

The Nightingale Metrics

Nurses at one institution improved outcomes by putting patients 'in the best condition for nature to act.'

Overview: Staff nurses at Children's Hospital Boston worked together to identify what was important to the patients and families they cared for, measured how often nurses performed these interventions, and used the data to improve the care they provide. This initiative, the Nightingale Metric Project, can serve as a model for ongoing measurement and improvement of nursing care in all settings.

This is a time of heightened national scrutiny on patient safety. Consequently, many hospitals are attempting to measure the quality and efficiency of care provided, and nurses are a part of this effort. Studies linking nursing care to patient outcomes have been well publicized,¹ giving nurses and the public an opportunity to consider the ways in which nursing influences patients and what patients can expect of nurses.

Fundamentally, nurses provide care in an environment that sustains a patient's and a family's capacity to heal. Florence Nightingale said as much: "what nursing has to do . . . is to put the patient in the best condition for nature to act upon him."² But because so much of nursing involves preventive care, researchers should address not only the visible but also the invisible aspects of nursing when measuring outcomes. For example, invisible are the large numbers of patients at risk for pressure ulcers who never develop them because of good nursing care; much more visible are the fewer patients who do develop pressure ulcers.

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Today, most standardized "nursing-sensitive" outcome indicators concentrate on adult care,³ and those that examine outcomes in children usually are too general to be meaningful for subspecialties in pediatrics. It's a common quandary—the measures are either too general to be meaningful or too specific to be generalized. For example, "patient fall rate" is too general

a measure to provide meaningful data for the neonatal ICU; comparably, "endotracheal tube self-extubation rate" is too specific a measure to be of use outside of the ICU.

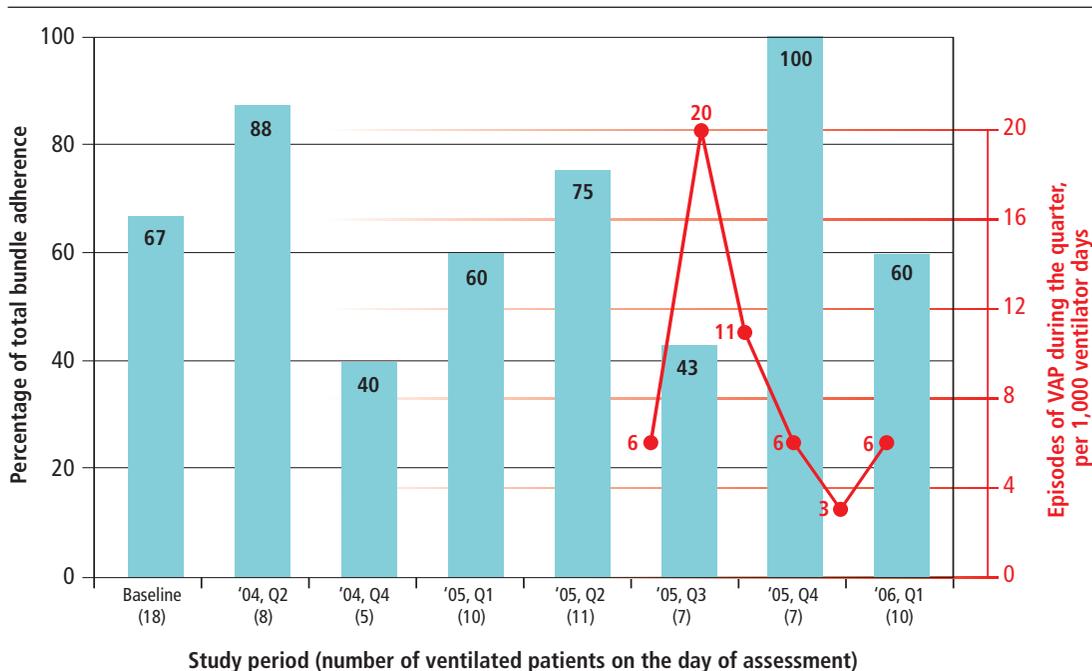
With these things in mind, we developed an ongoing initiative, the Nightingale Metric Project, whereby staff nurses at our facility, Children's Hospital Boston, could identify which interventions were most important to patients and families, measure how often nurses performed these interventions, and use the data to improve care. This initiative can serve as a model that nurses can use for ongoing measurement in all settings.

