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Earplugs for Intensive Care Unit Delirium Prevention: Impact of an Evidence-Based Intervention on Patient Outcomes

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Recommended Citation

Click, Morgan P., "Earplugs for Intensive Care Unit Delirium Prevention: Impact of an Evidence-Based Intervention on Patient Outcomes" (2021). *MSN Capstone Projects*. Paper 114.
<http://hdl.handle.net/10950/3696>

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EARPLUGS FOR INTENSIVE CARE UNIT DELIRIUM PREVENTION: IMPACT OF AN EVIDENCE-BASED INTERVENTION ON PATIENT OUTCOMES



Verin, E. (2014). [Image]. Retrieved from <https://www.cidrap.umn.edu/news-perspective/2014/06/experts-call-better-clinical-research-mers>

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Report Period:

January 2021 – April 2021

Date of Submission:

4/27/2021

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Acknowledgements

Thank you to my nursing colleagues at Parkland Hospital for their assistance, encouragement, and advice for my benchmark project. Given the current difficulties with implementing a change project in the midst of the current COVID-19 pandemic, your guidance allowed me to make the best of my benchmark project and overcome more challenges than I initially anticipated. My benchmark project would not have been possible without your help and participation, so I greatly appreciate your feedback and support. I am honored to know such great health care professionals dedicated to providing outstanding patient care and improving patient outcomes.

Executive Summary

Delirium is characterized by the abrupt onset of significant confusion that may cause the patient to become agitated, aggressive, unable to focus, and sometimes hallucinate. Intensive care unit (ICU) delirium is a large area of focus for current research to help understand the causes, preventative measures, and potential treatments. This problem isn't only faced in the hospital setting, but can affect patients long after discharge. The PICOT question guiding this benchmark project stated: In adult ICU patients (P), how does the use of earplugs (I) compared to the use of no earplugs (C) affect the patient's future risk of ICU delirium (O) during the time on the unit or hospital stay (T)?

Delirium is a common complication that is faced in the hospital setting. Patients of all ages have a high risk of developing ICU delirium due to many underlying factors such as the use of sedatives, mechanical ventilation, immobility, sleep-wake cycle interruptions, physical and chemical restraints, sleep deprivation, noisy environment, and constant stimulation by medical personnel. Older age, poor vision, and prior underlying mental conditions, such as dementia, play a major role in the development of ICU delirium as well. ICU delirium not only increases the length of the patient's hospital stay, it also affects their long-term mental health, causes utilization of higher acuity resources resulting in higher health care costs, and leads to worse patient outcomes. ICU delirium increases the patient's days spent in the hospital, hospital and patient costs, and can often can cause significant cognitive problems once the patient is discharged and seen in a primary care setting. Post-traumatic stress disorder, depression, anxiety are the most noted issues patients faced after being hospitalized.

Current practice is being pushed by recent research that aims to decrease the use of sedatives, limiting the patient's number of days on the ventilator, increasing early mobility,

limiting noise, keeping the lights on during daytime and lights off during nighttime, and initiating a sleep/wake cycle which promotes the body's natural circadian rhythm cycle by retiming nursing interventions between 2200 and 0500 to allow for adequate sleep when the patient's status permits. However, most health care facilities have ICU delirium screening tools in place, but a multitude of different approaches are taken when it comes to implementing preventative interventions. Overall, there are numerous assessment tools being utilized to identify delirium early and treatments available, but current research findings suggest that there is no single intervention that can be applied as a blanket solution (Schiemann, Hadzidiakos, & Spies, 2011). Immediate action must be taken to enact an evidence-based, cost-effective change that improves patient outcomes, but also decrease Parkland's health care spending for an often times preventable complication that many intensive care unit patients experience. The process of improving patient outcomes emphasizes the importance of implementing the most current evidence-based practice into the clinical setting in order to benefit patients and this change is no exception.

Rationale for Earplug Intervention for ICU Delirium

The brief rationale for implementing the benchmark project is to improve patient outcomes, decrease patient's length of ICU stay, and decrease the associated health care costs that come with treating patients that develop ICU delirium. All of these measures would in turn directly increase unit revenue which is especially important to highlight given the current financial strain on health care spending due to the COVID-19 pandemic. Pun and Ely (2007) discuss the benefits of identifying causes of ICU delirium in order to prevent higher rates of reintubation, ICU, in-hospital and out-of-hospital mortality, and higher medical care costs. This change should be implemented in practice because effective, non-pharmacological interventions

are key to preventing ICU delirium. Earplugs would eliminate or lessen one major underlying factor of ICU delirium: the noisy environment. By creating an environment that is more conducive to sleep, patients would be able to reduce nighttime awakenings due to loud noises and optimize their sleeping cycles. Additionally, Parkland would also likely benefit from higher patient satisfaction scores which would improve financial reimbursement.

