Reducing Medical Device-Related Pressure Ulcers: A Quality Improvement Project

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Abstract

**Purpose:** The purpose of this quality improvement project was to improve medical device-related pressure ulcers (MDRPU) incidence rates on a 23-bed orthopedic unit within a large midwestern hospital located in a metropolitan area. Medical devices have an essential role in providing effective therapeutic care by restoring mobility and reducing pain for orthopedic patients. However, MDRPUs can cause pressure injuries if not closely monitored by nurses.

**Synthesis and Supporting Literature:** Several authors identified clinician were lacking knowledge related to specific MDRPU prevention strategies as the most common reasons for the increase in MDRPU incidence rates (Kim, 2020). Studies show frequent skin assessments underneath medical devices, repositioning medical devices, and applying dressings are effective preventive strategies to reduce MDRPU incidence rates (Gefen et al., 2020). Educational programs were beneficial to enhance nurses’ knowledge about MDRPU prevention strategies. The Plan-Do-Study-Act (PDSA) theoretical framework was found to be the most applicable framework to effect a change in MDRPU management.

**Method:** This QI project implemented a three-phase approach that included: 1) the evaluation of \( n=30 \) nurses’ baseline knowledge about MDRPU prevention and use of appropriate interventions, 2) incorporation of an educational bundle that included a PPT presentation about MDRPU prevention strategies, an MDRPU algorithm, and MDRPU documentation tool during unit huddles, 3) evaluation of nurses’ MDRPU prevention interventions and knowledge using an MDRPU documentation tool and multiple-choice post-implementation survey.

**Outcomes:** There was an overall reduction of MDRPU incidence rate from 0.4 % per 1000 patients over 6 weeks before implementation compared to 0 per 500 patients 6 weeks after implementation. The respondents \( n=30 \) demonstrated an increase in the level of knowledge regarding the use of MDRPU prevention strategies following the viewing of the education modules (48% to 79%). In addition, nurses’ MDRPU prevention interventions frequencies have substantially improved following education, especially for skin inspection underneath the device (35% to 76%) and routinely repositioning medical devices (46% to 88%).

**Recommendations:** This QI project results suggest that educating nurses about MDRPU prevention interventions can improve MDRPU incidence rates and nurses’ knowledge and practices. With many limitations, further research is necessary to evaluate the potential impact MDRPU training has in different settings.

**Keywords:** Medical device-related pressure ulcers, nurses training on medical devices, medical devices
Reducing Medical Device-Related Pressure Ulcers: A Quality Improvement Project

Medical device-related pressure ulcers (MDRPUs) are becoming a major problem in the United States. MDRPUs are localized areas of tissue damage caused by medical devices, such as splints, braces, immobilizers, and pneumatic compression devices (Gefen, 2020). Because MDRPUs can cause serious complications, such as infections, the need to prevent MDRPUs is significant (Gefen, 2020). Nurses have a major role and responsibility in identifying patients at risk for MDRPUs and preventing their occurrence (Karadog, 2017). For these reasons, additional training for nurses about MDRPU awareness and prevention methods is highly suggested to reduce the incidence rate (Tan, 2020). Therefore, this quality improvement project focused on reducing MDRPUs incidence rate by educating nurses about the importance and use of implementing evidence-based preventive strategies.

The Problem Identification/Available Knowledge

In general, pressure ulcer incidence rates remain high. Each year, more than 2.5 million people develop pressure ulcers in the United States (Agency for Healthcare Research and Quality, 2014). More specifically, MDRPUs incident rates are increasing in all settings and age groups throughout the United States (Black, 2016). Hospitalized patients with medical devices are 2.4 times more likely to develop a pressure ulcer of any kind (Black et al., 2010). MDRPUs often develop because of many contributing factors, such as lack of clinician awareness about the importance of frequent skin assessment underneath medical devices, repositioning, and correctly fitting or securing them to patients (Gefen, 2020). A study by Apold and Rydrych (2012) revealed 63% of reported MDRPUs lacked documentation of device removal at regular intervals for pressure relief or skin inspection. The authors believed that the unfamiliarity with best practices for skin inspection is a contributing factor for the increase in MDRPUs. Kim and Lee
(2019) found nurses understand the importance of MDRPU prevention interventions but do not perform prevention interventions. Therefore, additional education about prevention performance is highly recommended (Gefen, 2020).

**PICO**

For orthopedic nurses (P), what is the effect of MDRPU prevention training (I) on reducing MDRPU incidence rates and increasing nurses’ knowledge practices (O) compared to nurses without training (C)?

**Literature Review**

A literature review was conducted utilizing reliable databases, such as SOLAR, CINAHL, and MedLine (see Appendix J). Various articles and studies were found to help support this quality improvement project. Keywords, such as “medical device related pressure ulcers” and “nurses training on medical device” were used to find the following content.

