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INSIDE

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Rampant premature discharge to wards may be behind high ICU readmissions

Many readmission rates may not be high at all but normal

Many critical care units are using a medical standard that is too low when deciding to transfer patients out of the ICU. By setting the bar so low, physicians are almost ensuring that the patient will have to return to the ICU, often sicker and with more serious medical complications.

However, researchers aren't so certain this is the case. It is only one of several theories being offered to explain a nagging problem of readmissions in critical care that is steadily growing worse.

For decades, nursing administrators have wondered about the phenomenon that causes patients to return to the ICU within 72 hours following an otherwise medically appropriate discharge to another inpatient unit of the hospital. Some readmissions have occurred on the same day of a transfer that was deemed medically correct in all respects.

Several theories have been offered to help explain the reasons for high readmission rates. Pressures leading to early discharge, managed care, and even the limited value of critical care as a medical intervention have been cited as reasons why some patients inevitably return to the ICU.

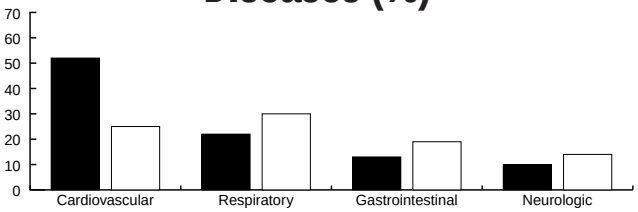
But in fact, no one is certain whether any single set of factors is

EXECUTIVE SUMMARY

Nurse administrators continue to wonder about the causes of ICU readmissions during the same hospital stay. A lack of useful information across a spectrum of hospitals has stymied intelligent decision making about reducing readmission rates. But research is finding that:

- Readmissions aren't necessarily a reflection of quality in ICU care.
- Differences in rates may be determined by the amount of clinical resources at certain hospitals.
- Patients with certain diseases may be more vulnerable to readmission than others.
- Mortality rates are higher among some readmitted patients.
- Not enough is known to help identify likely readmission candidates.

Diagnostic Category for Readmissions Due to Original Diseases (%)



The most frequent medical problems that lead to intensive care unit readmission due to the initial disease in teaching **(solid bars)** and community **(open bars)** hospitals.

Source of charts, pp. 2-3: Chen LM, Martin CM, Keenan SP, et al. Patients readmitted to the intensive care unit during the same hospitalization: Clinical features and outcomes. *Crit Care Med* 1996; 26:1,834-1,841.

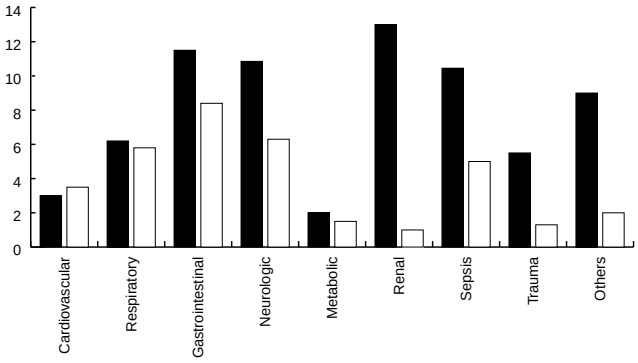
responsible for ICU readmissions. "There are no absolutes regarding the reasons for high readmissions," says **Derek C. Angus**, MD, MPH, associate professor of anesthesia, critical care and medicine at the University of Pittsburgh School of Medicine.

Some authorities even argue that in many cases readmission rates aren't actually high, but are a function of a particular hospital's effect on certain patients much like the unemployment rate: There will always be a certain unemployment rate no matter how healthy the economy is.

According to this view, a readmission rate perceived as high at one hospital could be the norm at another. Adding confusion, a dearth of national benchmarks or statistics on readmission norms ultimately makes rational assessments about high rates compared to low ones impossible to determine, according to some critical care experts.

Angus is among them. A certain level of patient recidivism in ICUs appears to be a norm, he observes.

Readmission Rates in Different Disease Categories (%)



Intensive care unit readmission rates in different disease categories to teaching **(solid bars)** and community **(open bars)** hospitals.

