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Incentive Spirometer Use in Trauma Patients 65 Years and Older with Rib Fractures/Chest Trauma

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Incentive Spirometer Use in Trauma Patients 65 Years and Older with Rib Fractures/Chest Trauma

by

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Abstract

Geriatric patients 65 years old and older admitted to the medical surgical trauma unit with rib fractures had increased readmission rates to the trauma ICU, due to respiratory insufficiency within the last 12 months. This DNP project followed all patients admitted to the trauma service of a Level I trauma hospital with rib fractures/blunt chest trauma during the months of February 2-April 30, 2022. The focus was on the nurse-driven protocol, which included providing incentive spirometer education to the trauma patient for aggressive pulmonary hygiene and documenting patients' achievements and goals into the medical record. Registered nurses (RN) were asked to document on even hours or at least every 2 hours and nursing assistants (NA) to document on odd hours or at least every 2 hours in the patient medical record. The results indicated that out of 250 patients, RNs documented IS use on 24 patients and NAs documented on 14 patients. There was no change in the rate of newly acquired pneumonia during the months of the project intervention compared to previous data.

Keywords: rib fractures, blunt chest trauma, incentive spirometer, pulmonary toileting, traumatic injuries, geriatric trauma, and respiratory complications

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Problem Recognition

Within the past 24 months, for patients 65 years and older admitted with rib fractures or blunt chest trauma to the trauma unit, 128 were re-admitted to the trauma intensive care unit (TICU) for respiratory insufficiency based on the facility's Trauma Quality Improvement Report. "Caring for critically ill patients is expensive, accounting for 13.4% of all U.S. hospital admissions" (Dasta et al., 2005, p. 1267). Intensive care unit costs are highest during the first 2 days of admission, and interventions that result in reduced intensive care unit length of stay could lead to substantial reductions in total inpatient cost (Dasta et al., 2005; Gershengorn et al., 2015). Geriatric trauma patients requiring unplanned intensive care unit admission (UIA) "have a significant increase in morbidity and mortality", suggesting strategies to prevent UIA may be beneficial (Mulvey et al., 2020, p.1).

Problem Statement

Geriatric patients, 65 years old or greater, admitted to the TICU with rib fractures, have increased by approximately 5% in readmission rates to the trauma ICU, due to respiratory insufficiency within the last 24 months based on the trauma quality improvement report.

Literature Review

This literature review includes past studies on geriatric trauma patients hospitalized for rib fractures and or blunt chest trauma. The review followed patients with surgical management of rib fractures, conventional management, economic cost of readmission rates to ICU for geriatric patients who experienced respiratory insufficiency, and this patient population disposition post-acute care.

Keywords used to search the literature included: “rib fractures”, “geriatric blunt trauma”, “incentive spirometer” (IS), and “surgical stabilization of rib fractures” (SSRF). This search was completed using the following databases: CINAHL, Google, PubMed, and JAMA with a total of 15 articles selected. The research included qualitative and quantitative studies, and randomized and controlled trials. Surgical and conventional management of respiratory complications were explored to help guide this project.

In the United States, 400,000 patients are admitted to the hospital annually due to chest trauma, with rib fracture being one of the most common injuries, accounting for 61–90% of injuries reports (Sum et al., 2019). “Multiple complications can follow rib fracture, including pneumothorax, hemothorax, lung contusion, flail chest, atelectasis, respiratory failure, and even death; atelectasis is the most common complication” (Sum et al., 2019, p. 2). In a controlled study of 50 patients divided into a study and control group, 24 patients in the study group were advised to use the incentive spirometer (IS) and 26 patients in the control group did not use IS. IS use reduced pulmonary complications, including atelectasis and hemothorax, and further interventions such as a tube thoracostomy. The benefit of using an incentive spirometer is that it forces the patient to take long deep breaths and hold them for seconds, thereby reducing breathing effort, decreasing the activity of accessory muscles, promoting diaphragmatic breathing, opening the alveoli to improve the tidal volume and basal ventilation, and consequently, encourages the cleaning out of secretions. The pulmonary function test results in patients who used an IS showed significant improvements in percentage forced vital capacity (FVC) and percentage forced expiratory volume (FEV), and “the IS device did not extend the length of hospitalization or increase the severity of chest pain” (Sum et al., 2019, p.

6). These devices are easy to use, and they have clinical benefits for patients with rib fractures without harmful effects. The limitations of this study include a focus on inpatient status only with the likelihood that patients not admitted also suffered from delayed pulmonary complications, and pulmonary function testing being completed only within 1 week of trauma (Sum et al., 2019).

A cross-sectional study, with the use of a national survey, compromised of 1,681 registered nurses (RN) and respiratory therapists (RT) was completed by Eltorai et al. (2018) to examine the perception of incentive spirometer use in clinical practice. The findings suggested the need for improved incentive spirometer use due to patient forgetfulness and ineffective/infrequent use. Eltorai et al. (2018) further stated "due to the high cost of postoperative pulmonary complications for patient, providers, and healthcare expenditures, optimizing therapeutic strategies such as incentive spirometer is important" (p. 533). Limitations related to this study were that it included only RNs and RTs from four professional societies making the sample not all-inclusive. The response rate was not known due to the manner in which the survey was distributed, and patient adherence with the incentive spirometer in this survey was determined from assessments of RNs and RTs, rather than from measurements of patients (Eltorai et al., 2018).

Butt et al. (2017) completed an exploratory study to evaluate if incentive spirometer volume and peak expiratory flow rate could predict acute respiratory failure in patients admitted with rib fractures. Criteria included patients 18 years and older with a Glasgow Coma Scale of 14, without the need for intubation within the first 48 hours of admission, and able to participate in lung function tests. Findings indicated that pulmonary expiratory flow rate was not useful in the prediction of respiratory failure in

elderly patients with fib fractures, and recommended that rib fracture management in the elderly needed further study (Butt et al., 2017).

