Fluid balance measurement (FBM) is a routine intervention in oncology, but accuracy and compliance issues have been documented. This article describes how a medical oncology nursing clinical practice committee used the Iowa Model for Evidence-Based Practice to establish a policy for FBM. Nursing and medical education was performed with emphasis on oncology-specific defaults in a computerized provider order entry system reflecting the new FBM policy. At two months of implementation, the policy effectively demonstrated improved staff compliance and satisfaction, as well as appropriate orders for patients requiring stricter FBM.

Intake and output measures are used commonly for evaluating fluid balance and have been standard practice for nurses in all settings. However, issues regarding the accuracy of intake and output measures and staff compliance in performing and documenting intake and output presented opportunities for establishing an evidence-based policy for fluid balance measurements (FBM) that may benefit medical care and staff satisfaction. Therefore, the Iowa Model for Evidence-Based Practice (Titler et al., 2001) guided a unit-based clinical practice committee to recommend a policy for FBM to nursing and medical leadership.

**Model for Change**

The setting included two 31-bed medical oncology units in a large, academic, National Comprehensive Cancer Network-designated comprehensive cancer center. The hematology-oncology unit admits patients with hematologic disorders for chemotherapy induction and consolidation, accounting for more than 90% of admissions, whereas the medical oncology unit admits patients with solid tumor malignancies primarily for symptom management or palliative care, with 40% of patients admitted for chemotherapy or brachytherapy. The average length of stay for the hematology-oncology unit is 8.3 days (induction 30 days; consolidation 5 days), whereas the average stay for the medical oncology unit is 4.4 days. The units’ combined staff includes 101 full-time RNs and 25 nursing care assistants; 70% of RNs have more than two years of experience and 45% are oncology certified nurses.

The Iowa Model for Evidence-Based Practice (Titler et al., 2001) prompts staff in critical evaluation of problem or knowledge-focused triggers. The process-improvement trigger of persistently poor compliance with intake and output documentation led the medical oncology clinical practice committee to begin a systematic examination. First, barriers to intake and output documentation were identified from a representative sample of nurses through structured interviews. Inconsistencies in practice, variability in reports from patients, and appropriateness of orders were principal categories.

Nurses often use estimations of intake and output, such as in the case of a patient spilling their drink or accidentally forgetting to void in the collection device. Meal trays may be removed from patients’ rooms before measurement and documentation occurs. In addition, patients often do not report their intake and output. Because patients and families are encouraged to create a home environment within the walls of the hospital, they often inaccurately report intake and output. In a chart audit, 88% of patient records did not have intake and output documented throughout the shift. Nursing staff question the medical necessity of intake and output orders in select patient populations. For example, medical teaching services with first-year physicians may order intake and output because of habit or computerized physician order entry prompts without considering patient medical necessity or reviewing more relevant measurements such as serum creatinine and other biomarkers.
body weight. The exemplars highlight the impact of this routine intervention in clinical practice.

**Literature Review**

Three computerized databases were used for the literature search: PubMed, MEDLINE®, and CINAHL®. The terms *intake and output, fluid measurement, fluid balance, weights, patient indicators, chemotherapy, cancer patients, and oncology* were searched in articles from 2000–2010. No oncology-specific articles were found; therefore, the term *general medicine* was added to the search. Because the literature regarding the topic was sparse, articles from 1995–2010 were included. The search yielded 10 articles, with only four research articles addressing nursing practice and a relevant patient population.

The studies involved qualitative (Kalisch, 2006), quantitative (Mank, Semin-Goossens, Lelie, Bakker, & Vos, 2003; Wise, Mersch, Racioppi, Crosier, & Thompson, 2000), or mixed methods (Daffurn et al., 1994), with only one study involving patients with cancer as the primary sample (Mank et al., 2003). Structured interviews and observations of nursing practices (n = 105) for intake and output measurements and weights (Kalisch, 2006) or surveys (n = 143) on nursing perceptions of fluid balance records (Daffurn et al., 1994) produced similarities in identified barriers. The barriers included failure to record fluids on a tray prior to removal or dumping of output (Kalisch, 2006); inaccuracies in recording fluid spills, wet beds, or melting foods (Daffurn et al., 1994; Kalisch, 2006); and failure or inaccuracies in measuring insensible loss or other body fluids (e.g., emesis) (Daffurn et al., 1994; Kalisch, 2006). Wise et al. (2000) observed similar obstacles that created inaccuracies for performing intake and output. In addition, failure to have appropriate measuring containers available was observed as an issue for intake and output measurements (Wise et al., 2000).