A certain rate will be a constant at hospitals no matter what you do. But it's difficult to gauge systematically when the rate becomes too high, although everyone knows it intuitively. "Like obscenity, which evades an accurate definition, you know it when you see it," Angus says.

Patient returned to ICU in one hour

In some cases, the situation is undeniable. One veteran nurse recalls a critically-ill surgical ICU patient who was transferred to a medical unit of her hospital at 3 p.m., only to return an hour later because he was too ill to remain on a general med-surg floor.

Minutes before his transfer out of the ICU, nurses had declared him stable. He was not on titration, seemed conscious, and was vaguely alert. His blood pressure had not changed for several hours; nurses had taken him off suctioning the previous night by order of the physician on duty.

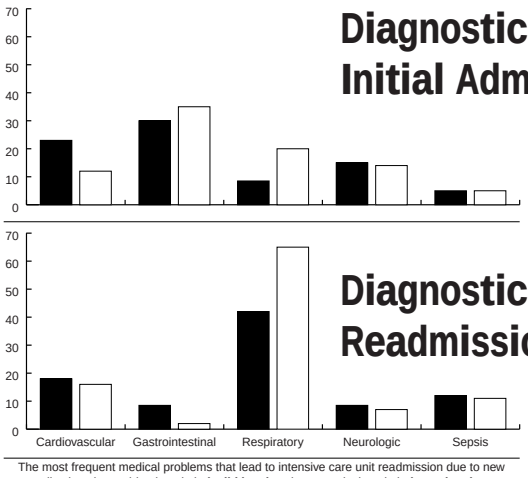
But, by some indications, the patient wasn't considered sufficiently ready for transfer. Instead, his condition was "borderline" at best, says **Kathleen T. Bergin**, RN, a surgical nurse practitioner at MetroHealth Medical Center in Cleveland, who was there at the time.

The patient could have gone either way. He could have remained on the general medical floor and continued to do well. Or, his condition could have deteriorated as is what actually occurred as a result of the transfer; his readmission would have been a foregone conclusion, Bergin states.

Until recently, medical researchers did not really question factors driving recidivism rates in critical care. Today, overriding concerns about cost and hospital financial results have fueled a demand for reductions in patient utilization and lengths of hospital stays. But, statistical facts that can serve to point the way to achieving these results in critical care have lagged behind the enthusiasm to create standards and best practices, Angus notes.

"The Society for *Critical Care Medicine's* Quality Indicators Committee ranked ICU readmissions within 48 hours as the top indicator for judging ICU quality. Yet aside from a few single-center studies, there has been little systematic evaluation of ICU readmission rates," states Angus in a *Critical Care Medicine* editorial.[1]

"What's driving the need for hospitals to perform better? Is it money? Is it an interest in quality? There isn't enough data about readmission rates across any spectrum to help achieve either of



The most frequent medical problems that lead to intensive care unit readmission due to new complications in teaching hospitals **(solid bars)** and community hospitals **(open bars)**. Diagnostic categories for initial admission **(top)** and readmission **(bottom)**.

these ends. How can we intelligently speak about the readmission phenomenon?" Angus asks.

Hampering the effort is the fact that hospitals tend to stop collecting data on patients once they leave an ICU. No one really knows statistically how patients react outside the unit, which may be responsible for the readmission, Angus notes. Whatever in-hospital data is available is usually site-specific. Therefore, conclusions regarding what may cause ICU readmissions don't necessarily apply to other hospitals either in a region or across the country.

Saying that a hospital's readmission rate is far too high may not have any basis in fact because it becomes impossible to compare two or more institutions. Furthermore, the factors responsible for the readmissions at each facility may be so different that there still would be no basis for comparisons, according to some researchers.

The result is that "questions regarding readmission rate and its correlation with ICU quality remain unexplored," according to Angus.[1]

Study compares readmission causes

Some researchers are making an effort nonetheless. Physicians at the Critical Care Research Network of the London Health Sciences Centre in Ontario, Canada, studied patients discharged from ICUs at six different hospitals to determine the causes that led to their readmissions.