Owen et al. (2017) conducted a literature review as an internal quality improvement initiative. Findings from the review recommended direct intensive care unit (ICU) admission for non-mechanically ventilated elderly patients with thoracic trauma (multiple rib fractures). Owen et al. (2017) "completed a retrospective review of the trauma registry at a level I trauma center for patients aged 65 years and older with blunt thoracic trauma, admitted between the 2 years before (2010-2012) and after (2013-2015) the recommendation" (p. 334). Owen et al. (2017) suggested admission of elderly individuals with clinically significant blunt thoracic trauma admitted directly to the ICU had a decrease in readmission to the ICU, complications, and ICU length of stay (LOS).

A retrospective review of the National Trauma Bank was performed for patients with blunt trauma, greater than 65 years old, and rib fractures between 2009 and 2012 (Shulzhenko et al., 2016). Data collected include controls for age, sex, injury severity score, injury mechanism, comorbidities, and number of rib fractures (Schulzhenko et al. 2016). Hospital mortality, hospital length of stay, intensive care unit length of stay, duration of mechanical ventilation, and the occurrence of pneumonia were included as outcome measures. The focus of this study was to determine if the number of rib fractures involved in trauma patients greater than 65 years old was associated with worse hospital outcomes. Patients diagnosed with five rib fractures had an increase in ICU admission, patients with seven rib fractures had an increased incidence of pneumonia and ICU duration of stay, and patients with eight rib fractures had a high risk for mechanical ventilation and mortality (Shulzhenko et al., 2016).

Vana et al. (2016) provided a summary of the current literature surrounding thoracic trauma in the elderly population and suggested admission to the hospital is necessary for most patients older than 65 years or those presenting with more than three rib fractures. For patients presenting with more than six rib fractures, intensive care unit admission is most likely needed (Vana et al., 2016). Due to the possibility of pneumonia, admission is recommended for the prevention of respiratory complications, as the elderly patient's risk of pneumonia was 31-34%, which included the risk for mortality, compared to patients less than 65 years old whose risk for pneumonia was 11-17% (Vana et al., 2016).

In a retrospective cohort study of patients at the University of California Davis Health, rib fractures were the most common injury, and geriatric patients 65 years and older with rib fractures had twice the risk of pneumonia and death as compared with patients less than 65 years old (Bowman et al., 2020). In this study, Bowman et al. (2020) sought to determine the frequency in which older adults with isolated rib fractures needed ICU-level care and identify patient and injury characteristics that may predict needing ICU-level care. Bowman et al. (2020) suggested most older adults with isolated rib fractures did not require ICU care, but patients who were 72 years old, had an increased acute injury chest score, used a walker, had an incentive spirometry volume <1000 mL were most likely to experience a critical care intervention. Limitations of this study were the sample from one hospital, being unable to characterize key information about baseline characteristics that might predict Critical Care Intervention or Event (CCIEs), why patients were admitted to an ICU, and what interventions occurred in that setting. Conversely, patients may not have been able to perform incentive spirometry in the

emergency department due to inadequate pain control or poor understanding of instructions, as evidenced by incentive spirometry volume not being recorded for 44% of patients (Bowman et al., 2020). It is possible that either the lack of incentive spirometer use or the lack of documentation thereof may explain the increased odds of a CCIE for these patients (Bowman et al., 2020). Routine evaluation of incentive spirometry usage and documentation of use, including whether a patient refused or was unable to participate, is important (Bowman et al., 2020).

Coary et al. (2020) provided an evidence-based overview of the management of rib fractures for providers treating older patients with sustained trauma. Patients 60 years or older now represent most patients presenting with major trauma to the thorax, as the second most common site of injury and is often associated with other serious injuries (Coary et al., 2020). Clinical outcomes for patients with rib fractures may be improved by the use of thoracic trauma protocols, risk assessment techniques, and rib stabilization surgery (Coary et al., 2020). Older patients with rib fractures who are admitted to the hospital typically experience higher rates of frailty, morbidity, and complications, therefore requiring healthcare systems to consider evidence-based interventions to advance care (Coary et al., 2020).

The impact of rib fractures, including mortality and pneumonia, in patients 65-year-old and older, has been well documented (Christie et al., 2019). Christie et al. (2019) analyzed the literature to identify characteristics of geriatric trauma patients and areas of management where improvement is needed. Findings showed that in 67 recorded plating cases in patients 65 years and older, there were no deaths, recurrent pneumothoraces, pleural effusions, soft tissue, hardware infections, or malfunctions (Christie et al., 2019).

There was only one patient of the 67 cases who were readmitted for pneumonia that was acquired eight months after the patient's admission for trauma, suggesting the rib plating is effective (Christie et al., 2019).

Ali-Osman et al. (2018) performed a review and analysis on 64 geriatric patients 60 years old and older to evaluate and compare pulmonary function tests before and after minimally invasive thoracotomy rib fixation. The non-operative management group was identified retrospectively by querying the trauma registry data bank and included 135 patients (Ali-Osman et al., 2018). The standard therapy for non-operative management included aggressive pain management which consisted of analgesia: intravenous, oral, or epidural, and when clinically indicated, endotracheal intubation and mechanical ventilation (Ali-Osman et al., 2018). The standardized rib fracture protocol included scheduled pain medications, nebulizer treatments, incentive spirometry, intermittent positive pressure ventilation (EZPap®), and physical and occupational therapy. Bedside pulmonary function tests were obtained pre-operatively, on postoperative day 2, and again on postoperative day 5 whenever possible. Forty-three (43) of 64 patients had a complete data set of bedside pulmonary function tests at all three-time points. In elderly patients, rib fixation improved pulmonary function tests in geriatric patients with severe rib fractures with or without a flail chest (Ali-Osman et al., 2018). These observations were consistent with the idea that a higher percentage of geriatric trauma patients with rib fractures, may benefit from rib fixation (Ali-Osman et al., 2018). The major limitations of this study included a small sample size and a retrospective study design.

