before beginning my work with the actual project, I conducted a literature review to find relevant articles to better understand the background behind our research project.

Once beginning on the actual project, the majority of my time was spent administering patient surveys. Margaret Topf’s Disturbance Due to Hospital Noise Scale survey was used to measure the patients’ perceived disturbance due to noise levels on the wards. Each day that I would go to the unit to administer surveys, I would first go the nurses’ station to obtain a census. After gathering my materials, I would look through the previous survey day’s census to
determine if any current patients had already participated in the survey. I would then look at the patient board to determine the nurses for each team of patients, which patients were being discharged, which rooms were empty, and if there were any special considerations, such as one-to-one observation. After this, I would walk through the ward to see which patients had isolation precaution signs outside of their rooms to exclude them from consideration. Once I was ready to administer surveys, I would talk to the nurse for the team of patients to determine if any patient had altered mental status, significant visual deficits, or hearing loss. These findings would cause the patients to fail to meet the inclusion criteria, and would thus be excluded from survey participation. After speaking with the nurse, I would go into a patient’s room and introduce myself as a nursing student from the University of Florida. I would explain to the patient that the unit has a project on reducing noise in the hospital, and part of the project includes surveying patients on their experience with noise during their stay. I would then ask the patient if they would be interested in participating in such a survey, explaining that it would be voluntary and anonymous. If the patient chose not to participate, I would thank them and leave the room. If the patient verbally consented to participate in the survey, I would give them the explanation letter of our project. I would then explain the survey’s likert scale by using the first question as an example. During this time, I would also verify that the patient could read and understand the survey. I would then reiterate that the survey is anonymous, and requested that the patient place their completed survey in a sealable manila envelope, that would later be taken by a different member of the project team or a staff member. After answering any questions the patient might have, I would then thank the patient for their participation and leave the room. Later, another member of our team would collect the surveys and place them in one location, where the completed surveys remained until the desired number was completed. In order to properly
administer the surveys, it was important for me to understand the actual survey and our purpose for including it in the research project. It was also vital to the integrity of the project that I did not bias the research by persuading patients to participate or by allowing patients who did not fully meet the criteria.

The Topf Disturbance Due to Hospital Noise Scale survey was created in 1985 by Dr. Margaret Topf, who established the predictive validity of the survey instrument. With the permission of Dr. Topf, the survey was slightly modified to include modern sounds currently found in a hospital unit. Another study by Taylor-Ford, Catlin, LaPlante, and Weinke (2009) used the adapted version of the Topf survey and established reliability for the adaptation. This same study used the survey as a means of measuring patients’ perceptions of noise in the pre-intervention and post-intervention phases. The study also found that patients who had significant hearing loss and were included in the survey posed a limitation because these patients reported hearing no noise in the same environment that others deemed to have high levels of noise. As a result, we did not include patients with significant hearing loss in our study.

I also assisted in measuring the noise levels on the unit with the Extech Digital Datalogging Sound Level Meter Model HD600, which is an industry standard noise level meter. Seven different zones were chosen on the units to measure the noise levels in each area. Two of the zones were the front and back nurses’ stations, and the other five were patient rooms. For each location, the noise level meter needed to be calibrated and set to record for the next 24 hours. When the noise level meter was placed in the nurses’ stations, there was simply a sign placed near the meter so that it would not be removed from the area during the 24 hour period. The process was very different when the meter was placed in patient rooms because the patient needed to consent prior to the meter’s placement. For this process, I would first introduce myself
to the patient as a nursing student from the University of Florida, and then I would explain the research project. Once again, participation was voluntary, so the patient could refuse placement of the meter in their room. I would explain to the patient that the meter does not record actual words or conversations; rather it simply measures the decibel level of whatever noise occurs in the area around the room. If the patient gave verbal consent for the meter to be placed, I would give them a paper explaining the project and would then calibrate and place the meter in the location for the subsequent 24 hour period. Once each 24 hour period was complete, the meter would be connected to the computer and the data would be uploaded into the Datalogger HD 600 computer program. This computer program would then compile the data and produce a graph of the decibel levels throughout the past 24 hours, with numerical data available to view. After the data was uploaded, the noise level meter would be reset and taken to the next zone location. In order to form a complete view of the noise levels on the units, the noise meter collected readings every 30 seconds to form an almost continuous log of decibel levels. A similar study done in 2004 used continuous measurements during specified times of the day to collect noise data (Cmiel, Karr, Gasser, Oliphant, & Neveau). Another study by Deitrick, Kennedy, Cyriax, and Davies-Hathen (2009) used the 24 hour time periods to collect noise level data, and our project followed this collection period.