The retrospective study also investigated the clinical features and outcomes for the cases that were readmitted.[2]

During the study period, which ranged between Jan. 1, 1995 and Feb. 29, 1996, researchers studied the outcomes of 236 patients who were discharged from the ICU but later readmitted. The study found that patients with gastrointestinal and neurologic disorders faced the greatest risk of an ICU readmission.

Cardiovascular and respiratory diseases were reported as the major reasons for the readmission.

Of the readmitted cases, nearly half, or 45%, had a worsening or recurrence of the initial disease; 39% experienced new complications; and 14% required additional surgery.

Aspiration or bacterial pneumonia comprised 60% of the new respiratory complications in patients admitted at a group of community hospitals. In comparison, 30.2% of readmitted cases were diagnosed with respiratory arrest; 25.6% with pulmonary edema; and 16.3% with pneumonia. These were patients treated at a group of teaching hospitals.

Stark differences between hospitals

In fact, the research revealed stark differences in outcomes between community and teaching hospitals that participated in the study. Three ICUs from two teaching hospitals and four ICUs from four community hospitals participated.

For example, the number of patients who needed at least one ICU readmission during the same hospital stay was higher at the teaching hospitals than the community hospitals. Readmission within 24 hours of initial ICU discharge occurred in 26% of teaching hospital cases compared with 30% in community hospital patients. **(For additional comparisons between the two hospital types, see bar graphs, pp. 2-3.)**

Researchers didn't attempt to explain the statistical differences between the two hospital types. But **Claudio M. Martin**, MD, MSc, one of the project lead investigators, noted that inherent factors that normally distinguish teaching hospitals from non-teaching ones might account for the differences.

Higher 24-hour staff-to-patient coverage and the prevalence of additional residency education resources, including intermediate and other step-down unit facilities at teaching institutions,

compared with community hospitals may have contributed to a lower readmission rate. It also may have been a factor in the number of cases that needed more than one readmission at the teaching facilities during the same stay. But these reasons are more speculation than fact, Martin told *Critical Care Management*.

Yet, one of the surprising trends encountered by investigators was that readmitted patients at either type of hospital faced a high risk of hospital death. Readmitted patients who did not survive were older and more frequently readmitted for new complications than those surviving the hospitalization.

Patient bumping plays a role

Does this fact mean that premature ICU discharges may be at the core of the problem? Angus and Martin hesitate to draw any conclusions. Complications that lead to an ICU readmission in, say, a post operative cardiac patient "may be more reflective of surgical technique than of post-operative ICU care," Angus asserts.

Similarly, a readmission may be due to sub-par care on a general medical ward and may not stem from a premature ICU discharge, Angus adds.

In his study, Martin leaves the point moot: "Further studies are required to determine if patients at risk for readmission can be identified early to improve the outcome."[2]

Bergin of MetroHealth is convinced that the continuing trend toward premature ICU discharges is having a detrimental affect on patient outcomes.

"The process of bumping patients into general medical wards too soon is at the heart of the problem," she contends. Innovations such as step-down and subacute care units have helped at many facilities.

Nurses are still seeing far too many patients transferred, only to have them return sicker and in need of higher clinical resources. "If all this is being done to save money, it certainly isn't meeting those goals," Bergin says.

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Patient-centered steps get them breathing sooner

Formal protocols work for ventilator weaning

(Editor's note: Long-term intubated patients are defined as those needing help to breathe from a mechanical ventilator for more than three days. Here, weaning is defined as the ability to breathe spontaneously for 24 hours with or without an artificial airway in place. The definition of both terms comes from the American Association of Critical Care Nurses' Third National Study Group on Weaning.)

A growing cadre of clinical researchers is seeking answers to one of critical care nursing's most elusive questions, namely: How do long-term ventilator patients respond to weaning under various nursing techniques; and, is there a system of ventilator weaning that will lead to better, more predictable outcomes?

For as long as anyone can recall, efforts to free ICU patients from their dependence on bedside mechanical ventilation devices has been to a great degree determined by nurses. But for the nursing staff, the weaning process for critically-ill patients has been a difficult, day-to-day struggle to get patients to breathe on their own. Mostly, it's been a struggle for hope against setbacks and patience against frustration.