Battle et al. (2013) completed a retrospective study in which the medical record was analyzed for all blunt chest wall trauma patients presenting to a large trauma center

in South Wales between 2009 and 2010. The goal was to determine the risk factors for development and complications during the recovery phase after blunt chest wall trauma using univariate and multivariable logistic regression analysis. Findings suggested risk factors for the development of complications in the recovery phase following blunt chest wall trauma were: age of 65 years old and older, with three or more rib fractures, the presence of chronic lung disease or cardiovascular disease, pre-injury anticoagulant use, and blood oxygen saturation levels of less than 90% (Battle et al., 2013). Limitations to this study include a retrospective design and a degree of selection bias as all the medical notes could not be successfully located, leading to the potential loss of important data.

Jones et al. (2011) reviewed the respective relationships between mortality and the number of fractured ribs, patient age, and severity of intra and extra thoracic injuries. A multivariate logistic regression implied the strongest influence on mortality was the severity of the intrathoracic injury, age 65 years or older, and more than five ribs fractured (Jones et al., 2011). The mortality rate for isolated rib fractures ranged from 1.8% to 3.2%, indicating these patients may benefit from a higher level of care (Jones et al., 2011). The limitations identified in this study were the lack of standardized criteria and definitions for various data fields between the various registries used by trauma centers and potentially incomplete data, which allowed for both information and selection bias (Jones et al., 2011). These findings may be used to aid clinicians in identifying which patients should be triaged to a higher level of care (Jones et al., 2011).

Barry and Thompson (2018) aimed to determine the mortality rate for geriatric patients with rib fractures/blunt chest trauma. Variables in the study included the number of rib fractures, need for mechanical ventilation, ICU length of stay, and duration of

hospital stay (Barry & Thompson, 2018). The mortality rate findings were 9.4%, with 29% of these occurring early within 24 hours, and 71% occurring late >24 hours. Factors associated with ICU admission included: base deficit, bilateral rib fractures, hemothorax, pneumothorax, hypotension in the emergency room, first rib fracture, and a Glasgow coma score of less than 15 (Barry & Thompson, 2018). The need to prospectively identify elderly patients with rib fractures should include a geriatrician in the trauma team, to identify patients at risk for acute respiratory failure as early as possible (Barry & Thompson, 2018).

To quantify the mean daily cost of intensive care, Dasta et al. (2005) identified key factors related to the increased cost of mechanical ventilation during a patient's stay per day in the intensive care unit. A retrospective cohort analysis was performed using data from NDCHealth's Hospital Patient Level Database from a total of 253 geographically diverse U.S. hospitals, which included 51,009 patients 18 years and older, admitted to an intensive care unit during the period of October 1-December 31, 2002. The results indicated that intensive care unit costs are highest during the first two days of admission but stabilize at a lower level thereafter (Dasta et al., 2005). Mechanical ventilation is associated with higher daily costs for patients receiving treatment in the intensive care unit throughout their entire intensive care unit stay. Mechanically ventilated patients were older compared with patients who were not mechanically ventilated and required mechanical ventilation for a mean duration of 5.6 days. The mean intensive care unit cost was between $31,574 and $42,570 for patients requiring mechanical ventilation, and the average length of stay was between 14.4 and15.8 days. For patients who did require mechanical ventilation, the average cost was between

$12,931 and $20,569, and the average length of stay was between 8.5 and 10.5 (Dasta et al., 2005). Dasta et al. (2005) noted costs were greatest on day 1 (mechanical ventilation, $10,794; no mechanical ventilation, $6,667), decreased in cost on day 2 (mechanical ventilation, $4,796; no mechanical ventilation, $3,496), and then became stable after day 3 (mechanical ventilation, $3,968; no mechanical ventilation, $3,184). The mean incremental cost of mechanical ventilation in intensive care unit patients was $1,522 per day (Dasta et al. 2005). Interventions focused on reducing intensive care unit length of stay and/or duration of mechanical ventilation could lead to substantial reductions in total inpatient cost (Dasta et al., 2005).

A retrospective analysis of patients who received trauma care at hospitals in a nationwide inpatient sample from 2005–2010 was conducted by Velopulos et al. (2013). A total of 2,542,551 patients were eligible for the study, and the payer status indicated 672,960 patients (26.47%) had private insurance, 1,244,817 (48.96%) had Medicare, 262,256 (10.31%) had Medicaid, 195,056 (7.67%) were self-pay, 18,506 (0.73%) were no charge, and 150,956 (5.94%) had other types of insurance (Velopulos et al., 2013). The yearly trauma inpatient cost burden was estimated at $274 million, and the adjusted national inpatient trauma yearly costs were estimated at $37 billion (Velopulos et al., 2013). Results of the study showed that the distribution of trauma burden across payers is significantly different from that of the overall healthcare system, which suggests that although the cost burden of trauma is high, the cost of self-pay or non-reimbursed inpatient services is less than of overall medical care (Velopulos et al., 2013).

This literature review indicated that geriatric patients 65 years and older with a diagnosis of rib fractures/blunt chest trauma, need specialized care to prevent respiratory

complications in the acute phase. Several treatment options were mentioned which included aggressive pulmonary toileting, pulmonary function testing, pain management, mobility, and rib fixation. Depending on the number of ribs fractured indicated level of care that will be appropriate for this patient population and the mortality risk. The review also suggested that there was insufficient literature related to incentive spirometer use which is a vital tool in patient recovery with the clinical benefit and ease of use.