Pressure ulcers have been nationally defined as “a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear” (National Pressure Ulcer Advisory Panel, 2018, p. 1). This definition only applies to pressure ulcers, but many pressure ulcers occur as a result of external pressure caused by medical devices, which are not included in this definition. Therefore, with a thorough review of the evidence, the Hospital-Acquired Pressure Ulcer (HAPU) committee defined MDRPU as “a localized injury to the skin and/or underlying tissue including mucous membranes, as a result of pressure, with a history if an external medical device at the location of the ulcer, and mirrors the shape of the device” (Pittman, 2015, pg 3). With a more specific definition and guidance, this led to a decrease in overall HAPU rates of 33% from 2011 and 2012 (Pittman, 2015).
Even with a concise definition of MDRPU, incidence rates continue to increase throughout the United States (AHRQ, 2015). Various authors explore the reasons behind this increase. Apold and Rydrych (2012) found MDRPUs were commonly associated with the lack of understanding the frequency of removing devices and performing skin inspections underneath devices. In this study, 74% of MDRPUs were not identified until they developed stage 3 and stage 4 pressure ulcers. Karadog’s (2017) study showed that 20% of the nurses did not believe that medical devices could cause pressure injuries. These findings suggest additional training in MDRPU prevention interventions is necessary to decrease the incidence rates.

Various evidence-based prevention strategies may help improve MDRPU incidence rates. Through extensive training, clinical nurses can help decrease MDRPU by focusing on the importance of prevention performance (Kim, 2019). Nurses should implement frequent skin assessments underneath medical devices (Black, 2012). The National Pressure Injury Advisory Panel (2020) recommended performing skin inspections underneath the device twice daily and more frequently in vulnerable patients. In addition to skin inspections, Gefen (2020) suggested repositioning devices to redistribute pressure and decrease shearing. Many nurses argued against repositioning devices because providers do not allow nurses to do so (Seong, 2021). Applying cushion and dressing between the skin and medical device is another prevention strategy nurses could perform to help prevent MDRPUs (Cooper, 2016). Research supports that foam dressings are more beneficial in patients by reducing pressure and absorbing moisture; however, hydrocolloids and films still can provide an effective cushion (Black, 2013). Despite common misconceptions that MDRPUs will occur inevitably, reducing MDRPU incidence rates is critical, and it will take a multidisciplinary team and training to achieve (Gefen, 2020).
**Gap Analysis/Needs Assessment**

The high incidence rate for MDRPUs has been problematic on an orthopedic floor within a large Midwest institution. In 2019, this orthopedic unit’s incidence rate was 0.4 % per 1000 patients over 6 weeks, which surpassed the unit’s target goal of 0.3% per 1000 patients. According to Thul (personal communication, 2020), orthopedic nurses are not performing frequent skin assessments underneath medical devices and are lacking appropriate documentation. Therefore, this quality improvement project proposed to implement an educational session, teaching nurses about the importance of implementing MDRPU preventive strategies.

There are many ways to reduce MDRPUs through implementing evidence-based preventive strategies. Gefen et al. (2020) suggested several interventions, such as skin assessments and repositioning the medical device at frequent intervals. Other suggested prevention strategies include applying padding between the device and skin, ensuring the device is secured, and effective documentation among nurses (Black, 2016). Each suggested intervention supported the nursing staff in their goal to reduce the incidence of MDRPUs on this unit.

**Organizational Project Information**

This project was implemented on an adult orthopedic unit at a large Midwest hospital. This orthopedic unit admits at least five postoperative orthopedic patients per day, 500 per month, and 6,000 a year, this orthopedic unit is constantly active. This orthopedic department that fills 23 beds typically admits patients who have undergone surgery for many orthopedic problems, such as hip and leg fractures, torn rotator cuffs, and ruptured tendons. All of which
may require medical devices to help restore mobility, reduce pain, and improve the quality of life for patients.

**Population**

This quality improvement project included orthopedic nurses on an adult orthopedic unit. It included the project leader, nurse manager, charge nurses, wound nurses, and all orthopedic floor nurses working all shifts (i.e., day, evening, and night). This quality improvement project also included all patients on an orthopedic unit with medical devices.

**Interprofessional Team**

The DNP project leader conducted and directed this quality improvement project on an adult orthopedic unit. The interdisciplinary team included the DNP project leader, nursing supervisor, charge nurses, orthopedic nurses, and wound nurses.

**Theoretical Framework**

The Plan-Do-Study-Act (PDSA) method is to test a change that is implemented through four distinct steps (Agency for Healthcare Research & Quality, 2015). The steps include: 1) coordinate a plan, 2) execute the plan, 3) study the results, 4) and begin data analysis. The PDSA framework structured this quality improvement project in all phases. During the pre-implementation phase, the DNP project leader created a plan to decrease MDRPU incidence rates by educating nurses about MDRPU prevention strategies and evaluating their performance using an MDRPU documentation tool (see Appendix D). In the implementation phase, the DNP project leader executed the plan by providing an educational bundle including a PowerPoint presentation about MDRPU prevention interventions, MDRPU algorithm (see Appendix C), and MDRPU documentation tool (see Appendix D). In addition, the DNP project leader conducted weekly audits/interviews evaluating nurses’ MDRPU prevention interventions during a six-week
time period. During the post-implementation phase, the DNP project leader analyzed and interpreted the results to determine whether the project’s goal was met.

