Incentive spirometry has been used to help prevent pulmonary complications after surgery, although its therapeutic efficacy remains in dispute (Freitas, Soares, Cardoso, & Atallah, 2008; Haeffener, Ferreira, Barreto, Arena, & Dall’Ago, 2008). At the author’s urban tertiary care hospital, incentive spirometry is part of the postoperative respiratory care protocol for most surgical patients hospitalized longer than 24 hours. The author of this small clinical trial found no evidence of any benefit from incentive spirometry in reducing pulmonary complications in adults undergoing coronary artery bypass graft (CABG). In this study of patients undergoing CABG, the success of the use of an incentive spirometer for reinforcing a breathing pattern that prevents or reverses breathing complications and improves lung function was measured. The author suggested the results should be interpreted cautiously, as there were limitations related to methodology and reporting.

An extensive literature search (2001-2008) found no references for the use of an incentive spirometer for patients admitted with medical diagnoses. No other studies to date have assessed incentive spirometry use among hospitalized general medical patients, with most reports targeting specific surgical populations to evaluate the efficacy of incentive spirometry in preventing pulmonary complications. Over the past few decades, conflicting results have been reported regarding the therapeutic usefulness of incentive spirometry in the perioperative period. Recent studies reported benefits for patients following major abdominal surgery (Westwood et al., 2007) and CABG (Haeffener et al., 2008), whereas others found no conclusive evidence that incentive spirometry prevents pulmonary complications following either thoracic surgery (Agostini, Calvert, Subramanian, & Naidu, 2008) or CABG (Freitas et al., 2008). Incentive spirometry has been reported to benefit patients with pulmonary disease after elective cardiopulmonary or non-cardiopulmonary surgery (Bapoje, Whitaker, Schulz, Chu, & Albert, 2007).

When patients are admitted to the hospital for exacerbation of a medical condition, they may spend a great deal of time in a supine position with a reduction of their routine daily activities. The result of this activity reduction may be respiratory distress, often requiring transfer to the intensive care unit. For medical patients, nurses follow the dictum that good respiratory function and oral hygiene are essential for preventing pneumonia and other respiratory complications. These are basic foundations of nursing care.

Any patient developing respiratory distress prompts immediate mobilization of the institution’s rapid response team (RRT) and, in most cases, subsequent transfer of the patient to the intensive care unit (ICU) for monitoring and stabilization. In spring 2007, members of the RRT noted the medical general practice unit (GPU) had been showing a steady increase in the number of patients being transferred to the ICU because of respiratory problems. To address this issue, a nursing team designed a respiratory care bundle utilizing incentive spirometry to determine if respiratory complications could be avoided or reduced among medical patients.

**Respiratory Bundle**

The Institute for Healthcare Improvement provided an evidence-based resource for eliminating ventilator-associated pneumonia (VAP) in critical care settings (Westley et al., 2008). Joanne Lamar, MSN, MSBA, RN, was Nurse Manager, Medical General Practice Unit, Henry Ford Hospital, Detroit, MI, at the time this article was written.

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The intensive care units at the author’s hospital adopted a successful VAP bundle. Coordinating with their colleagues from the medical intensive care unit (MICU), they developed a second bundle for use on a medical GPU. It incorporated the interventions used on the MICU, but adapted to patients who did not require assisted ventilation. The MICU VAP bundle included elevation of the head of bed and oral care routines.

The GPU staff nurses designed the respiratory bundle to include all patients on the medical GPU, with two regimens developed to distinguish between cognitively and physically independent versus dependent patients. Independent patients received an incentive spirometer (Voldyne® 5000 Volumetric Exerciser, Hudson RCI [Research Triangle Park, NC]) and an oral care packet of toothbrush and toothpaste. Nurses taught the patients how to use the spirometer based on the instructions in the package insert. Nurses prompted patients to use the spirometer 10 times every 2 hours and to brush their teeth twice daily. For dependent patients, the head of the bed was elevated 30°-45°. In addition, nursing staff repositioned dependent patients every 2 hours and administered mouth care using an oral care packet (Toothette® Oral Care, Sage [Cary, IL]) once every shift. The respiratory bundle for independent and dependent patients was followed from admittance through discharge from the medical GPU. Audit sheets attached to room doors were used to document adherence to each patient’s regimen.

**Study Design**

The hospital’s institutional review board approved the study, with initiation of the respiratory bundle on the 31-bed medical GPU in December 2007. Three time points were established for data collection: the 6-month period before initiation of the respiratory bundle, and 6 and 12 months after implementation. Nurses compared the number patient transfers to the ICU due to respiratory reasons across the three time points. They also compared RRT calls for respiratory problems at the same time points for the medical GPU and a control GPU, a 30-bed medical unit that admits patients of similar ages and diagnoses. The control GPU followed the institution’s daily oral care policy, consisting of toothbrush and toothpaste provided to independent patients and the Toothette Oral Care packet administered to dependent patients once daily. Nurse staffing was similar in the study and control GPUs, and each followed the same RRT call process.