And in planning and protocol development, nurses who have often worked the closest with

(Continued on page 6)

EXECUTIVE SUMMARY

Efforts at freeing patients from dependence on mechanical ventilators often lack precision and effectiveness. A shortage of lasting solutions on how patients should be weaned and why they respond differently keeps nurses in the dark. But some experts advise that:

- Weaning should use a formal, systematic approach such as outcomes management based on an individual patient's condition.
- Taking a holistic approach, including a patient's nutritional needs and pain tolerance, will affect weaning success.
- Building flexibility into the care plan, adjusting expectations, and breaking down weaning schedules into smaller time units are more realistic goals.

Burns Weaning Assessment Program (BWAP)

Patient name_____ Patient history number _____

Yes	No	Not Assessed	
			General assessment
___	___	___	1. Hemodynamically stable (pulse rate, cardiac output)?
___	___	___	2. Free from factors that increase or decrease metabolic rate (seizures, temperature, sepsis, bacteremia, hypo/hyperthyroid)?
___	___	___	3. Hematocrit >25% (or baseline)?
___	___	___	4. Systemically hydrated (weight at or near baseline, balanced intake and output)?
___	___	___	5. Nourished (albumin >2.5, parenteral/enteral feeding maximized)? (If albumin is low and anasarca or third spacing is present, score for hydration should be "no")
___	___	___	6. Electrolytes within normal limits? (Including Ca^{++}, Mg^{+}, PO_4) * Correct Ca^{++} for albumin level.
___	___	___	7. Pain controlled? (subjective determination)
___	___	___	8. Adequate sleep/rest? (subjective determination)
___	___	___	9. Appropriate level of anxiety and nervousness (subjective determination)?
___	___	___	10. Absence of bowel problems? (diarrhea, constipation, ileus)
___	___	___	11. Improved general body strength/endurance (ie., out of bed in chair, progressive activity program)?
___	___	___	12. Chest roentgenogram improving?
			Respiratory Assessment
			Gas flow and work of breathing
___	___	___	13. Eupnic respiratory rate and pattern (spontaneous respiratory rate <25, without dyspnea, absence of accessory muscle use). *This is assessed off the ventilator while measuring #20-23.
___	___	___	14. Absence of adventitious breath sounds (ronchl, rales, wheezing)?
___	___	___	15. Secretions thin and minimal?
___	___	___	16. Absence of neuromuscular disease/deformity?
___	___	___	17. Absence of abdominal distention/obesity/escites?
___	___	___	18. Oral endotracheal tube >#7.5 or trach >#7.5
			Airway clearance
___	___	___	19. Cough and swallow reflexes adequate?
			Strength
___	___	___	20. Negative inspiratory pressure <-20?
___	___	___	21. Positive expiratory pressure >+30?
			Endurance
___	___	___	22. Spontaneous tidal volume >5 mL/kg?
___	___	___	23. Vital capacity >10-15 mL/kg?
			Arterial blood gases
___	___	___	24. pH 7.30 - 7.45?
___	___	___	25. $PaCO^2$ approximately 40 mm Hg (or baseline) with minute ventilation <10 L/min (evaluated while on ventilator)?
___	___	___	26. PaO^2 >60 on FrO^2 <40%

patients have virtually been left out of the loop, according to many veteran ICU nurses.

Now, some nurses are calling for a different approach. It reverses many long-held beliefs about when long-term intubated patients should start breathing on their own and offers new ways to begin the weaning process. One such technique, for example, advocates improving the patient's nutritional requirements before undertaking any formal weaning.

"These are extremely sick patients who suffer from more than the primary underlying disorder. They don't usually wean in a linear fashion. They have good days and bad days," says **Suzanne M. Burns**, RN, MSN, an associate professor in the school of nursing at the University of Virginia Health Sciences Center in Charlottesville.