**Ethical Considerations**

The Institutional Review Board (IRB) is a group that is designated to review and monitor research projects that involve human subjects (Center for Drug Evaluation and Research, 2019). The purpose is to assure that appropriate steps are being taken to protect participants’ confidentiality and safety (Center for Drug Evaluation and Research, 2019). To accomplish this purpose, the DNP project leader must submit documentation explaining the project’s purpose, participants’ population, potential risks, and interventions. The IRB must approve the project before any implementation. In addition to the IRB process, the DNP project leader ensured participants’ identities were protected during this project. This project did not require identification to participate in the completion of pre/post-implementation surveys and submission of the MDRPU documentation tool. In this project, orthopedic nurses were the only participants. Nurses understood the purpose of this project, and their participation was voluntary. Because this project merely focused on nurses’ MDRPU knowledge and prevention interventions, orthopedic patients and any vulnerable populations (i.e., children, cognitively impaired adults, pregnant individuals) were excluded. Only orthopedic nurses who received MDRPU prevention training were included. Therefore, float pool nurses (non-orthopedic nurses) were also excluded.

**Mission Statement, Goals, and Objectives**

**Mission**

The mission of this quality improvement project was to improve the quality of skincare in postoperative patients on an orthopedic unit.
Goal

This quality improvement project goal was to reduce the MDRPU incidence rate in orthopedic patients by educating nurses about the importance and use of implementing evidence-based preventive strategies.

Objective 1

The DNP project leader developed a PowerPoint presentation and materials (pre and post-implementation survey, MDRPU Documentation Tool, and MDRPU algorithm) within a 2-week time frame.

Implementation. The DNP project leader organized and prepared necessary project materials, including an educational PowerPoint presentation for participants, pre and post-implementation survey, MDRPU Documentation Tool, and MDRPU algorithm by February 1, 2021.

Outcome Measure and Evaluation. The DNP project leader measured the success of this objective by a self-completion of the PowerPoint presentation and materials development by February 1, 2021.

Objective 2

The DNP project leader collected baseline data of all nurses’ current MDRPU prevention practices before the project implementation.

Implementation. The DNP project leader used the MDRPU Documentation Tool to collect pre-intervention data of nurses’ current prevention interventions. Data collection occurred weekly through an audit/interview of all orthopedic nurses’ current prevention interventions and
charting habits on all shifts (i.e., day, evening, night) during this timeframe. The DNP project leader audited/interviewed nurses before shift change. By doing so, this helped gather recent and accurate data. Data was collected and secured in a lockbox in the nurse manager’s locked office.

**Outcome Measure and Evaluation.** The DNP project leader measured the success of this objective by analyzing the number of audited/interviews compared to the total of nurses \( n = 30 \) employed on the unit.

**Objective 3**

By May 6, 2021, 80% of staff nurses on the orthopedic unit will participate in this quality improvement project.

**Implementation.** The DNP project leader emailed the project announcement and invitation to participate in this quality improvement project to all staff nurses. One week following the initial email, the DNP project leader resent the project announcement and invitation in an attempt to capture as many nurses as possible on the unit to participate in the project. In addition, the DNP project leader and charge nurses promoted participation in high level/huddle shift reports.

**Outcome Measure and Evaluation.** The DNP project leader measured this objective by comparing the number of nurses who confirmed their desire to participate in the project to the email invitation to all nurses on the unit. The DNP project leader recorded each respondent’s name on a participation sheet, which will be secured in the nurse manager’s locked office.

**Objective 4**

All participants will complete the pre-implementation survey within a 2-week time frame.

**Implementation.** The DNP project leader created an anonymous pre-implementation survey (see Appendix A) on SurveyMonkey and emailed it to all project participants on the
orthopedic unit. One week following the initial email, the DNP project sent participants a reminder to complete the pre-implementation survey. In addition, the DNP project leader and charge nurses reminded participants about the survey during high level/huddle shift report to complete the pre-implementation survey.

**Outcome Measure and Evaluation.** This objective was measured by comparing the total number of project participants to complete the pre-implementation survey. This data was secured in the nurse manager’s locked office in the project locked box.

**Objective 5**

All participants reviewed the educational PowerPoint presentation and materials within a 2-week time period.

**Implementation.** The DNP project leader emailed the PowerPoint presentation, MDRPU algorithm (see Appendix C), and MDRPU Documentation Tool (see Appendix D) to all participants on the orthopedic unit. One week later, the DNP project leader emailed participants a reminder to review the PowerPoint presentation and materials. Weekly, the DNP project leader and charge nurses reminded participants in high level/huddle shift report to review the educational PowerPoint presentation. Once completed, participants notified the DNP project leader that they were ready to receive the post-implementation survey.

**Outcome Measure and Evaluation.** Participants notified the DNP project leader via email, indicating that they had reviewed the PowerPoint presentation and materials. These were compared to the number of nurses who agreed to participate in the project. The DNP project leader secured this data in the nurse manager’s office inside a locked box.

**Objective 6**

All participants will achieve a score of 80% or better on the post-implementation survey.
Implementation. Following the email from participants, indicating that they have reviewed the materials and are ready to take the post-implementation survey (see Appendix A), the DNP project leader emailed the SurveyMonkey link to the post-implementation survey.

Outcome Measure and Evaluation. This objective will be met when results reveal an 80% or better passing score on the post-implementation survey.

Objective 7

All participants will perform appropriate MDRPU prevention interventions within a 6-week time frame.

Implementation. As a reminder for appropriate prevention interventions, the DNP project leader reviewed them in the PowerPoint presentation and placed the MDRPU algorithm (see Appendix C) and the MDRPU Documentation Tool (Appendix A) at the nurse station. In addition, appropriate charting examples via flowsheets (See Appendix E) and progress notes (See Appendix F) were located at the nurse station.