Literature Synthesis

Majority consensus among all included studies was that earplugs in conjunction with other non-pharmacological interventions were the most effective in preventing ICU delirium. Most studies also reported that earplugs used as a single intervention or in a multi-interventional protocol improved participants' subjective sleep quality. A majority of the evaluated articles examined sleep quality as a major underlying factor for ICU delirium. All articles suggested that there are clinical benefits to the use of earplugs for delirium prevention in ICU patients although not all results reflected statistically significant findings. A study evaluating earplug use was deemed feasible based on protocol compliance and participant acceptability of intervention (Litton, Elliott, Ferrier, & Webb, 2017). Earplugs contributed to less activity during optimal sleep hours, improved sleep quality, decreased number of awakenings, reduced long awakenings, increased total sleep time, and increased the amount of time spent in the deepest stage of sleep (Arttawejkul, Reutrakul, Muntham, & Chirakalwasan, 2020; Bannon et al., 2019; Demoule et al., 2017; Edvardsen & Hetmann, 2020; Hu et al., 2018; Litton et al., 2017; Locihova, Axmann, Padysakova, and Fejfar, 2018; Sahawneh & Boss, 2020). Consistent findings were reproduced in a simulated ICU environment with the use of earplugs and eye masks producing fewer awakenings, shorter sleep onset latency, and improved participant-rated sleep quality and anxiety levels (Huang et al., 2015).

A wide variety of single interventions and multi-interventional protocols including cognitive assessment and reorientation, environmental interventions, and noise-reduction strategies were evaluated (Bannon et. al, 2019; Hu et al., 2018; Locihova et al., 2018; Moon & Lee, 2015; Rivosecchi, Smitherburger, Svec, Campbell, & Kane-McGill, 2015; Tang, Su, Mabasa, Thomas, & Suchorowski 2019). Multi-interventional protocols showed a greater decrease in delirium incidence compared to single interventions and patients reported improved sleep quality measured through a subjective sleep questionnaire (Hu et al., 2018; Rivosecchi et al., 2015; Sahawneh & Boss, 2020; Tang et al., 2019). Earplugs in combination with eye masks were also found to decrease the risk of developing delirium (Edvardsen & Hetmann, 2020). Collectively, the evaluated articles suggest the potential benefits of using earplugs to prevent ICU delirium in addition to other preventative measures and further highlight the need for proven multi-interventional protocols to decrease ICU delirium.

Stakeholders

The main stakeholders impacted by my benchmark project include the SICU bedside nurses, assistant unit managers, unit manager, director, providers, and the Surgical Services executives and administrative personnel. The entire SICU team from non-clinical roles to clinical positions are impacted either directly or indirectly from this project. My benchmark project would not only improve patient outcomes, but also reduce the intensive care unit's costs by reducing healthcare-associated delirium costs, decrease the patient's length of ICU stay which would generate more income from quicker patient turnover, decrease the patient's acuity resulting in fewer required nursing interventions, and decrease the utilization of nursing staff resulting in reduction of paid nursing wages. All of these various outcomes would be of high value to the stakeholders.

Stakeholders in my practice setting value effective interventions that are low-cost especially in light of the ongoing pandemic. While their focus is more aimed at cost-related aspects of patient care, patient outcomes do hold great value as well due to the emphasis on reimbursement. Multiple different supplies have been eliminated from supply rooms due to budget restraints and increased costs related to patient care, so there is very little room in the budget for new products or devices. Additionally, my project is immensely benefited by the recent addition of earplugs to the SICU supply rooms stock, so an additional expense would not be necessary for project implementation which stakeholders would greatly value given the current financial restraints.

Planned Implementation and Timetable/Flowchart

The evidence-based change is anticipated to be carried out in the Surgical-Trauma ICU at Parkland Hospital in Dallas, Texas. ICU length of stay, unit cost reductions, unit reimbursement, and average patient census would be applicable in building a case that this change is warranted, so the hospital can preventatively avoid future unnecessary costs. The implementation process will include four phases: pre-change data collection, education and training, change implementation, and post-change data analysis.

Upon project approval from the unit manager, the pre-change data collection will occur over a two-week period to allow thorough data collection and analysis. Pre-change data collection will include delirium incidence, duration, length of ICU stay, and severity of delirium measured by CAM-ICU screening tool which is performed twice daily with nurses first assessment at either 0800 or 2000. All of these measurements are able to be directly pulled from the SICU patients' charts through a report on EPIC. The assistant unit managers already pull this

report on a monthly basis, so it should be able to be easily obtained. I would also obtain total monthly patient census, unit revenue, and unit expenses which the unit manager tracks monthly and shares in leadership meetings. All patients will complete a Pittsburg Sleep Quality Index every day during this two-week period to record subjective sleep quality scores with spaces marked to document the date and time completed.