DESCRIPTION OF THE PROGRAM

The inpatient Cardiovascular and Critical Care Program at Children's Hospital Boston consists of a cardiology unit and three critical care units: a pediatric intensive care unit (PICU), a cardiovascular intensive care unit (CICU), and a neonatal intensive care unit (NICU). Each unit is self-governed, and a clinical practice committee reviews nursing policies and procedures and standardizes practices to decrease unnecessary variation in procedures across units; for example, the best method for safely changing syringe pumps for infusion of vasoactive medications becomes the standard across the ICUs.

How did we do this? Nurses know intuitively what they do that's important to patients and families; they just need help in articulating and measuring it. Nursing staff were paired with a nurse scientist—Martha Curley, one of the authors of this article—who initiated the program.

Figure 1. Percentage of Ventilated Patients Who Received the Ventilator-Associated Pneumonia (VAP) Prevention Bundle, Over Time



Each bar represents the percentage of patients who received the VAP prevention bundle each month. The red points and line represent the monthly VAP rate per 1,000 ventilator days, beginning in August 2005. Q = quarter.

Curley met with nurses from each of the units to discuss the nursing care that they believed was important to patient outcomes on each unit. The same question was posed to each group: “How do you put patients and families in the best condition for nature to act upon them?” The nurses talked about their practice in a way they hadn’t done before: during their annual self-evaluation each nurse had used exemplars to articulate his or her contributions to patient outcomes, but in these sessions nurses spoke about their *collective* contributions. These sessions generated a preliminary list of “nursing care indicators,” chosen according to established and measurable standards of care.

Once we identified an indicator and defined how it would be measured, we conducted a three-month pilot test: did it do what we designed it to do? The results helped us to modify or cancel the indicator in the next measurement period. This “rapid-cycle” method not only helped us to implement a measurement process quickly; it also got nurses excited about their data when they saw them for the first time.

This process resulted in a set of what we called “Nightingale metrics” for each unit: aspects of care identified by the nurses as important to the population served by that unit, reflected as standards of care, based on evidence, and measurable. (See Table 1, page TK.) For example, in the PICU, document-

ing the sedation score every four hours was identified as important. Data collected every three months showed the rate at which nurses completed these assessments; we set a benchmark of 100%—that is, all patients should have sedation levels assessed and documented every four hours. The three-month pilot test showed that our PICU’s average was 62%. We then sought to improve performance by retraining staff, giving them reminders, and providing follow-up with a clinical nurse specialist during daily rounds. Subsequent data collection showed that scores improved and reached the benchmark of 100%.

In this way all indicators were assessed every three months. If the results showed a need for immediate improvement, monthly audits were instituted until data showed improved performance. Also, if the results showed three consecutive audits at benchmark, we then conducted only yearly spot checks.

On each unit staff nurses and a research assistant, Elizabeth Mitchell, who is not a nurse, collected data. Mitchell’s involvement not only improved the reliability of the data collected but also helped nurses to become more familiar with and adept at the auditing process. For each patient Mitchell and a staff nurse completed one data-collection sheet, which listed all indicators for the

unit. Mitchell then entered all the data into a statistical analysis program and completed a report that included tables and graphs of the data, which Curley then reviewed and edited.

We observed that staff nurses adhered strictly to the rules of data collection and were critical appraisers of their own practice. We also noticed another interesting phenomenon: that when something is measured and the data show that improvements are necessary, performance starts to improve. We believe that this is because, fundamentally, nurses want to provide the best care possible.

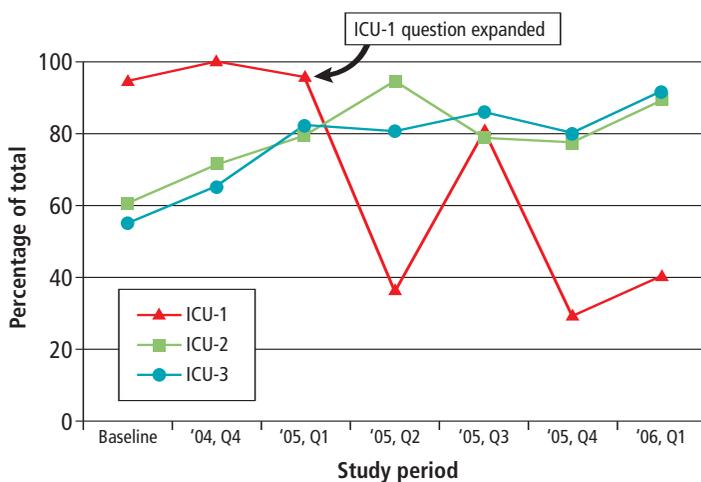
WHAT DID THE NURSES CHOOSE AS INDICATORS?