Weekly, the DNP project leader audited/interviewed participants’ MDRPU prevention interventions, including charting, before shift change on all shifts (i.e., day, evening, and night) during the 6-week data collection period. The DNP project leader used the MDRPU Documentation Tool to collect prevention interventions data. Data collected was secured in the nurse manager’s locked box.

Outcome Measure and Evaluation. This objective was measured by comparing the pre and post-intervention audits/interviews.
**Objective 8**

The MDRPU incidence rate will decrease by 20% or more 6 weeks after the implementation.

**Implementation.** The DNP project leader obtained data on MDRPU incidence rate 6 weeks pre and post-implementation intervention. The DNP project leader consulted with the nurse manager and WOC nurse to gather this data.

**Outcome Measure and Evaluation.** The DNP project leader measured 6 weeks pre and post-implementation MDRPU incidence rate. The reduction by 20% or more will indicate the success of this objective.

**Gantt Chart/Work Breakdown**

This project’s Gantt chart is displayed in a timeline (See Appendix G). There are three distinct phases: 1) Pre-Implementation phase, 2) the implementation phase, and 3) the post-implementation phase.

In the pre-implementation phase, baseline data of current nurses’ MDRPU prevention interventions were collected from March 25, 2021—April 29, 2021. This 6-week time period allowed the DNP project leader to collect sufficient data on orthopedic nurses working all shifts (i.e. morning, evening, night). Following the baseline data collection, a project participant invitation and presurvey email were sent to all nurses on May 6, 2021, to determine baseline knowledge. The presurvey was expected to be completed by May 29, 2021.

The implementation phase began on May 31, 2021. Participants reviewed the PowerPoint presentation and completed the postsurvey by June 30, 2021. In addition, the MDRPU algorithm (see Appendix C) and MDRPU documentation tool (see Appendix D) were reviewed in the huddle during this phase. Between July 1, 2021—August 12, 2021, nurses performed appropriate
MDRPU prevention interventions, and weekly audits were performed by the DNP project leader.

The post-implementation phase started after August 12, 2021. This phase included data analysis. The DNP project leader will gather and perform data analysis using Excel. With the comparison of the pre and post-implementation, the DNP project determined whether this project met the following objectives: an increase in performance of appropriate MDRPU prevention interventions, an increase in nurses’ knowledge about MDRPU prevention interventions, and a decrease in MDRPU incidence rate.

Methods

This quality improvement project used a descriptive analysis design to determine the frequency of (n= 30) nurses’ MDRPU prevention interventions and MDRPU incidence rate on a 23-bed orthopedic unit within a large midwestern hospital located in a metropolitan area.

Data Collection Methods

Data was collected using the MDRPU Data Collection Tool (see Appendix D). This tool was created to assess the frequency of nurses’ MDRPU prevention strategy interventions. Phase one data was collected weekly for six weeks prior to implementation to determine nurses’ baseline MDRPU prevention interventions. In addition, nurses’ baseline knowledge was assessed and collected by an online survey (See Appendix A). In phase two, nurses were provided an educational bundle, including a PowerPoint presentation about MDRPU prevention interventions, an MDRPU documentation tool, and an MDRPU algorithm. A checklist was created in Excel to keep track of those who reviewed the educational bundle. In addition, nurses’ post-implementation knowledge was assessed and collected by an online survey. Following the survey, data was collected weekly for six weeks to evaluate nurses’ post-implementation
MDRPU prevention interventions. Phase three measured project sustainability over a six-week period.

All phases used the MDRPU Data Collection Tool (see Appendix D). On each collection day, nurses were asked whether they performed appropriate MDRPU prevention interventions. The tool measured whether nurses were implementing MDRPU evidence-based preventive strategies, including skin inspection underneath the medical device, applying prophylactic dressing for skin protection, repositioning the device, and ensuring the device was secured. This data was collected and stored in Excel to evaluate the frequency of nurses’ MDRPU prevention interventions.

**Phase One**

Phase one included baseline data collection of nurses’ MDRPU preventive practices and knowledge before the implementation of this phase on March 25, 2021. The method and frequency of nurses’ pre-implementation preventive interventions was collected weekly, using the MDRPU documentation tool (see Appendix A). Each intervention (e.g., skin inspection underneath device) performed gained one credit point for using appropriate prevention interventions. If a nurse did not perform an appropriate prevention intervention method, it counted as one credit loss for the specific intervention. For each intervention, the credit points earned were divided by the possible total points to determine the frequency of the intervention.

To assess nurses’ baseline knowledge about MDRPU prevention interventions, a 6-question survey (See appendix A) was distributed via email. The questions consisted of evidence-based practice MDRPU preventive strategies obtained from the literature review conducted by the DNP project leader. Each participant’s score was presented as a percentage, which was used to formulate the total average score of the participants’ group.
The MDRPU incidence rate was measured by the number of MDRPU occurrences that were newly developed during hospitalizations, using the rate of MDRPU’s per 1000 patients. The 6-week pre-implementation incidence rate was compared to the 6-week post-implementation rate.

**Phase Two**

Phase two included an educational bundle that included a PowerPoint presentation about MDRPU preventive strategies, an MDRPU algorithm (see Appendix C), and an MDRPU documentation tool, which was created to help guide nurses with their MDRPU prevention interventions. The PowerPoint presentation used evidenced-based practice recommendations to convey MDRPU’s importance. The algorithm helped guide nurses with their MDRPU assessments and interventions for specific medical devices. The educational bundle was emailed to all nurses and placed at the nurse station for review. Nursing staff were reminded in huddle to review the materials. A checkoff list was created to track the total number of staff who reviewed the educational bundle. The number of nursing staff who reviewed the materials represented the percentage of completion.