Another function I performed in this research project was compiling and evaluating the data. Once the patient surveys were completed from ward W, I went through each survey and entered the data into a spreadsheet. After entering the data, I compared the survey results to the pre-intervention and post-intervention results from A to determine any differences or improvements in the survey data. The noise level meter data that was collected on ward W was first recorded into a computer program that computed the maximum, minimum, and average
decibel levels for each of the seven zones in which it was placed. I then compared those numbers with the pre-intervention and post-intervention measurements to determine any differences or improvements in the data. Although the results are not complete for ward E, I will also compile the survey and noise level meter data once their collection is finished and compare the results to the previous pre-intervention and post-intervention data from ward B. Once the data is compiled, it will undergo statistical analysis to determine the level of effectiveness of the noise reduction project.

My final role in the project involved education of the staff members of the participating units and assisting with the re-implementation of Quiet Time. While the majority of staff members were present during the project’s implementation on wards A and B, education was given to remind staff of the project prior to the collection of evaluation data on the new units. This education primarily consisted of speaking with staff during staff meetings to make them aware of the data collection on the unit. I also assisted in making a bulletin board for the staff lounge that contained noise level data collected on the unit with a corresponding chart for decibel interpretation, with the decibel reading for sounds such as a lawn mower and washing machine. This board allowed staff to visualize their noise levels on the unit and relate them to levels that are easily understood. In this way, staff members are able to comprehend the noise levels that patients perceive on a daily basis on the unit, which encourages the staff to be more aware of their own volume. Quiet time did not initially carry over from the old wards to the new locations, so this was included in staff education prior to data collection. Upon the actual application of Quiet Time to the wards, patients were given an explanation letter within their admission packet and a daily announcement was made over the intercom to inform staff and visitors of the upcoming hour.
The idea of Quiet Time in our project originated from two separate research designs. One study in an Intensive Care Unit setting found that staff education and clear representation of the purpose and application of Quiet Time on the unit assisted in producing a more positive result (Lower, Bonsack, & Guion, 2003). For this reason, the explanation letter was given to patients upon their admission to the unit and Quiet Time was included in the education of the staff. The actual announcement for Quiet Time was based off of another research study, in which the hour of quiet showed an improvement in patient and family perceptions of the environment and was eventually implemented hospital-wide (Boehm & Morast, 2009).

Although our execution of Quiet Time did not directly mirror either of these studies, the research behind them was the basis for the use of this daily time period in our research project.

I encountered a few problems during my participation in this research project, most of which involved the patient population. The population of patients who met the inclusion criteria on the units consisted of a majority of the patient population. However, many patients fell under the exclusion criteria, which significantly decreased the number of potential subjects in comparison to the actual population of the units. This increased the length of time required for the distribution of surveys because the available population of subjects to include was relatively small. Patients who had vision problems, could not read the survey, or had altered mental status did not meet the inclusion criteria because they could not complete the survey without assistance. Since patients on isolation were excluded from the survey, a fairly significant number of patients could not participate due to a variety of bacterial infections or colonization. Although not specifically included in our exclusion criteria, we did not include patients with significant hearing loss in the subject population. Since significant hearing loss alters the patients’ ability to perceive the unit’s noise levels, the resulting survey data could be skewed to possibly show a
lower disturbance level than would be perceived by a normal ear. Since the hospital solely caters to the veteran population, the number of patients with hearing loss was significant and decreased the possible sample size. To counter the limitations set by the possible subject sample size, I administered surveys on a greater number of days to be able to collect data from the desired number of patient participants.

Another problem I encountered with the administration of surveys was patient understanding of the project and survey results. Some patients declined participation in the survey because they were afraid they would “get someone in trouble” with the survey. Even though the survey was presented as anonymous, some patients did not feel comfortable completing it. Other patients stated that they should not participate because they had nothing negative to give as feedback. I would explain to the patients that any feedback, positive or negative, would be important for our data collection. After this explanation, most of these patients agreed to participate in the survey. However, some of these patients did not want to take the time to fill out a survey where they felt they had no productive feedback to give.