Few answers to proper extubation

Granted, the field of inquiry has turned up few definitive answers as to why some patients wean sooner than others, and how to best develop weaning protocols that successfully work across large patient groups, Burns admits. She and her colleagues are advocating a more systematic, patient-centered approach built on two primary concerns:

- Using a tolerance-based system that allows the patient to dictate when weaning should start and what the rate of progress should be.

SOURCES

To obtain a free copy of the Burns Weaning Assessment Program, contact the University of Virginia Patient Foundation. Telephone: (804) 924-2175. Fax: (804) 924-1583.

For further information on long-term ventilator weaning research, contact:

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- **Jan Weber**, public relations, American Association of Critical Care Nurses, 101 Columbia Ave., Aliso Viejo, CA 92656-1491. Telephone: (800) 809-2273. E-mail: www.aacn.org. Ask for information concerning the Third National Study Group on Weaning.

- Adopting a holistic view of ventilator weaning that includes, among other things, nutritional support, objective values for pain assessment and sensitivity from nurses, and the patient's general health status and readiness for weaning.

The common, long-held practice has been to attempt to get patients free of the ventilator almost on ICU arrival. "The effort may work well with patients identified early during admission as short-term ventilator patients, but the long-term patient is usually the one out of 10 or 20 who clearly falls outside these parameters," observes **Donna Caracciolo**, RN, a cardiovascular nurse in the ICU at St. Vincent Medical Center in Toledo, OH.

Strategies based on initial assumptions that all patients should be started on weaning from day one should be re-examined, Burns maintains. Instead, a more individualistic approach based on each patient's specific medical condition serves as a better guide for weaning.

Standard physiological predictors for weaning generally have included: A fraction of inspired oxygen of less than 0.5 with arterial partial pressure of oxygen of more than 50 to 60 mm Hg, and vital capacity of 10 mL/kg or more. They've also involved maximum inspiratory pressure of less than -20cm H_2O; minute ventilation of 10 L/min or less; tidal volume of 5 mL/kg or more; and maximum voluntary ventilation of more than twice the value of minute ventilation.[1]

Other researchers have debated the value of this standard predictor. Yet, physicians have long known that factors such as respiratory muscle weakness and changes in breathing patterns, respiratory rates, and vital signs are important factors in weaning efforts and outcomes. They also know that other important indicators such as breathing force (negative inspiratory pressure) can change over time and aren't necessarily reliable measures.

Use a formal, systematic approach

To help nurses begin the weaning process, Burns and her colleagues developed a 26-item assessment tool that combines 12 general factors, such as pulse rate and cardiac output, and 14 respiratory factors — including respiratory rate and arterial blood gas levels — in a single score.

They've also designed a clinical pathway for weaning mechanically ventilated patients. The pathway identifies patient-related issues such as mobility, nutrition, gas exchange, and infection potential and outlines outcomes in phases that mark improvement in food-feeding tolerance and

recovery rates from underlying disorders. It also guides the patient through treatment from initial assessment for weaning to discharge preparation.

The BWAP (Burns Weaning Assessment Program) is a bedside checklist that attempts to set a minimum standard or threshold for alerting nurses when weaning should begin. The tool can be used in an outcomes management program to focus properly needed clinical interventions and track patient progress. It also can be applied as a threshold for initiating weaning protocols and to start active weaning trials, Burns says. **(For a chart showing the BWAP, see p. 5.)**

Using a systematic, outcomes-managed approach to weaning will produce better results than the current practice of weaning based on the need for immediate short-term results. "The emphasis is moving away from looking at weaning in terms of simple extubation," says Burns.

"The preferred method focuses instead on breaking down the monitoring periods into small units of time, and correct problems with the patient's breathing as they occur and not wait until later," notes **Milo Engoren**, MD, an anesthesiologist and intensivist at St. Vincent in Toledo.

Engoren has been studying the effects of respiratory failure on a patient's breathing rate and tidal volume (the amount of air inhaled and exhaled in one breath). The key to speeding up the weaning process could lie in measuring changes in the patient's breathing pattern, not necessarily the respiratory rate. "The patterns in the tidal volume may tell us more about the ability to wean or not to wean than the rate itself," Engoren says.[2]

Engoren also endorses a systematic, patient-holistic approach to weaning. "Patients are coming into the ICU who are older and sicker than before. They often have underlying conditions related to past renal failure and strokes. Yet, they're undergoing cardiac surgery and are being intubated in the ICU."