**Results**

In the 6-month period before implementation of the respiratory bundle, the study GPU transferred 33 patients to the ICU because of respiratory problems compared to 15 patient transfers in the first 6 months of the intervention period and 5 patient transfers during an additional 6 months of intervention. RRT calls for respiratory reasons decreased by 13% during the 12-month intervention period in the study GPU, while calls in the control GPU increased by 10% over the same period (see Figure 1).

Statistical analysis involved computation of chi-square for total RRT calls for respiratory reasons based on total patient admissions for each of the two GPUs during the 12-month intervention period. A statistically significant reduction in RRT calls occurred for the study GPU ($p<0.001$). Of the study GPU patients, 74% were classified as independent utilizing incentive spirometry. Statistics were equated by comparing the two units on RRT calls per 100 patients on each unit.

**Discussion**

The respiratory bundle utilizing nurse-prompted incentive spirometry for independent patients and nurse-administered oral care, head-of-bed elevation, and body repositioning for dependent patients led to decreased respiratory distress throughout the 12-month intervention period. The control GPU showed no significant change in patients’ respiratory distress requiring ICU transfers.

Investigators generally agree that different types of spirometers, and correct versus incorrect use of spirometers, may produce different results. Tomich and colleagues (2007) studied breathing patterns at baseline and after respiratory exercises in healthy young adult subjects, comparing diaphragmatic breathing exercises with two types of incentive
spirometers. They found diaphragmatic breathing and the volume-oriented incentive spirometer (Voldyne) exercises showed similar beneficial results over the flow-oriented incentive spirometer (Triflo™ II).

While a Voldyne model was used in the study GPU patients, the use of incentive spirometry alone cannot be the definitive intervention as the respiratory bundle included other care measures. However, the majority of patients (74%) in the study GPU were independent patients utilizing incentive spirometry alone. Only the patients who could not use an incentive spirometer were turned and provided with daily oral care.

What began as a nursing team idea to address the problem of rising ICU transfers because of respiratory distress in a general medical patient population led to several benefits not expected initially. The only goal in the development of this project was the reduction in ICU transfers due to respiratory compromise, so the focus from a nursing perspective was safety. Only after all data were collected and reviewed, demonstrating marked reductions in ICU transfers, did cost savings emerge as an outcome. Ongoing data measures suggested specific care steps can contribute to a beneficial impact on patient welfare as well as the cost of care.

In addition, wound care specialists noticed this was the only unit with a significant decline in the incidence of pressure ulcers. This serendipitous effect was attributed to the respiratory care protocol and the devotion to timely, regular patient turning. The respiratory care protocol not only reduced patients’ respiratory distress but also led to an observed decrease in pressure ulcers and overall significant cost savings.

The variable costs were examined for ICU transfers from the GPU for respiratory complications before and after initiation of the respiratory protocol. Savings to the facility by not transferring patients to the ICU exceeded $271,000 over 12 months. In addition, consistent turning included in the respiratory bundle appeared to contribute to the decrease in hospital-acquired pressure ulcers. The decrease in pressure ulcers among patients in the GPU over the past year (see Figure 2) was associated with an additional, conservative cost savings of approximately $250,000.

**Nursing Implications**

When this project began, it was based only on anecdotal observation that GPU staff were transferring many patients with worsening symptoms to the ICU. The GPU staff did not start with data but learned to study the evidence that came from both creativity and critical thinking. Turning patients and ensuring good oral care are nursing standards. Reminding patients to use an incentive spirometer is customary on surgical units. No new or highly technical nursing strategies were used. Knowledge and nursing interventions led to creation of a bundle that successfully reduced transfers to the ICU.

The nursing staff found the easiest and most basic nursing interventions sometimes have the most impact on patient safety. Reminding medical patients to use their incentive spirometers hourly is integrated into daily care and requires very little additional time. Turning cognitively impaired patients and providing them with good oral hygiene is also basic nursing care. In addition to a reduction in transfers to the ICU, the GPU experienced a continued reduction in the incidence of pressure ulcers as a result of the focus on consistently turning patients. Focusing purposefully on these interventions resulted in fewer complications for many patients and a cost savings to the hospital. It also helped staff become even more engaged in collegiality and sustained improvement in care delivery.

**Conclusion**

The initial goal of reducing transfers to the ICU subsequently was disseminated to all general practice units as part of the hourly rounding routine. GPU nursing staff achieved the satisfaction of contributing to improved patient care by embracing new ideas. Such small changes can create substantial impact on patient care.

**REFERENCES**


ADDITIONAL READINGS