We learned early on that the measures can differ by unit. For example, PICU nurses care for many medical and surgical patients with varying diagnoses. But what most of the patients have in common is that they require mechanical ventilation, which increases the risk of developing ventilator-associated pneumonia (VAP)—defined as nosocomial pneumonia that arises in a patient who has been on mechanical ventilation for 48 hours or longer.⁴ PICU nurses work to prevent this potential complication. Evidenced-based practices known to prevent VAP include head of bed elevation,⁵ oral hygiene,⁶ peptic ulcer prophylaxis,⁷ extubation readiness testing,⁸ and daily interruption of sedation⁹ and chemical paralysis.¹⁰ We reported the presence or absence of all six VAP-prevention strategies for each patient in the PICU, grouped as a bundle, and linked that result to the unit's VAP rate (see Figure 1, page TK).

Such a “bundle approach” is becoming more common in quality-improvement monitoring.¹¹ A *bundle* describes a group, say three to five, of evidence-based steps that must be taken to improve a clinical outcome. (The Institute for Healthcare Improvement has used the bundle approach in its 100,000 Lives Campaign; see www.ihl.org/IHI/Topics/CriticalCare/IntensiveCare/ImprovementStories/BundleUpforSafety.htm). Because all aspects of care defined in the bundle must be completed, the bundle is scored as either completed or not completed.¹¹ Nurses in our NICU implemented and audited a “safety bundle,” the steps of which were defined by the NICU Nurse Leadership Council and included maintaining an alcohol-based hand gel at each patient's bedside, setting oxygen-saturation alarm limits according to the NICU's guideline, and keeping suction catheters of all sizes at the bedside, among other aspects of care.

This project also acknowledged the importance of a rapid response to evolving clinical situations. Nurses on our inpatient cardiology unit, for example, are pioneering a “time-to-critical-intervention indicator.” Because pediatric cardiovascular patients can decompensate so rapidly and require transfer to the CICU, as part of the project the cardiology unit documented the reason for each CICU transfer and

Figure 2. Percentage of Patients in Whom Pain Assessments Were Completed Every Four Hours in Three ICUs