Therefore, nurses need to consider existing problems with the patient before beginning the weaning protocol. "The key is to try and optimize the patient's condition and address the issues that may be interfering with the weaning," Engoren says.

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New techniques put post-ops on the fast track

Nurses can cut cardiac patients' recovery time

Surgical breakthroughs are enabling postoperative cardiac patients to achieve faster recovery time even for complex procedures that once involved lengthy inpatient stays. But what are the drawbacks to fast-tracking traditional ICU patients, and why should nurses even consider guiding their cases into such accelerated treatment and recovery protocols?

Today, patients generally spend less time than ever in recovery, thanks chiefly to minimally-invasive surgical techniques and new anesthetic agents such as Proponol that have shorter half-lives. Patients can even circumvent a long stay in a post-anesthesia care (PACU) or med-surg unit followed by a two-or-three day ICU admission. Instead, the ICU-stay, even when necessary, is much shorter, often lasting less than 12 hours. In some cases, the ICU can be avoided completely.

The patient usually feels better; and in almost all cases, he or she is discharged to a home care program in less than 24 hours. Although these techniques are becoming well known, fast tracking can be fraught with concerns. The drawbacks have chiefly involved patient safety in light of scant, though growing research into streamlining post-operative care.

Post-op patients spend too long in recovery

Most of the research has been based on a growing belief that cardiac post-op patients typically spend far too much time in a traditional recovery unit, says **Myrna Mamaril**, RN, MS, a nurse manager at St. Joseph Medical Center in Towson, MD. According to some estimates, patients spend up to three times longer than necessary in recovery. Several reasons are responsible. Most focus on a lack of willingness by clinicians to change long-established medical practice, says Mamaril.

Interest is growing in the development of new pathways, or care maps, that will allow eligible patients to be discharged sooner than later. The longer a patient stays in the hospital, the longer he or she will take to achieve normal recovery, says Mamaril, an advocate of carefully monitored and planned fast tracking.

Streamlining patient care in this manner is

something of a balancing act. It involves knowing, with reasonable clinical certainty, when a patient is ready for discharge and making sound, educated predictions that he or she will not develop medical complications that may require a second hospital admission within days.

The threat always looms that the patient may have to return with a serious co-morbidity, says **Vallire D. Hooper**, RN, MSN, an instructor in the department of adult nursing at the Medical College of Georgia in Augusta.

The complications are likely to occur with a certain percentage of post-op cardiac patients, regardless of the length of their in-hospital recovery.

This factor should not discourage nurses from working with patients toward a prompt, appropriate discharge, Hooper says. The protocol "can work for the right post-op case and should be explored as a way to improve outcomes and ease the potential for ICU overcrowding," Hooper says. Nursing factors to take into account include:

• **Strong pre-op assessment.**

Generally healthy patients with no history of chronic disorders or potential for medical complications following surgery make the strongest candidates for the pathway, says Hooper. The level of complexity of the surgery itself is also a factor. Complex procedures generally reduce the predictability of an appropriate recovery.

The patient's history and physical should rule out the existence of pulmonary defects, circulatory problems such as hypertension, or other chronic disorders — including diabetes — that would give rise to future complications. Strong family support and the patient's psychological state of mind also should be evaluated prior to determining pathway eligibility, Hooper adds.

• **Well-conceived and supported care maps.**

The clinical team, including physicians, nurses and anesthesiologist, is ultimately responsible for determining eligibility for the fast track pathway. The pathway itself has to be well defined, reasonably designed, yet sufficiently detailed to enable nurses to look for specific clinical criteria such as blood pressure and heart rate that may rule out the patient during recovery, says Mamaril.

The team can devise the care map for each type of surgical procedure based on the surgical department's past experience with patients and their outcomes. The map also should anticipate unexpected complications during in-hospital recovery that may require a longer length of stay.