After reviewing the educational bundle, a post-implementation survey was emailed to all participants. The survey included the same six questions as the pre-implementation survey. To measure nurses’ knowledge, the pre and post-implementation survey scores were compared using a paired \( t \) test analysis.

Weekly audits of nurses’ MDRPU prevention interventions were conducted using the MDRPU documentation tool (Appendix D). The tool measured whether nurses were implementing MDRPU evidence-based preventive strategies, including skin inspection underneath the medical device, applying prophylactic dressing for skin protection, repositioning
the device, and ensuring the device was secured. The frequency of nurses’ MDPRU prevention interventions were measured and presented as descriptive data.

Phase Three

Phase three measured the project’s sustainability 6 weeks after the final data collection day on August 12, 2021. This phase included data analysis of nurses’ MDPRU prevention interventions and MDPRU incidence rate.

Outcomes Analysis

Data collected were measured and analyzed using descriptive statistics. All phases utilized the MDPRU Data Collection Tool (see Appendix A). Phase one collected nurses’ baseline data. Phase two collected post-implementation data during a six-week intervention timeframe. The rate of MDPRU was determined by dividing the total number of patients by the number of MDPRU incidence within a six-week timeframe. SurveyMonkey was used to calculate and compare the pre and post-implementation survey scores.

Results

Participant Survey

The respondents (n=30) demonstrated an increase in knowledge regarding the use of MDPRU prevention strategies following the viewing of the education modules (48% to 79%). The paired t test showed a significant difference between the pre and post-implementation survey scores (p= 0.15). The results showed educating nurses about MDPRU preventive strategies can significantly increase their knowledge.

Interviews/Audits

The following data was based on the frequency and method of each prevention intervention (e.g., skin inspection underneath the device) performed during the pre and post-
implementation period. The frequency of nurses performing skin inspections underneath medical devices increased from 35% to 76%, applying prophylactic dressing for skin protection increased from 16% to 50%, repositioning the medical device at frequent intervals increased from 46% to 88%, documenting interventions increased from 80% to 95%, and ensuring correct medical device size remained at 100%. The results showed the method and frequency of nurses’ MDRPU prevention intervention either sustained or increased after the project’s implementation.

Participants who did not perform appropriate MDRPU prevention interventions were expected to provide their reasons. The most common reasons included: “patient was sleeping,” (34%), “I didn’t have time to perform the intervention.” (29%), “I didn’t think of it.” (15%), “the patient didn’t need the prophylactic dressing.” (12%), and “the doctor already performed the intervention, so I didn’t perform it.” (9%).

Sustained Medical Device Rated Pressure Ulcer Prevention Intervention Incidence Rates

To measure the success of this objective, data were collected six weeks after the implementation phase on August 12, 2021. The pre-implementation MDRPU incidence rate was compared to the post-implementation incidence rate. There was an overall reduction of MDRPU incidence rate from 0.4% per 1000 patients over 6 weeks before implementation compared to 0 per 500 patients 6 weeks after implementation. This data showed training nurses about MDRPU prevention interventions via emailed PowerPoint educational modules have a significant impact on the MDRPU incidence rate.

Discussion

Summary

The project goal to reduce MDRPU’s on an orthopedic unit was achieved during the implementation of this DNP project. Likewise, the project supported the mission of the project in
enhancing the overall skin integrity of post-surgical orthopedic patients using medical devices during the first stages of healing.

Interpretation

The presented data show that educating nurses can decrease the rate of MDRPU and increase nurses’ MDRPU prevention interventions and knowledge. With consideration, nurses in this project demonstrated little knowledge and skill about MDRPU prevention strategies on their pre-implementation surveys and baseline MDRPU prevention interventions. The results show that orthopedic nurses may benefit from additional education and training. Although nurses’ knowledge and prevention practices have improved, nurses explained significant reasons to take into consideration when not completing the intervention. The reasons varied for different shifts. Day shift nurses’ common reasons included time management, explaining they did not have enough time to perform appropriate MDRPU prevention interventions. On the contrary, evening shift nurses commonly mentioned the physician had already performed the MDRPU prevention interventions, so they decided not to perform them. Night shift nurses commonly reported they did not perform appropriate prevention interventions because the patient was sleeping. The presented outcomes show each shift has a barrier for the lack of prevention interventions. Therefore, further education and strategies to increase each shift prevention intervention are warranted.

Limitations

The COVID-19 pandemic impacted the amount of orthopedic surgeries performed, which led to less orthopedic patients with medical devices and data collection. Because this quality improvement project excluded float pool nurses (non-orthopedic nurses), it limited the population size and any additional discoveries. In addition, the DNP project leader did not
observe nurses’ prevention interventions, which makes it possible that the information given was inaccurate.