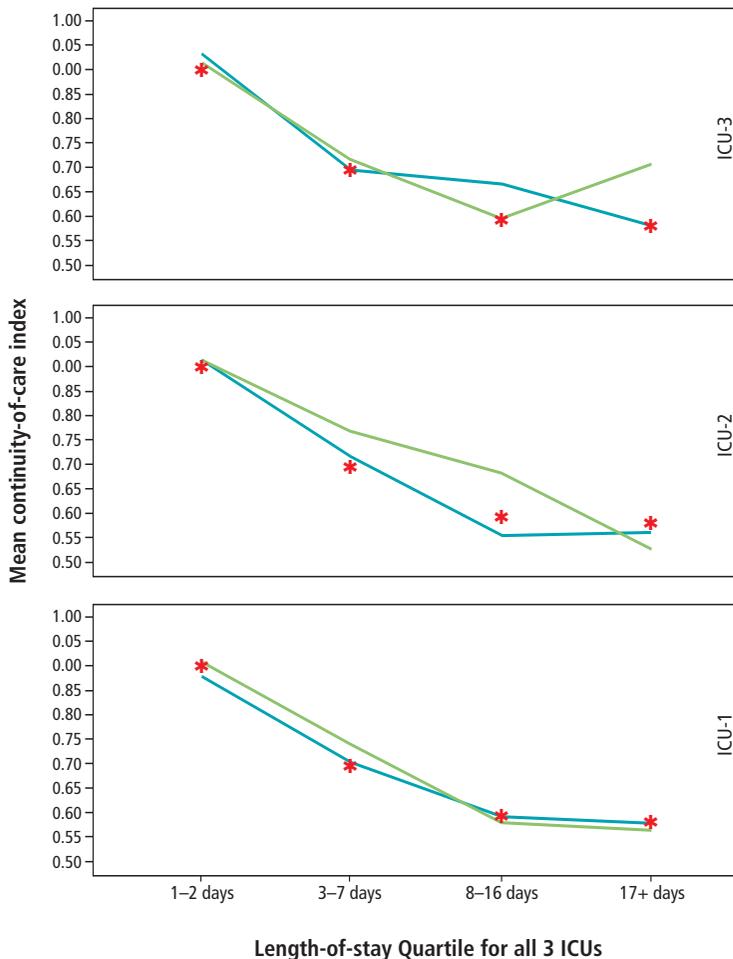


From the start, ICU-1 outperformed the other two ICUs. After consistently achieving their benchmark, ICU-1 decided to expand its indicator to include pain assessment performed before and after an intervention, in addition to every four hours, after the first quarter of 2005. ICU-1 still needs to improve documentation of the pre- and postintervention assessment. ICU-2 and ICU-3 both showed gradual improvement over several quarters, then a plateau followed by recent improvement. These two ICUs will also expand the indicator once the benchmark is achieved. Q = quarter.

the interval between the appearance of symptoms and transfer to the CICU. We used the data compiled to determine what should be taught to nurses during orientation on the cardiology unit, as well as to monitor the appropriateness of the care patients received.

Some indicators, such as whether pain scores are obtained, applied to all three ICUs, while others, such as whether enteral tube placement is confirmed, applied to the entire program (see Figure 2, page TK). Such items can be compared. For example, two of the three ICUs monitor the frequency of pressure abrasions resulting from the sensor (encased in an adhesive attached to a patient's finger or toe) that's used to determine peripheral oxygen saturation. Even though both the CICU and the PICU use the same equipment, the frequency of pressure abrasions varied between them. When this disparity was noted during a meeting of the Clinical Practice Committee, nurses from the two ICUs discussed how they attached sensors to patients. It was discovered that the unit with the lower rate of device-related injury attached the sensor with the cord going toward the body; the unit with the higher rate of injury attached it with the cord going away from the body. The better practice became the standard, and the rates of pressure abrasions decreased.

Figure 3. Continuity-of-Care Index for Three ICUs, According to Length of Stay



Continuity of care can be measured using the continuity of care index (CCI), which is calculated by dividing the number of different nurses caring for a patient during a hospitalization by the number of nursing shifts in that hospitalization. The CCI typically decreases over time, so that the patients with the longest hospital stay usually have better continuity of care. In the panels above, the green lines represent data from the most recent data-collection period; the blue lines represent consolidation of data from all previous data-collection periods. (For comparison, the asterisks represent the mean CCIs for all ICUs in all quartiles.)

Focusing on patients with stays of 8 to 16 days, the most recent CCI (green line) in ICU-3 shows improvement over the former ones (blue line); this change coincided with the formal establishment of nursing care teams early in the course of a patient's illness; in ICU-2, the CCI deteriorated after the unit moved, disrupting nursing assignments. (ICU-3's improvements did not carry over to the patients with stays of more than 17 days.)

What about continuity of care? While most of the Nightingale metrics were “process indicators” describing nursing care, we also monitored a “system indicator” that described one aspect of nurse staffing: continuity of care. For our project we defined it as making sure that the same nurse or just

a few nurses were assigned to the same patient each day. We monitored it by calculating the continuity-of-care index (CCI)—dividing the number of different nurses caring for a patient during a hospitalization by the number of nursing shifts in that hospitalization. For example, on a unit with 12-hour shifts, a patient with a four-day stay might receive care from eight different nurses (CCI = 1; eight nurses divided by eight shifts) or from four different nurses (CCI = 0.5; four nurses divided by eight shifts). Generally, a higher CCI indicates less continuity of care and a lower CCI indicates greater continuity of care.

We have found that, over all, the number of nurses assigned to each patient should be limited: the greater the continuity of care, the better knowledge the nurses, patient, and family have of one another. And in pediatrics, decreasing the number of nurses a family interacts with can help family members feel more comfortable at a child's bedside.

HOW DID WE DO?