Once the first phase is completed, two weeks will be allotted to create education material and provide a total of six training sessions. Each training session will include a brief overview of the intervention including proper earplug placement, time of earplug use, earplug replacement criteria, and where earplugs will be stored. I will also review the document that each nurse will complete per patient that records whether earplugs were worn or not, length of earplug use, and when or if earplugs were replaced. This one-page document will include up to 14 days for nurses to document and will stay with the patient until ICU discharge or transfer to lower level of care. Fourteen sleep quality questionnaires will be attached to this document for easy retrieval and organization. Both the one-page nursing document and corresponding patient questionnaires will be placed in a plastic folder adhered to the patient's room door. The plastic folder will align with infection prevention's requirements and will be able to be properly disinfected twice daily. Extra copies of the sleep quality questionnaires will be available if needed on the break room bulletin board. Each ten-minute staff training session will take place during nightshift report at 1845 on Monday, Thursday, and Saturday for two weeks. Parkland's pay periods are Wednesday to Tuesday, so these dates ensure that education and training sessions can be maximized to reach as many staff members as possible. A one-page instruction sheet with my contact information will also be posted on the staff's bulletin board for staff's reference. Finally, the implementation of the evidence-based change will take place over a period of four weeks. During this time, I will

make one visit to the unit per week to answer any of staff's questions and also collect the completed forms of patients who have been discharged or transferred to a lower level of care. Data analysis will be completed within the next two weeks following completion. To determine if the change was successful, data would be obtained reflecting outcome measures relating to earplug compliance, delirium incidence, duration, length of ICU stay, and subjective sleep quality scores. Data including total monthly patient census, unit revenue, and unit expenses related to implementing the change would be evaluated to determine if and how the organization was impacted.



Data Collection Methods/Planned Evaluation

My evaluation plan will occur after collecting post-change data. The primary outcomes are delirium incidence, delirium duration, and subjective sleep quality. Delirium severity could not be measured without instituting another tool, so to minimize the time bedside nurses would

have to spend collecting data, I did not include this as primary measure. Secondary outcomes are total monthly patient census, unit revenue, and unit expenses.

Data will be analyzed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). Delirium incidence, duration, and length of ICU stay data will all be expressed as mean \pm SD. Delirium incidence and duration will be measured by using the CAM-ICU delirium screening tool which is reported as either 'positive' or 'negative'. The length of ICU stay will be collected from the one-page document that the nurses fill out for every patient and verified via the patient's chart in EPIC in the patient demographic section. All patients will complete a Pittsburg Sleep Quality Index every day to record subjective sleep quality scores. Subjective sleep quality measure data will be recorded on electronic case report forms powered by a data manager (CleanWEB; Telemedicine Technologies, Boulogne-Billancourt, France).

Delirium incidence will be analyzed by logistic regression analysis and the length of ICU stay will be assessed by linear regression analysis. One-way analysis of variance (ANOVA) will be used to determine differences in perceived sleep quality during each night spent in the ICU. All secondary outcomes including total monthly patient census, unit revenue, and unit expenses are generated directly from the EPIC charting system and already collected on a monthly basis by the unit manager. After data analysis is complete, I would create a visual graph to depict the changes between the pre-change and post-change data and reflect the change in patient's reported sleep quality scores from the Pittsburg Sleep Quality Questionnaire.

Costs/Benefit Discussion

One of the biggest benefits to my project is that the SICU recently started stocking single-use foam earplugs in the unit supply rooms for patient comfort, so there would be no additional cost to the unit since this is the only item necessary to implement the change. While I

was not able to obtain the exact cost of the earplugs that are already supplied, the estimated retail cost of a 3M 200-pair pack of single-use foam earplugs is \$30-35. There are a total number of 21 ICU beds, so an estimated three to five packs would be needed on a monthly basis (\$90-175/month) assuming patient's length of ICU stays are about three days total. The number of earplugs needed per month would vary due to many underlying factors like total patient census, length of patient's ICU stay, and possible reusability of the earplugs.

This change is very cost-effective with little to no risk and a vast number of potential benefits to increase unit revenue. More definitive data including the exact whole sale cost of earplugs through the hospital's medical supplies vendor would be required to perform a more accurate cost analysis, but there are numerous potential benefits for both the hospital and ICU patients. Feasible potential benefits to patients include lower hospital bills from decreased length of stay, decreased acuity resulting from delirium requiring additional interventions such as mechanical ventilation, sedation, benzodiazepines, and decreased risk of long-term physical and mental complications resulting from delirium such as depression, anxiety, and possible physical disabilities that greatly impact patient's quality of life.