**Conclusion**

Preventing MDRPUs has been a major problem for clinicians throughout the United States. It has been shown that the lack of knowledge regarding prevention strategies specific to this type of pressure ulcer is directly related to incidence rates (Gefen, 2020). This quality improvement project was conducted on an orthopedic unit to evaluate nurses’ MDRPU prevention knowledge and interventions. Results revealed that education about MDRPU preventive strategies and MDRPU guideline tools (e.g. MDRPU algorithm and MDRPU documentation tool) improved nurses’ MDRPU prevention knowledge and practices. Therefore, comprehensive training programs about MDRPU prevention interventions in health care institutions are warranted.
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Appendix A

Pre/Post-implementation Survey

<table>
<thead>
<tr>
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<th>Pre/Post-implementation Survey</th>
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| 1. | The most common reported medical device related pressure injuries in Minnesota hospitals are caused by:  
A. Respiratory devices  
B. IV tubing  
C. Orthotic devices  
D. All the above |
| 2. | Medical device related pressure injury retention includes:  
A. Follow manufacturers’ instructions  
B. Inspect under and around medical devices once a day  
C. Inspect under and around medical devices at least twice a day  
D. A and C |
| 3. | Fundamental elements of prevention include risk assessments, skin assessments, care planning, and documentation.  
A. True  
B. False |
| 4. | Prophylactic dressings for medical device related injury prevention should:  
A. Be changed only if loose or soiled  
B. Should be removed to allow for twice daily skin inspections  
C. Be thick to provide cushion and pressure relief  
D. All the above |
| 5. | Repositioning the medical device can help prevent MDRPUs.  
A. True  
B. False |
| 6. | M-D-R-P-I stands for:  
A. Medical Device Related Pressure Injury  
B. Medically necessary, device fit selection stabilization, Reposition remove rotate, Prophylactic dressing, inspect  
C. Both A and B  
D. None of the above |
Appendix B

Pre/Post-implementation Survey Answer Key

<table>
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<tr>
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<th>Pre/Post-implementation Survey Answer Key</th>
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D. All the above |
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A. True  
B. False |
| 6. | M-D-R-P-I stands for:  
A. Medical Device Related Pressure Injury  
B. Medically necessary, device fit selection stabilization, Reposition remove rotate, Prophylactic dressing, inspect  
C. Both A and B  
D. None of the above |
Appendix C

Medical Device Related Pressure Ulcers Algorithm

Which type of Medical Device?

ACE Bandage

- Remove ACE Bandage for skin inspection q shift
- Apply Mepilex dressing
- Notify WOC
- Documet findings in flowsheet and progress note
- Reposition the device
- Secure the device

Knee Immobilizer
Shoulder Immobilizer
Hinged Brace
Splint

- Remove for skin inspection q shift
- Apply Mepilex dressing
- Notify WOC
- Apply padding between the device and skin (if needed)
- Reposition the device
- Secure the device

Pneumatic Compression

- Ensure correct fit
- Remove for skin inspection q shift
- Apply Mepilex dressing
- Notify WOC
- Document findings in flowsheet and progress note
## Appendix D

### MDRPU Documentation Tool

<table>
<thead>
<tr>
<th>Date/Time/Shift</th>
<th>Room:</th>
<th>Room:</th>
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<tbody>
<tr>
<td><strong>Ace Bandage</strong></td>
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<tr>
<td>Removed ACE bandage for skin inspection?</td>
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<td>□ Not performed</td>
<td>□ Performed</td>
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<td>Reason ______</td>
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<td>Reason ______</td>
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<td>□ N/A</td>
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<td>□ Skin tear</td>
<td>□ N/A</td>
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<td>□ WOC nurse notified?</td>
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<tr>
<td>Knee Immobilizer</td>
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<tr>
<td>Shoulder Immobilizer</td>
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<td>Hinged Brace</td>
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**Removed for skin inspection?**
- [ ] Performed
- [ ] Not performed
- Reason _________

**Skin Inspection**

| Any: | | | | |
| --- | --- | --- | --- |
| [ ] Erythema | [ ] Ecchymosis | [ ] Skin tear | [ ] N/A |
| [ ] Dressing applied? | [ ] WOC nurse notified? | [ ] Dressing applied? | [ ] WOC nurse notified? |
| [ ] Dressing applied? | [ ] WOC nurse notified? | [ ] Dressing applied? | [ ] WOC nurse notified? |
| [ ] Dressing applied? | [ ] WOC nurse notified? | [ ] Dressing applied? | [ ] WOC nurse notified? |

**Applied prophylactic dressing between the device and skin?**
- [ ] Performed
- [ ] Not performed
- Reason _________

**Repositioned medical device?**
- [ ] Performed
- [ ] Not performed
- Reason _________

**Is the medical device secured?**
- [ ] Yes
- [ ] No
- Reason _________

**Document findings in flowsheet and progress note?**
- [ ] Yes
- [ ] No
- Reason _________
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## Appendix E

### Flowsheet Documentation

#### Figure 1

<table>
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<th>Quick Adds</th>
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<td>PHI/WY Quick Adds</td>
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<td>UMMC Quick Adds</td>
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<tr>
<td>FSH/FRH Quick Adds</td>
</tr>
<tr>
<td>HI Quick Adds</td>
</tr>
<tr>
<td>Gin Quick Adds</td>
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**RASS (Richmond Agitation-Sedation Scale)**

**Coping/Psychosocial**

**Obstetric Equipment State**

**Whisked Emotional State**

**Trust Relationship/Rapport**

**Additional Documentation**

**Cognitive**

**Cognition/Neuro/Behavioral VCL**

**Level of Consciousness**

**Aural Level**

**Orientation**

**Visual Functions**

**Mood/Behavior**

**Additional Documentation**

**CAM-ICU**

**Next step to cruise to take**

**Neuro**

**Additional Documentation**

**Glasgow Coma Scale**

#### Figure 2

The following groups/rows are suggested for:

**FSH/FRH Quick Adds**

Choose groups/rows to add to the flowsheet:

- **LLE Weight-Bearing Status** (Group: Musculoskeletal)
- **RLE Weight-Bearing Status** (Group: Musculoskeletal)
- **Suggested groups**
  - **Pulse Cerebral**
  - **Pulse Brachial**
  - **Pulse Radial**
  - **Pulse Ulnar**
  - **Pulse Femoral**
  - **Pulse Popliteal**
  - **Pulse Dorsalis Pedis**
  - **Pulse Posterior Tibial**
  - **Edema**
  - **Incision/Surgical Site**
  - **Incision/Surgical Site with Packing**
  - **Brace/Orthotic/Orthoses**
  - **Continuous Passive Motion: Knee**
  - **Continuous Passive Motion: Any Joint**

**Condition: Substance Use**

**Suggested groups**

- **GWAAR (Alcohol Withdrawal Assessment)**

**Condition: Neuro/Cognitive**

**Suggested rows**

- **LLE Motor Response** (Group: Motor Response)
- **RLE Motor Response** (Group: Motor Response)
- **LLE Motor Response** (Group: Motor Response)
- **RLE Motor Response** (Group: Motor Response)

**Suggested groups**

Expand All | Collapse All

Existing and selected groups/rows in the tree.Roots are in gray text.

Duplicate groups/rows can be added again.

**Neuro**

**Additional Documentation**

**Glasgow Coma Scale**
Appendix E

Flowsheet Documentation
Appendix F

Progress Note Documentation
Appendix G

Ganff Chart

<table>
<thead>
<tr>
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<tr>
<td>Collect Baseline Data</td>
<td>Collect Baseline Data</td>
<td>Collect Baseline Data</td>
<td>Collect Baseline Data</td>
<td>Collect Baseline Data</td>
<td>Collect Baseline Data</td>
<td>Send invite to staff</td>
<td>Await pretest</td>
<td>Await pretest</td>
<td>PPT education -Posttest</td>
</tr>
<tr>
<td>Week 11 7/29/2021</td>
<td>Week 12 8/5/2021</td>
<td>Week 13 8/12/2021</td>
<td>Week 14 8/19/2021</td>
<td>Week 15 8/26/2021</td>
<td>Week 16 9/2/2021</td>
<td>Week 17 9/9/2021</td>
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<td>PPT education -Posttest</td>
<td>Weekly Data Collection</td>
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Appendix H

Nurses’ MDRPU Prevention Intervention Knowledge on Pre/Post-Implementation Survey

Pre-Implementation Average Scores=48%  Post-Implementation Average Scores=79%
Appendix I

Descriptive Analysis of Nurses’ MDRPU Prevention Intervention

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Before Implementation</th>
<th>After Implementation</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>I performed n (%)</td>
<td>I did not perform n (%)</td>
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<tr>
<td>Removing ACE bandage for skin inspection</td>
<td>15 (44.0)</td>
<td>19 (55.0)</td>
</tr>
<tr>
<td>Evaluating skin condition under medical device</td>
<td>17 (35.0)</td>
<td>32 (65.0)</td>
</tr>
<tr>
<td>Apply padding between medical device</td>
<td>2 (17.0)</td>
<td>10 (88.0)</td>
</tr>
<tr>
<td>Repositioned medical device</td>
<td>6 (46.0)</td>
<td>7 (53.0)</td>
</tr>
<tr>
<td>Ensuring correct fit</td>
<td>29 (100)</td>
<td></td>
</tr>
<tr>
<td>Document findings</td>
<td>33 (80.0)</td>
<td>8 (20.0)</td>
</tr>
<tr>
<td>Device secured</td>
<td>29 (100)</td>
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</table>

Paired samples t-tests revealed statistically significant increases in MDRPU prevention interventions (p= 0.04)
## Appendix J

### Literature Review Table

<table>
<thead>
<tr>
<th>Citation, author, year, theme</th>
<th>Purpose</th>
<th>Research Design</th>
<th>Methodology</th>
<th>Findings</th>
<th>Conclusion</th>
<th>Critical Appraisal Tool &amp; Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent Skin Inspection</td>
<td>To identify and collect data about pattern of MDRPU through Minnesota</td>
<td>Descriptive Analysis</td>
<td>Collecting data to identify trends in common root causes for MDRPUs</td>
<td>Authors found lack of routine skin inspections under or around devices. 74% of MDRPU were not identified until they were stage 4</td>
<td>There is lack of clarity around skin inspection that may be the contributing for MDRPUs</td>
<td>Strength of Evidence = A</td>
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<tr>
<td>Apold J. &amp; Rydrych D. (2012) Preventing device-related pressure ulcers: Using data to guide statewide change. Journal of Nursing Care Quality 27(1), 28-34.</td>
<td>To quantify the extent of the problem and identify risk factors for MDRPU</td>
<td>Secondary Analysis</td>
<td>A series of eight quarterly cross-sectional point prevalence studies conducted. Data collected on risk factors, preventive care processes and pressure ulcer outcomes</td>
<td>The proportion of patients with hospital-acquired ulcers related to MDRPU was 35.5% (39 of 113)</td>
<td>More frequent and thorough skin assessments must be performed on patients with MDRPU</td>
<td>Strength of Evidence = C</td>
</tr>
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</table>