Nurses were amazed when they started looking at the data. Their perceptions of the care they gave were often quite different from what the data showed. Although it would have been easy for staff to select indicators they were confident would show good performance, our point was to highlight opportunities for improvement and to show progress. The nurses both performed better than expected in many areas and identified opportunities for improvement. Over time, the Nightingale metrics documented the history of practice improvements on the various units.

Resources. Data collection on each unit typically requires two hours of nursing and research assistant time each quarter. It takes one nurse eight hours a year for data collection on a 24-bed unit. During the data collection, data are entered directly into a statistical program on a laptop computer. The research assistant then transfers them to a report template, which requires a final check by the nurse scientist. Reports are then distributed to the nurse managers and Nightingale leaders on each unit. The results are then discussed with all staff. Prior to each round of data collection, the nurse scientist meets with the unit staff. Indicators are fine-tuned, and new measures are discussed and pilot tested.

MAKING IT WORK AT YOUR FACILITY

Nurses who don't have a scientist or research assistant available to them can still develop their own Nightingale metrics. Individual units should start small by selecting only one measure per month or three measures per quarter. Select those that are specific to the patients and are evidence based. Tying a measurement process to nursing vigilance and preventative care is one way of building upon the legacy of Florence Nightingale. ▼

Table 1. Examples of Nightingale Metrics

Inpatient Cardiology Unit

- In patients at risk for congestive heart failure, documentation of total intake and output every 24 hours and daily weight.
- In newborns to be discharged in 72 hours, documentation of results of a phenylketonuria test, the car-seat challenge, and hearing screening.
- In patients on a cardiac monitor, the setting of the monitor on a mode appropriate for age (paced, if needed) and the alarm limits on \pm 20% of baseline heart rate, respiratory rate, and oxygen saturation.
- "Time to critical intervention": the number of unplanned patient transfers to the cardiac intensive care unit (CICU) and the time interval from first assessment of distress to CICU transfer.

Pediatric Intensive Care Unit

- Documentation of sedation score every 4 hours.
- In patients with a central venous line, changing the dressing every 7 days.
- Establishment of a nutrition plan within 24 hours of admission.
- The double checking of all medications by 2 nurses.
- *Pressure ulcer bundle*: if patient is immobile, documentation of position change every 2 hours and positioning of heels off the bed; if not on bed rest, documentation of patient being out of bed or held in parent's or nurse's arms.
- *Ventilator-associated pneumonia bundle*: Head of bed elevation at 30°–45°; documentation of oral hygiene twice in 24 hours; peptic ulcer prophylaxis (in patients not receiving tube feedings); discussion of extubation readiness test on rounds; daily holiday from sedation or chemical paralysis.
- "Time to critical intervention": "panic" laboratory value, the time intervals from sending specimen to laboratory to first intervention to correct the laboratory value.

Cardiac Intensive Care Unit

- Documentation of PR interval at the start of each shift.
- Checking central line blood return at the start of each shift.
- Presence or absence of pressure abrasion.
- *Adult care bundle*: in patients on bed rest, wearing of compression boots and stockings and maintenance of potassium $>$ 4 mEq/L; in extubated patients, getting the patient out of bed before 10 AM and health care proxy in place.
- *Neonatal care bundle*: placement of physical boundary; documentation of head circumference on admission; maintenance of temperature, 36.5°C–36.7°C; placement of those weighing $<$ 2 kg in an isolette; checking glucose level every shift.
- "Time to critical intervention": interval between fever ($>$ 38.5°C) and administration of first antipyretic.

Neonatal Intensive Care Unit

- Documentation of weight daily (for up to 7 days).
- Parental notification of patient's transfer status.
- Documentation every 2 hours of turning or repositioning of immobile patients.
- Confirmation of nasogastric tube placement by checking the pH level of aspirate.
- Discussion of intravenous access plan on rounds for patients with difficult vascular access.
- Documentation of baseline withdrawal score in patients being weened off opioids.
- *Safety bundle*: placement of hand disinfectant at bedside; setting of oxygen saturation alarms according to protocol; placement of 1 size of each suction catheter at bedside; peripheral IV visible; securing of servo-mechanism for temperature regulation (visible and not on bony prominence).
- "Time to critical intervention": panic laboratory value: the time intervals from sending specimen to laboratory to first intervention to correct the laboratory value.

Note: Data are collected quarterly on a random day through chart audits, direct observation, or both. Chart audits are limited to the previous 7 days.

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