Needs Assessment

PICOT Statement

- Population: Patients 65-year-old and greater admitted to the trauma service with rib fractures/blunt chest trauma unit have a high risk for pulmonary complications.
- Intervention: RN-provided incentive spirometer education with teach back to the patient and monitored patient compliance with IS use by documenting on even hours, nursing assistant documenting on odd hours in the patient's EHR indicating patient use and volume achieved.
- Comparison: All patients 65 years and older admitted to the trauma service with rib fractures/blunt chest trauma using an incentive spirometer versus not using an incentive spirometer
- Outcome: Decreased prevalence of newly acquired pneumonia.
- Time: February 1-April 30, 2022.

Sponsors & Stakeholders

This facility's mission states on its website a "promise to keep our patient safe" and strives to always uphold this. A daily safety huddle is completed at 9:00 am every

morning with the attendees being managers representing each department to report on any safety issue. Any issues are addressed and delegated to the appropriate department for a solution on the mentioned safety event. The value of the organization is consistent with the vision of the trauma department with key efforts to always keep patients safe. Stakeholders for this project included the Director of Nursing Surgical Division who ensured that each department has adequate resources and the manager of the department, who reports to the director. The trauma floor Medical Director's interest was to maintain the appropriate level of care provided by the unit providers, which includes advanced nurse practitioners and residents. The facility administrator's interest was to ensure the project is completed following the facility's guidelines. The project faculty mentor's interest was to guide the student throughout the project. The student mentor served as a resource to the student on a chosen doctoral project. Registered nurses and nursing staff's interest was to assist in the implementation of the training education related to the project.

Organizational Assessment

This facility recently completed a merger with another leading health conglomerate. This current trauma facility is considered the main campus, with several other hospitals as subsidiaries in the community. The director of the trauma department engaged a disciplinary team to address the geriatric trauma population's high morbidity performance rate in 2017. This team consisted of the project leader, the director of the trauma department, and the management of the following departments: respiratory therapist, physical and occupational, speech therapy, pharmacy, advanced practice nurse practitioner, case management, trauma nurses, and clinical nurse educator.

The target audience was geared toward nurses implementing appropriate incentive spirometer education to the inpatient geriatric population 65 years and older with rib fractures/blunt chest trauma to prevent respiratory complications and decrease rates of newly acquired pneumonia.

Figure 1

Organizational Analysis

Strength	Weakness
• Accredited Level 1 Comprehensive Trauma Center • Multidisciplinary Trauma Team	• 10% of patients 65 years and older acquired respiratory complications within the last 30 months
Opportunities	**Threats**
• Monitor nursing staff implementation of incentive spirometer device on the geriatric patients with rib fractures/blunt chest trauma to promote pulmonary hygiene	• Geriatric patients 65 years and older with rib fractures/blunt chest trauma at risk for respiratory complications. • High nurse turnover rate and 80 percent of current staff consist of new graduate nurses

Available Resources

The resources available to assist in this project were the department chair, administrator of the facility, faculty mentor, registered nurses, and ancillary staff. All patients on the unit where the project was conducted received an IS during their hospital stay.

Desired and Expected Outcomes

The literature reviewed suggested that geriatric patients greater than 65 years with rib fractures/blunt chest trauma were at high risk for pneumonia due to the severity of the

injury and the number of rib fractures. This project involved following all patients on the trauma med-surg service 65 years and older admitted with rib fractures/blunt chest trauma using an incentive spirometer versus not using an incentive spirometer. The registered nurse (RN)/nurse aide (NA) completed incentive spirometer exercise with the patient hourly and documented patient achievement with the goal of even hours for the RN and odd hours for the NA, in the patient EMR from February 1 – April 30, 2022. The expected outcome was to decrease the risk of developing pneumonia in patients 65 years and older.

Team Selection

For this project, the team selected was the DNP student as project leader, performance improvement coordinator, student mentor, chosen Doctor of Nursing Practice advance practice provider, and the manager of the trauma unit.

Cost/Benefit Analysis

Because this facility is a teaching hospital and nonprofit organization most of the materials needed for the project were accessible without cost. The facility provided education on using Redcap for survey and performance improvement classes. The staff, both RN and NAs, performed this task during their 12-hour shifts for 8 weeks, which was already part of their duties. The average cost per day for a patient admitted to the ICU with ventilation is approximately $10,794 on the first day, $4,796 on the second day, and $3,968 on the third day. Without ventilation, the first day costs approximately $6,667, the second day $3,496, and the third day $3,184. On the medical surgical unit, the average cost per day for a nonprofit organization approximates $1,878. The cost of compensation for staff intervention for 8 weeks approximated $19,320 which approximates a 3-day cost

of $19,558 for patients admitted to the ICU on ventilation and $13,347 for unventilated patients. “The estimated yearly trauma inpatient cost burden was $274,598,190 for patients who were not charged for their inpatient trauma treatment. The adjusted national inpatient trauma yearly costs were estimated at $37,511,328,659” for patients admitted to the ICU, as patients who developed hospital complications were older, had more comorbidities, and had more severe injuries (Velopulos et. al., 2013, p. 444). The most common hospital complications amongst ICU patients were pneumonia, urinary tract infection, and acute respiratory distress syndrome (ARDS).

Scope of Project

This project addressed respiratory complications in geriatric patients 65 years and older with rib fractures/blunt chest that developed pneumonia during this period with the implementation of an incentive spirometer by RNs and NAs for aggressive pulmonary hygiene in the medical surgical trauma service units, which covered a total of five Med-Surg units to include the designated trauma unit and the overflow into other units within the division. This project did not address the readmission rate to the ICU for respiratory insufficiency. Co-morbidities for patients 65 years and older were addressed in this study to indicate the patient’s risk for further respiratory complications.

Project Purpose

There is currently a problem in the trauma unit where patients 65 years and older admitted with rib fractures or blunt chest trauma have a high risk for respiratory complications**.** Sum et al. (2019) stated multiple complications can follow rib fracture, including pneumothorax, hemothorax, lung contusion, flail chest, atelectasis, respiratory failure, and even death; atelectasis is the most common complication. This project aimed

to measure the impact of nurse-driven patient education and monitored incentive spirometer use for patients 65 years and older with rib fractures/blunt chest trauma admitted to the medical surgical trauma service on the rate of newly acquired pneumonia.