Twenty-four-hour intake and output consistently underestimated fluid change \( r = 0.28 \) (Mank et al., 2003) when compared to daily weights \( r = 0.29 \) (Wise et al., 2000). Error between measurements varied up to 36% among individual patients (Wise et al., 2000). However, intake and output were overestimated and factored into nurse-cited barriers in this sample. In a subsample of nurses \( n = 45 \), Daffurn et al. (1994) found that intake and output measurement of simulated fluid samples were slightly overestimated, with significant overestimations noted for output volumes involving wet beds or IV fluid leaks \( p \leq 0.05 \).

The studies demonstrate several key components in performing intake and output and are representative of the anecdotal feedback and practice observations of staff members involved in establishing the FBM policy. The studies illustrate insufficient evidence to support standard use of intake and output, but support obtaining daily weights for patients with fluid retention issues or those receiving chemotherapy (Daffurn et al., 1994; Kalisch, 2006; Mank et al., 2003; Wise et al., 2000).

**Process of Change**

After a thorough critique of the literature and review of relevancies to the nursing units, a plan of change was set involving the development of the FBM policy. Intake and output ordered per unit standard was defined by the following.

- *Nursing assessment of appetite is documented every shift.*
- *Daily weights are performed and documented per physician order if the doctor determines monitoring of dehydration, fluid retention, or dehydration is necessary.*
- *Additional assessment or documentation of measurement of patient intake and output and fluid balance is specified per physician order.*

At-risk conditions and treatments were identified, including patients receiving total parenteral nutrition or specific chemotherapies such as cisplatinum, patients requiring stringent postprocedure or surgical monitoring, and patients with preexisting risk factors affecting fluid retention (Daffurn et al., 1994; Mank et al., 2003; Wise et al., 2000). The recommendations were reviewed by the unit medical directors and nursing leadership for approval on the medical oncology unit. Medical and nursing leadership agreed the recommendation was substantial with practice implications for improvement on both oncology units.

Following approval, the unit clinical practice committee met with an information technology nursing representative to create the computerized physician order entry set for the FBM standard. Several features of the order set included continued use of the term “intake and output orders” for ease of provider identification. As a safeguard, the order defaults to the FBM standard of measuring patient nutritional intake and necessitates the provider to change the order intentionally when requiring a more strict FBM of intake and output or weights. In addition, providers must enter a comment on the medical necessity regarding an order change (e.g., renal failure, ascites).

With the computerized physician order entry set developed, the policy and order set were reviewed and approved by the oncology clinical practice committee and the director of the division.
of oncology. Nursing staff education was provided during annual mandatory competency validation. Medical education was established by oncology leadership and reviewed monthly in oncology intern orientation, and an educational poster in the unit workroom was displayed with full explanations of FBM orders. The change in practice occurred the following week after medical education completion in September 2010.

**Measures of Success**

Unit admissions vary substantially, with the hematology-oncology unit averaging 78 admissions per month and the medical oncology unit averaging 148 admissions per month. Monthly admissions before and after policy implementation were not significantly different for all admissions. Figure 1 shows the decline in actual number of intake and output orders and weight orders for both units. A subset analysis revealed a decrease from 49% to 21% for all admissions in the hematology-oncology unit and a decrease from 77% to 25% in the medical oncology unit. Audits after implementation on both units indicated that intake and output was ordered appropriately for patients meeting at-risk conditions. No cases have been identified where intake and output or other FBM beyond patient nutritional assessment should have been ordered. Weights were ordered with 100% compliance for patients receiving chemotherapy, total parenteral nutrition, or dialysis for renal conditions. Documentation compliance increased from an average of 15% before implementation to more than 90% for both units; the greatest improvement was observed in the medical oncology unit (see Figure 2).

**Implications for Practice**

Standard use of intake and output for the hematology-oncology and medical oncology nursing units often was ordered inappropriately for patients not requiring FBM. In many situations, daily weights also were obtained for chemotherapy administration, total parenteral nutrition, or hemodialysis monitoring. Nursing staff identified that intake and output measures are useful and necessary for at-risk populations; the perception is consistent with prior studies of medical nursing units (Daffurn et al., 1994; Wise et al., 2000). Implementation of the FBM policy substantially reduced the amount of intake and output orders for both units while also improving documentation compliance. Medical and nursing staff members have not reported compromises to patient care, and they have been satisfied with the FBM policy.

The Iowa Model for Evidence-Based Practice guided the plan for practice change. By evaluating the problem and analyzing the literature, the authors developed and implemented an evidence-based FBM policy. Outcome data support successful change in practice without medical compromise, as well as improved staff compliance and satisfaction.

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