The final limitation I encountered during this project centered on the use of the noise level meter. After educating the staff on the methods that would be used to collect post-intervention data, the noise level meter was used to record decibel levels over a period of 24 hours. When the meter was placed in the nurses’ station, it was in plain sight with a sign attached to prevent removal. The purpose of this was to prevent a staff member from removing the meter from the area or possibly placing it in a different location if they did not know what it was or its purpose. However, having the meter in plain sight of the nurses could have influenced the data that was collected because they could have lowered their normal volume levels to adjust for the meter recording. Another potential limitation for noise collection was the placement of
the meter in patient rooms. Since the patients must consent to the placement of the meter in their individual room, this could cause the patient to decrease the levels of the television, conversations, or other noise creating activities. While the influence of these possible limitations will not be seen in our data, they exist as potential influences in the data collection.

Through my participation in this project, I learned a great deal about the general research process and the necessary time commitment it requires. Before a research project can even begin, someone must come up with the idea and then perform background research to explore the current findings on the topic. Once the idea becomes more solidified, a proposal must be composed and altered to meet the expectations of the Institutional Review Board (IRB). While I previously understood the basics of this process, I did not realize the length of time that it demands. Upon approval from the IRB, the research project can then begin. Although I was not a member of this project from the beginning, going through research articles to better understand the background of the project was itself time consuming. I also never realized the large volume of paperwork necessary to begin and then continue a research project, particularly in a federal hospital. While this process can be lengthy and frustrating, it was an important learning experience because it fostered an appreciation for participating in the actual research study.

Through this research project, I also learned the process for consenting patients and the importance of obtaining consent without biasing the research. For our project, only verbal consent was required for patient participation in the noise survey and the placement of the noise level meter in patient rooms. However, prior to being able to properly consent patients I had to go through the process with my preceptor to understand all of the necessary components. In order to properly consent the patient for surveys, I had to introduce myself and the research project to the potential participant, while maintaining that participation was completely
voluntary. In some situations, patients stated that they did not want to participate in the study because they did not have any negative feedback. In these situations, it was important to relay to the patient that all feedback is important to the project, positive or negative, but that participation was still voluntary. It was sometimes frustrating to have patients not understand the importance of their feedback, but I could not bias the research by going into greater depth to persuade them to participate. I also had to learn to disregard patients’ refusal of the survey and not construe it as a reflection on myself. There were patients on the unit with advanced diseases who were in pain or not feeling well, and their refusal to participate was not related to my explanation of the project. Overall, I actually enjoyed administering the patient surveys because many patients shared very positive experiences at the hospital, and some were even surprised by the high quality of the services they received.

Another learning experience I had related to this project was the use of a noise level meter. Prior to this research project, I had never seen a noise level meter and had no idea how to use one. Through the gathering of decibel data on the unit, I have learned how the noise level meter functions and know how to calibrate and set up the device for recording. While this might seem like a simple task, the actual set up of the device can be very confusing at the beginning, and there are step by step instructions to follow. With the noise level meter, I also learned about the use of the corresponding computer program. This program records the raw data and produces graphs and numerical values for statistical analysis.

The most important concept I learned while participating in this research project was the large impact that noise can have on the patients in an acute care setting. Although I had some awareness of noise levels on the units where I have worked and had clinical experiences, I never fully realized the effects that noise had on patients. This project has made me acutely aware of
my own volume in the clinical setting, and I have purposefully lowered my own contribution to
the noise levels in patient areas. I have also shared this project with nurses and other students to
try to help reduce noise levels in the units where I am a student. Through my interaction with
patients during this project, I also have a better understanding of their experiences with noise
while in the acute care setting, and I have hope that this project will continue to expand to the
rest of the hospital so that all of the patients served will have the most positive experience
possible without the negative addition of excessive noise.

The negative effects of excessive noise on patients in the hospital setting must be
addressed to increase patient wellness and improve outcomes. This research project focused on
the effectiveness of a noise reduction program on inpatient units. While the data collection from
this project is not complete, preliminary analysis shows that a multi-faceted approach to noise
reduction can be effective in lowering noise levels and increasing patient satisfaction in an
inpatient unit. My role on this project has given me a greater awareness of the impact of noise
on patients, and has led to a modification of my own behavior to reduce my volume while caring
for patients in this setting. Overall, this project has the potential to help decrease noise levels in
the local VA hospital units, and can add to the evidence that supports staff noise behavior
modification in order to improve patient outcomes.
References