While improved patient outcomes are important to emphasize, ultimately the potential financial benefits for the SICU and Parkland hospital are what will convince stakeholders that this change is necessary to implement in clinical practice. Implementing earplugs to prevent ICU delirium will reduce the intensive care unit's costs by reducing healthcare-associated delirium costs, decrease the patient's length of ICU stay which would generate more income from quicker patient turnover, decrease the patient's acuity resulting in fewer required nursing interventions, and decrease the utilization of nursing staff resulting in reduction of paid nursing wages. The necessary nursing interventions for caring for a patient with delirium can include mechanical

ventilation and sedation medications which can be very costly. The increased agitation can also cause delirium patients to require a 1:1 sitter or RN which greatly increases the unit's cost in paid wages to those staff members for the duration that the patient requires this specific safety precaution. These multiple factors increase a patient's length of ICU stay which prevents the admission of another patient in that private room decreasing the total monthly patient census that would bring in additional revenue. All of the above measures are crucial to consider when evaluating cost versus benefit and emphasizes the unit's and hospital's return on the investment. Overall, my project is low-cost and well worth the potential benefits for both patients and hospitals.

Overall Discussion/Results

While I was not able to physically perform my change project in the ICU due to the current COVID-19 precautions my facility has taken including no visitors or outside staff, I was able to reflect on the process and things that could be improved to make this a successful evidence-based change implementation at a later time. The SICU has great, innovative nursing leaders and bedside nurses dedicated to improving patient outcomes, providing patient care consistent with the most current delirium prevention guidelines, and embracing evidence-based practice changes. I see this type of positive work environment as a huge benefit to initiating a change project and in the future would use that environment and overall attitude of the unit to my advantage.

I think it is also crucial to build the change into the current processes in place if you are able. The SICU is already utilizing CAM-ICU delirium screening assessments twice daily and has a written delirium protocol in place, so simply adding another evidence-based intervention to that multi-interventional, non-pharmacological protocol makes the change seem less interruptive

to the normal nursing routines and more feasible to implement. I had planned on still being a bedside ICU nurse when I started this project which I feel would have made the implementation of my project a lot easier and much more feasible, but continue to have great hopes in the future success of utilizing earplugs to prevent ICU delirium.

Recommendations

The discussion of promoting an ICU environment where measures can be taken to prevent delirium and not simply treat it once it develops is an innovative concept just recently recognized and implemented in intensive care units across the globe. Development of non-pharmacological interventions to prevent ICU delirium would help support better patient outcomes and reduce both patient and hospital costs. In order to influence a culture change in the ICU setting, additional support is needed to both initiate further research on this topic and incorporate new research findings into current nursing practice. Measures to establish the use of earplugs for ICU delirium prevention could hold great value for patients and health care facilities.

The next step for my benchmark project would be implementing this change at bedside. My goal was to have a successful change project in the SICU that would then be able to be implemented in the three other intensive care units at Parkland: the medicine ICU, burn ICU, and neuro ICU. As a future MSN, I would recommend an initial pilot study in the SICU due to the lack of statistically significant evidence found among the research articles. Due to the various underlying causative factors, many studies had limitations which impacted the overall findings, so a successful pilot study would also create more buy-in from Parkland on implementing the change at bedside if statistically significant findings resulted from a study performed on their specific patient population and intensive care units.

My recommendation to Parkland would be to create a unit-specific or hospital-wide evidence-based practice committee where the committee can discuss, evaluate, and implement various evidence-based practice initiatives to current clinical practice. The EBP committee would work in conjunction with unit leaders to develop and implement EBP changes on different units within the hospital. This would assist in streamlining the implementation process for future projects and potentially implement EBP changes on a wider scale.

The multidisciplinary SICU team really emphasizes delirium prevention measures and that adherence to the current delirium prevention protocol are followed especially during morning rounds. This creates a “trickle down” effect to the residents who end up rotating to the other ICUs and creates a culture that values evidence-based practice. I would recommend to continue this practice and advocate for additional EPIC charting from the bedside nurses that reflect adherence to the delirium prevention protocol. Currently, EPIC charting for bedside nurses just includes a CAM-ICU screening assessment that is performed twice daily with the first nursing assessment of the nurse’s shift. This could be improved to closer monitor adherence by adding documentation rows for the current included interventions in the delirium prevention protocol such as retiming of routine nursing assessments and interventions like medication administration and lab draws from 2200-0500, lights on during the day and off at night, physical and occupational therapy, avoiding restraints and benzodiazepines, constant weaning and discontinuing sedation and mechanical ventilation as the patient is able to tolerate, and extended family visitation hours from 0500-2100 for all appropriate patients. Documentation of these interventions or activities that were or were not performed every day would assist in tracking of both day-to-day adherence to the preventative interventions and possible causative factors when

delirium occurs. Overall, the bedside nurses, patients, and staff members can continue to support the current efforts to prevent ICU delirium while striving to provide the best patient care.

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