In this unit, there is a specific order set provided by the trauma team consisting of attending physicians specializing in trauma care, residents, advanced practice providers, respiratory therapists, and physical, occupational, and speech therapists. For patients 65 years and older with rib fractures or blunt chest trauma, these orders implemented by the registered nurse (RN) included teaching incentive spirometer use, pain management, increasing mobility by getting patient out of bed for all meals, and ambulating twice a day as tolerated by the patient if indicated. This unit currently had a high nurse turnover rate with 80% of the staff being new graduate nurses, 15% with less than 2 years experience, and 5% with more than 10 years experience currently. The goal of this project was to determine if providing education to RNs about the adequate use and monitoring of incentive spirometer compliance for patients 65 years and older admitted to the Med-Surg Trauma Unit with an admission diagnosis of rib fractures or blunt chest trauma will decrease respiratory complications and prevent patients from acquiring pneumonia.

The project leader monitored current incentive spirometer use administered by nursing staff to patients, then implemented staff education on incentive spirometer use. Nursing staff was monitored after the educational intervention to compare the effectiveness of the education provided from February 1, 2022, to April 30, 2022, to reduce the rate of newly acquired pneumonia. Best practices related to the care of geriatric trauma patients were followed with the implementation of aggressive pulmonary

hygiene. The project leader worked closely with the nursing staff on the unit in carrying out the hourly nursing intervention by reminding the patient to use their incentive spirometer and completing the required nursing documentation. The nursing staff's cooperation with the project's intervention was important to this practice project to benefit the geriatric population with the best outcomes from a respiratory perspective.

Objectives and Mission Statement

Objectives

- All registered nurses (RN) and nursing assistants (NA) received education about proper IS use and methods to promote patient compliance within 3 weeks of project implementation.
- RN/nurse aide (NA) completed incentive spirometer exercise with the trauma patients 65 years and older hourly and documented patient achievement with the goal of even hours for the RN, and odd hours for the NA, in the electronic health record (EHR) during the months February 1 – April 30, 2022.
- Weekly audits were completed by the project leader to follow nursing interventions, patient compliance, tolerance, and goal management.
- At the end of the project, pneumonia rates were identified in patients 65 years and older admitted with rib fractures/blunt chest trauma to the trauma service during the months of February 1 – April 30, 2022, from the trauma quality improvement report (TQIP).

Mission Statement

The mission of this project was to provide the best outcome for this sensitive geriatric trauma patient population by advocating to decrease respiratory complications

and prevent pneumonia. This project was intended to ensure patient compliance using an incentive spirometer in the geriatric population 65 years and older with rib fractures or blunt chest trauma to prevent the development of complications during admission to the trauma Med-Surg unit. Bowman et al. (2020) stated rib fractures are the most common injury in patients 65 years old and have twice the risk of pneumonia and death compared with younger patients. Advocating for this sensitive population included following the current interventions in place at the facility related to pulmonary hygiene care, and barriers related to patients not completing pulmonary hygiene exercises as ordered. The trauma disciplinary team on this unit strives to maintain patient safety by following the facility's mission related to patient safety.

Theoretical Underpinnings

The theory used to guide this project was Peplau's Model of Interpersonal Relations. Jeffrey et al. (2017) state the nurse is identified as the patient's resource person, to encourage the patient's learning experiences and promote health management. Patient education is important for self-management and health maintenance. In current nursing practice, mapping the education plan will help progress the patient along the trajectory from illness to wellness with the goal to return the patient to the highest level of independence possible (Jeffrey et al., 2017).

Peplau's Model of Interpersonal Relations considers nursing as an interpersonal process between the nurse and patient, who are working toward mutually agreed-on goals (Zaccagnini & Pechacek, 2021). By applying Peplau's four sequential steps outlined in this project, orientation, the first step in which the patient's problems were identified, the nurse and patient clarified expectations and figured out how to work together to promote

a better health outcome. The second step identified exploitation, where the patient used the services offered by the nurse that the patient found useful; identification, the role of the nurse from the patient's perception; lastly, resolution, in which the patient's needs were met and the patient moved toward independence (Zaccagnini & Pechacek, 2021).

This model was incorporated into the entire project, followed each step as outlined in Peplau's interpersonal model, and assisted the patient from admission to discharge. During the orientation stage, the patient who is 65 years or older is admitted with a diagnosis of rib fractures/blunt chest trauma. The problem identified and steps taken to reduce the patient developing pneumonia as a risk factor related to the chest trauma diagnosis. The nurse and patient entered a therapeutic relationship, the nurse provided education on proper breathing techniques, with the use of an incentive spirometer to promote lung expansion and create healing. The patient and nurse further clarified the expectation of the relationship with the education provided by the nurse and return demonstration of the incentive spirometer by the patient with continued compliance towards the achievement of goals.