---
<table>
<thead>
<tr>
<th>Gefen A, Alves P, Ciprandi G et al. (2020). Device related pressure ulcers: SECURE prevention. Journal of Wound Care; 29(Suppl. 2a), S1–S52</th>
<th>To provide overview of MDRPU problem and background as well as evidence based strategies</th>
<th>Descriptive Analysis</th>
<th>Comprehensive literature analysis</th>
<th>MDRPU develop faster than non MDRPU. There is a need for greater recognition of MDRPU, including their causes, management, and prevention</th>
<th>Many factors contribute to MDRPU, including the lack of clinician awareness of the importance of repositioning, offloading, rotating devices or correctly fitting or securing them</th>
<th>Strength of Evidence=A Strong positive Recommendation</th>
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</thead>
<tbody>
<tr>
<td>Coyer, F. M., Stotts, N. A., &amp; Blackman, V. S. (2014). A prospective window into medical device-related pressure ulcers in intensive care. International wound journal, 11(6), 656–664. <a href="https://doi.org/10.1111/iwj.12026">https://doi.org/10.1111/iwj.12026</a></td>
<td>To determine the prevalence, severity, location, treatment, and healing of MDRPU in ICU patients up to 7 days.</td>
<td>A prospective, descriptive study</td>
<td>Screening form and MDRPU data collection form that includes the device causing the ulcer, when the device was inserted, ulcer size, and tissue type</td>
<td>Fifteen of 483 patients had a MDRPU and 9 of 15 with 11 ulcers were followed beyond screening. Repositioning was the most frequent treatment</td>
<td>Systemic assessment and repositioning of devices are the mainstays of care. Authors recommend nurses continue to use strategies to prevent MDRPU</td>
<td>Strength of Evidence=C Strong positive Recommendation</td>
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### Nursing Training on MDRPUs

<table>
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<tr>
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<th>Methodology</th>
<th>Findings</th>
<th>Recommendation</th>
<th>Strength of Evidence</th>
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<tr>
<td>Karadag, A., &amp; Hanonu, S. (2017). A Prospective, Descriptive study to assess nursing staff Perceptions of and Interventions to Prevent Medical Device-related Pressure Injury. <em>Ostomy Wound Management and change</em>. 63(10):34-41. <a href="https://doi.org/10.25270/owm.2017.10.344">https://doi.org/10.25270/owm.2017.10.344</a></td>
<td>To determine nursing perceptions about and interventions for MDRPU</td>
<td>A prospective, descriptive study</td>
<td>The most common interventions used by nurses included ensuring correct device positioning and loosening devices</td>
<td>Suggest nurses may not be aware of the risk for MDRPU, indicating training programs and research is needed</td>
<td>A</td>
</tr>
<tr>
<td>Kim, J. Y., &amp; Lee, Y. J. (2019). Medical device-related pressure ulcer (MDRPU) in Acute Care hospitals and its Perceived Importance and Prevention Performance by clinical nurses. <em>International Wound Journal</em>, 16, 51-61. <a href="https://doi.org/10.1111/iwj.13023">https://doi.org/10.1111/iwj.13023</a></td>
<td>To determine clinical nurses’ perceived importance and performance towards MDRPU prevention</td>
<td>Secondary data analysis</td>
<td>Perceived importance (3.56 ± 0.48) was higher than prevention performance (3.13 + 0.90) among nurses</td>
<td>Education and participation in MDRPU prevention training was found to enhance prevention performance</td>
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### Padding

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<th>Findings</th>
<th>Recommendation</th>
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<tr>
<td>Moore, Z. E., &amp; Webster, J. (2018). Dressings and topical agents for preventing pressure ulcers. <em>The Cochrane database of systematic reviews</em>, 12(12), CD009362. <a href="https://doi.org/10.1002/14651858">https://doi.org/10.1002/14651858</a></td>
<td>To evaluate the effects of dressings and on pressure ulcer prevention</td>
<td>Randomized controlled trials</td>
<td>Silicone dressings may reduce pressure ulcer incidence (RR 0.25, 95% CI 0.16 to 0.41)</td>
<td>Most of the trials exploring the impact of topical applications showed no benefit or harm.</td>
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<td>Study</td>
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<td>Tyrer, J. (2020). Evaluating Dermisplus® Prevent for the avoidance of development of medical device-related pressure ulcers. <em>Wounds UK, 16</em>(1), 100–105.</td>
<td>To evaluate whether Dermisplus prevent maintains skin integrity for MDRPU</td>
<td>Descriptive Analysis</td>
<td>20 staff members reported that the product performed better than other products for preventing MDRPUs.</td>
<td>Dermisplus Prevent is effective and cost-effective in preventing MDRPUs</td>
<td>Strength of Evidence=C Weak positive Recommendation</td>
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<td>National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers: Clinical Practice Guideline. Emily Haesler (Ed.). Cambridge Media:</td>
<td>To provide education and information about MDRPUs prevention</td>
<td>Descriptive Analysis</td>
<td>Recommendations is based on expert discretion</td>
<td>Ill-fitting can contribute to increase pressure at the device-skin interface</td>
<td>Strength of Evidence =C Strong positive Recommendation</td>
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Osborne Park, Western Australia; 2014

<p>| | | | | | | |</p>
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