The third of Peplau's subsequent stages, 'identifying oneself' highlights the idea that either the patient or the nurse responds to each individual experience, but the patient and nurse should have different interpersonal tasks (D'Antonio et al., 2014). The patient should view the nurse as a medical professional (D'Antonio et al., 2014). Likewise, the nurse relates to the patient holistically and focuses on the patient's entire personality to assist with the problem (D'Antonio et al., 2014). There needs to be mutuality in the interpersonal processes (D'Antonio et al., 2014). Zaccagnini and Pechacek (2021) state in

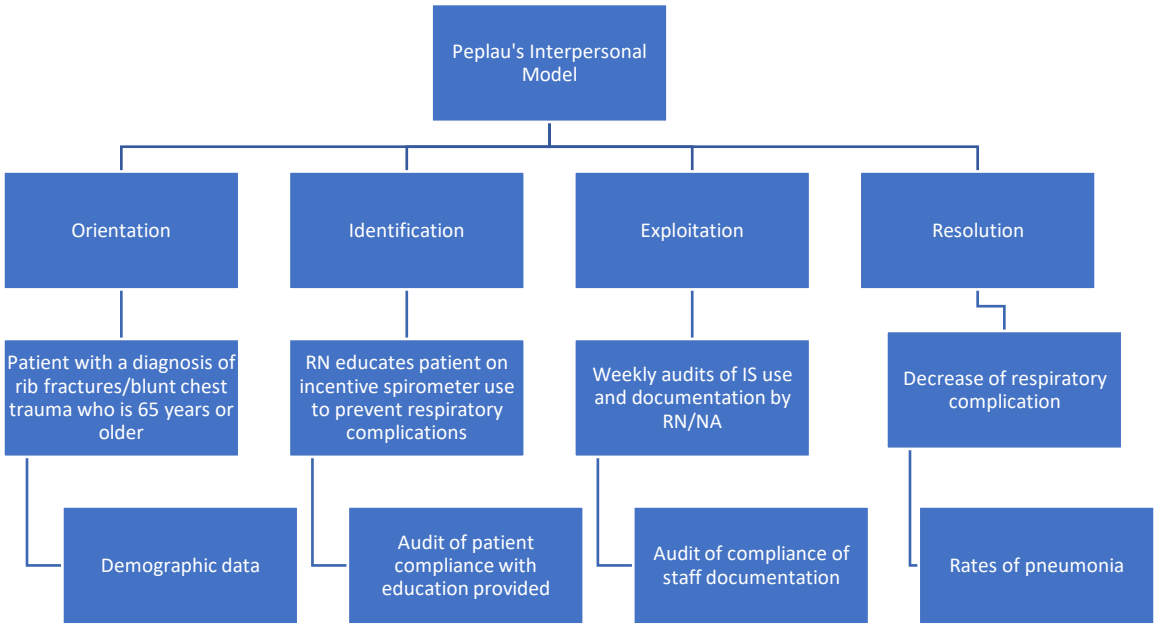
the exploitation stage the patient uses the services offered by the nurse that the patient found useful.

Using the fourth step as a resolution in Peplau's interpersonal model, Zaccagnini and Pechacek (2021) state this is when the patients' needs have been met and the patient moves towards independence. Using this model to guide this project and develop a therapeutic nurse-patient relationship can achieve a positive outcome for this patient population recovering from a traumatic diagnosis following the path from admission to discharge. This interpersonal collaboration resonates with the current reform-driven shift toward self-management of disease where individuals take responsibility for their own health (D'Antonio et al., 2014). Figure 2.

This project explored the impact of nurse-driven patient education on adverse health outcomes by monitoring current incentive spirometer use administered by RN to patients 65 years and older with rib fractures/blunt chest trauma before and after nurses received education on the appropriate use of incentive spirometers

Figure 2

Project Conceptual-Theoretical-Empirical Diagram



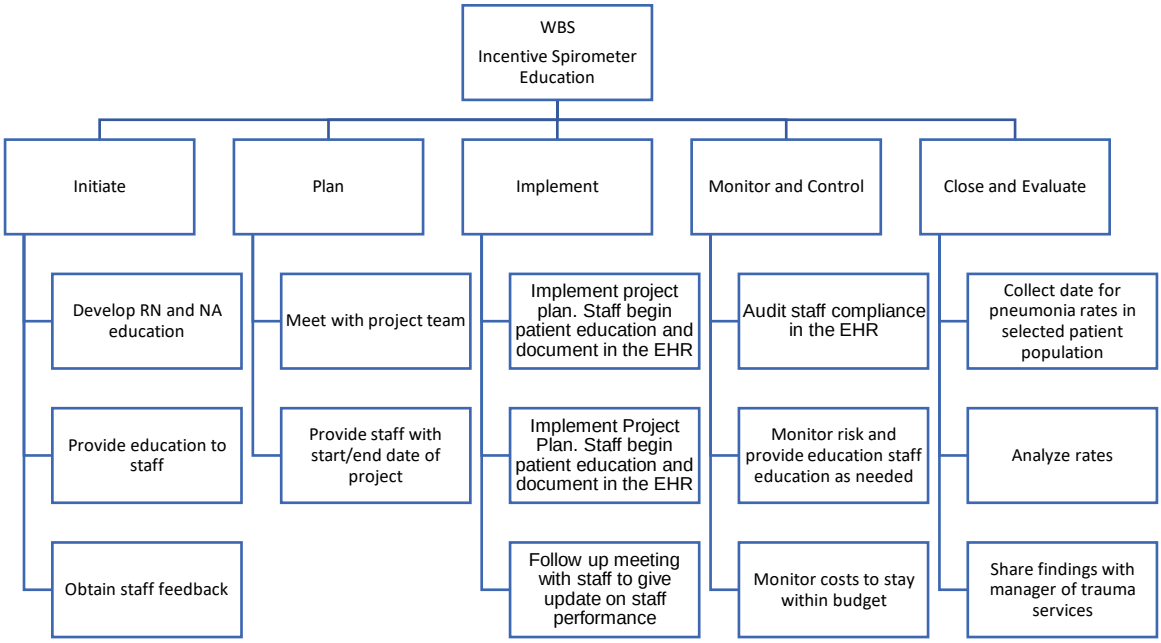
Work Planning

Project Management

The project management tool used in this project as a work breakdown structure is outlined in Figure 3. The following units which accept trauma patients within the trauma service consist of five units under the surgical division. The primary unit is the trauma medical surgical floor, and overflow patients are transferred to the burn unit, neurosurgery, orthopedic, and neurology floors.

Figure 3

Work Breakdown Structure for Project Management



Project Timeline

The timeline of the project is indicated below, including initiation dates. Figure 4.

- October 1 - October 30, 2021: complete steps 4-6 requirements to begin the IRB application.
- November 1, 2021 – January 31, 2022: complete the IRB application and submit it to the IRB committee with the intent to obtain approval from both facilities, the institution, and the facility where implementation of the project will be initiated.
- Implement staff education January 1-7, 2022. Set meeting with nursing staff on the units where trauma patients with rib fractures, 65 years and older are admitted. Begin incentive spirometer education for staff, obtain return demonstration, and acknowledge that the education plan was understood.

- Start project implementation February 1 – April 30, 2022, during this time weekly audits were completed to track staff compliance with documentation of intervention.
- Evaluate findings May 1 – 10, 2022, and notify nursing staff the study is complete. Evaluate findings to reflect the rate of patients that developed pneumonia or respiratory complications during the timeline of the study.

Figure 4

Project Timeline

Project Budget

The budget for this project implementation was $6,925, which included staff education delivery in the form of PowerPoint, handouts, and the Incentive Spirometer demonstration video cost $150.00. Each staff member completed appropriate use of the incentive spirometer education and demonstrated use with teach-back and role play. Cost for education time equals $5,200, RN $26 x 100/0.5, and $1,500, NA $15 x 50/0.5. Staff was treated with refreshments/snacks during the learning activity exercise cost of $75.00. The use of Epic for audit and staff communication through email was provided through the hospital at no additional cost. Table 1.

Table 1

Project Budget

Category	Detail	Total Cost
Direct labor cost	Incentive spirometer and staff education with return demonstrations	$6,700
	Handouts, PowerPoint presentation	$150.00
Indirect labor cost	Refreshments	$75.00
	Access to Epic for audit	$0
	Total project cost	$6,925

Planning of Evaluation

Evaluation Plan

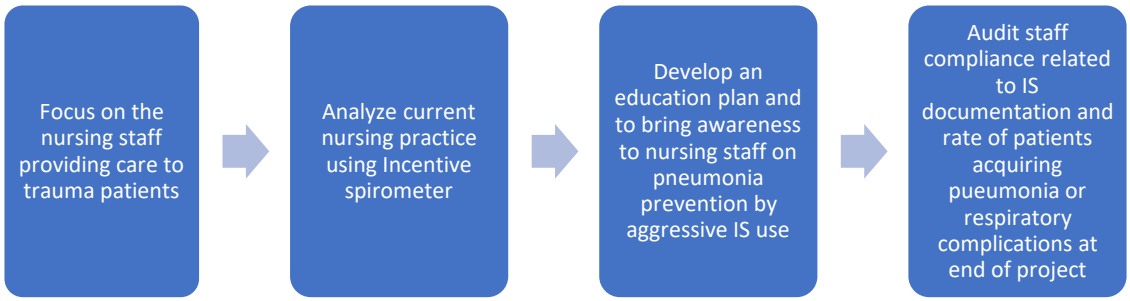
The FADE quality improvement model (focus, analyze, develop, execute) is more appropriate for acute care (Zaccagnini & Pechacek, 2021). This quality improvement project was implemented to assess the knowledge of the nursing staff on incentive spirometer use while providing care to patients 65 years and older admitted under the trauma service with rib fractures / blunt chest trauma in the acute stage of the injury to prevent pneumonia. Figure 5.

- Focus – on the nursing staff providing care for trauma patients under the trauma service to collect the data.
- Analyze – current nursing staff incentive spirometer administration by auditing nursing documentation in the patient EHR.

- Develop – an education plan on the proper use of incentive spirometer to nursing staff with an awareness of pneumonia prevention and aggressive pulmonary toileting by completing IS exercise hourly with the patient and documenting in the patient EHR. The RN will complete on even hours, NA on odd hours.
- Execute – final step will involve auditing EHR at the end of the project after 3 months of initiation to assess nursing compliance with documentation of IS education provided to the patient, and the rate of patients acquiring pneumonia/respiratory complications.

Figure 5

Project FADE Model



After completion of the IRB process, with approval from both the university and facility, the implementation process of this project was initiated on February 2, 2022, for patients 65 years and older admitted to the trauma service. These patients were bedded in the trauma, neurosurgery, orthopedic, and burn units, which are part of the surgical division. Registered nurses (RN) and nursing assistants (NA) were provided incentive spirometry (IS) education and asked to have all trauma patients 65 years and older demonstrate the use of IS. RNs were instructed to document in the patient's medical record on even hours or at least 4 times during their 12-hour shift. NAs were asked to

document on odd hours, or at least 4 times during their 12-hour shift in the patient medical record.

Implementation

Threats and Barriers

Due to the shortage of beds, some patients were admitted to the cardiology and medicine division, and nursing staff within this division were not provided incentive spirometer education during the period January to April 2022. Nursing staff provided care for patients during a pandemic related to the COVID-19 virus with high acuity patient needs, along with the national nursing shortage. "Around the world, nurses are working under enormous pressure providing care to sick and dying patients during the pandemic, and many are faced with increased stress, and other negative effects on their mental health" (Turale & Nantsupavat, 2021, p. 12). Although there was a global shortage of nurses before the pandemic, it was likely exacerbated by the increased demands of caring during COVID-19, in addition to the usual care of non-COVID patients (Turale & Nantsupavat, 2021). Many of these worldwide challenges posed similar threats to the success of this project in the facility.

Monitoring of Implementation

The DNP student provided IS education to the nursing staff within the surgical division from February 2 – 5, 2022, and both RNs and NAs received the education. Weekly audits were completed in the patient medical record to monitor RN and NA compliance with documentation of IS used on the trauma patients and then entered on the audit spreadsheet. At the end of each week, the staff was reminded to complete daily documentation. During implementation, the DNP student rounded frequently to answer

any questions staff had and send emails to update staff on the progress of the audits. During weekly audits, it was noted that some patients were transferred back to a higher level of care and three patients expired during the last month of this project.

Project Closure

Audits related to this project were completed on April 30, 2022. At this time, rounding occurred once more on each of the units that participated in the project to thank the staff for their participation and to let them know that the audit was complete. Staff was also given a "thank you" pen as a token of appreciation for their input towards this project. The manager of the unit was notified of the project closure and requested a copy of the results. The facility's IRB department chair sent emails monthly to follow the progress of the project and at the end of the implementation process, a survey was sent for this DNP student to complete related to the status of the project. The director of the trauma division expressed gratitude that this was a worthwhile and much-needed implementation and asked for a copy of the results.

Interpretation of Data

Process Improvement Data

Nursing staff comprising of registered nurses (RN) were asked to document in the patient's medical record on even hours or at least 4 times during their 12-hour shift, and nursing assistants (NA) were asked to document incentive spirometer (IS) use on odd hours, or at least 4 times during their 12-hour shift on patients 65 years and older admitted to the trauma service with traumatic injuries. The focus was to identify that patients were using IS per facilities policy during the project implementation from February 2, 2022 – April 30, 2022.

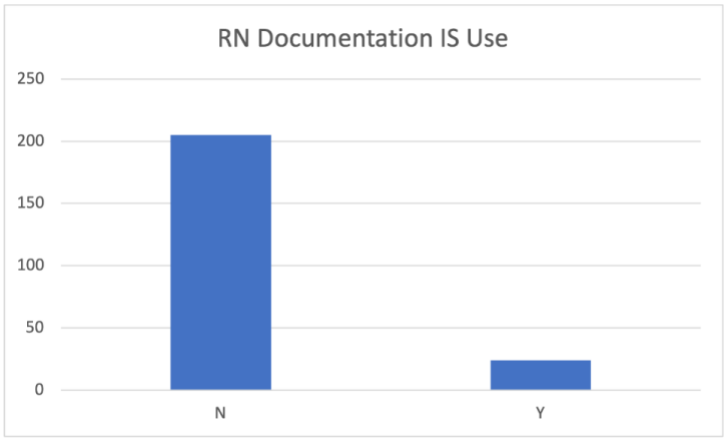
The units that participated in this project were the neurosurgery, orthopedic, burn, and trauma units, which are part of the surgical division. During the first week after the implementation of the study, an audit showed the trauma nursing staff documented patient IS use on daily assessment at the beginning of the shift. Respiratory therapists documented daily in these patients' charts, the patient's goals and achievements. On the neurosurgery unit, there was no documentation of IS use in the medical record. There were no patients admitted to the burn unit for the first week. Nursing staff on the orthopedic unit documented patient goals and achievements once per shift. Staff was coached on the second and remaining weeks of implementation as a reminder to document even hours for nurses and odd hours for nursing assistants in the patient medical record.

There was no change in the rate of newly acquired pneumonia during the months of February – April 2022 compared to previous data. It is possible that patients did not complete IS exercises leading to similar rates, based on documentation reflecting lack of use. Follow-up will include a reminder that the facility's IS policy created for these patients is followed by nursing staff, and to identify any barriers which may prevent nursing staff from getting this task completed.

The impact of this project indicated that patients may not be using the IS as often as the policy indicates. A spreadsheet was created to complete the audit with columns to indicate the date, RN documentation of patient use, NA documentation of patient use, total yes, total no, and staff compliance. The results were calculated in Excel, shown in a bar graph below, and indicated that out of 250 patients, RNs documented IS used on 24 patients and NAs documented on 14 patients from February 2 – April 30, 2022. Figure 6.

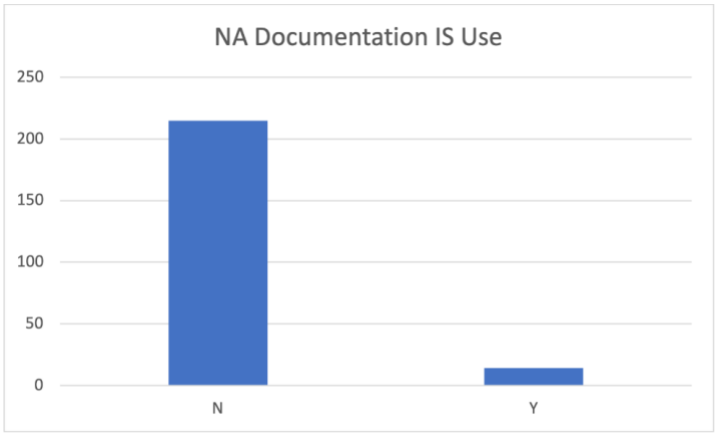
Figure 6

Results of RN and NA Documentation of IS Use



N=226

Y=24



N=236

Y=14

During coaching sessions staff was asked if any barriers were preventing them from completing required documentation after patient IS exercises, the responses were that patient acuity was high and it was difficult to remember to document in the medical record. On the trauma unit new graduate nurses comprised approximately 70% of the staff, which could explain a further need for education and support during the transition to practice.

Sustainment of the Project

This project will be sustained by sharing the results with the manager and nurse educator to further educate staff on the importance of nursing compliance related to IS use and documentation in the patient medical record per the facility's policy. Additional plans could include surveying the staff to determine perceptions of IS, sharing the results from their participation in the study, and providing further coaching sessions to staff frequently.

Based on the results of the audit on documentation of IS use, it was noted that staff did not complete documentation in the patient medical record as outlined in the facility's policy. Identification of barriers preventing staff from completing required documentation should be addressed. Conversely, there is the possibility that the staff did complete the IS education for the patient but did not follow through with documentation. Further education to staff on the units that did not complete any documentation per the audit should be completed. Due to the unavailability of beds in the surgical division, patients were admitted to the cardiology and medicine division where staff did not receive IS education, which is an area of follow-up as the project is sustained.

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