• **Close bedside monitoring and patient education.**

Bedside monitoring in a PACU or ICU should focus on helping the patient move toward becoming independent as soon as possible. If the patient responds, the nurse can offer instructions on how to change dressings and help with aspects of daily living such as bathing and medication schedules. The patient and family members have to be receptive to such education support, Hooper cautions. "There are no cookie-cutter approaches here," she says.

• **Post-discharge planning.**

Part of the process involves a well-defined home care program and discharge planning that includes regular physician office visits. The home care plan must be tailored to the individual patient and must be monitored by the critical and acute care staff for weeks following discharge.

"There is a high potential for re-hospitalization with certain patients," Hooper says. A community outreach program can coordinate the home care plan while monitoring the patient's post-discharge progress.

Research supports one-day admission as safe

While there is some complexity to fast tracking, a growing body of clinical research supports the effectiveness and benefits of these efforts. In 1995, researchers at Sewickley Valley Hospital in Sewickley, PA, documented results of their efforts to develop a pathway for streamlining the length of stay of patients who underwent an elective carotid endarterectomy.

In a review of cases involving 186 patients, researchers concluded that a one-day admission

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was a "safe, highly cost-effective" protocol, resulting in efficient use of ICU resources, according to a published report.[1]

Of the patients studied, 157 were discharged within 24 hours of the procedure. The average length of stay was 1.27 days. Of the discharged group, one patient died from cardiac causes on the 28th day following discharge. There was no hospital readmission within the study period, which ran from Jan. 1, 1991 to June 30, 1994.

Twenty-six percent of the patients who underwent the operation were diagnosed as asymptomatic, while 74% had either transient symptoms or a prior stroke. Thirteen percent were operated on under general anesthesia.

Furthermore, the hospital realized significant cost savings. For each patient in the discharged group, the institution saved an average of $3,000 in total patient-care costs calculated from a comparison of dollar amounts that would have been paid under the procedure's allowable diagnosis-related group (DRG).

The study cited neurological complications, ICU admission, and an increasing length of inpatient stay as factors that typically drive up the cost of performing the carotid endarterectomy. These factors were not significant enough to affect costs in the discharged patients, according to the study's author.

Hospital, staff must 'buy into the process'

A second study supported Sewickley Hospital's findings. In 1993, surgeons at Baystate Medical Center in Springfield, MA, initiated a fast-track protocol aimed at a one-day hospital stay following carotid endarterectomy.[2] In the majority of cases, the stay did not involve the minimum one night for ICU monitoring, which was the norm prior to the study.

Between 50% and 61% of the 152 cases studied were discharged within the first two post-op days. Eighty-seven percent went home by the second day. However, 60 cases did go to the ICU, but only 18 were admitted. Of the total, 21 patients experienced complication. Three patients died within 30 days, and five had reported neurological deficits. Fourteen patients had to be readmitted to the hospital, but none was related to the discharge on the first or second post-op day.

Excluded from the study were patients whose endarterectomy involved a coronary revascularization, and those who underwent the first part of a staged bilateral endarterectomy performed in the same hospitalization.

Both hospital studies point to the importance of selective screening of patients for eligibility. Throughout, advocates have cautioned that the streamlining process must be managed and planned carefully for each patient before the surgery. Efforts not achieving expected results are those that fail to achieve a unified multi-disciplinary approach, Hooper says.

Physicians, critical care nurses, and acute care personnel must support the organizational effort. "Everyone has to buy into the process for this to make any sense," she adds.

The process of identifying patients who are suitable fast-track candidates has to begin as early at the pre-op testing stage. Fast tracks work best, according to Hooper and others, when nurses adhere to a formal, detailed clinical pathway, and patients are carefully selected and monitored during the tracking period.

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Infant ICU deaths drop by 45% due to advancements

Technology, clinical efforts credited for progress

Advancements in medical technology and organizational systems are being credited for sharply reducing the death rate among young children receiving medical care in pediatric ICUs. Children given intensive care for serious respiratory ailments and other life-threatening diseases have a significantly better chance of surviving today than as recently as a decade ago, according to the federal Agency for Health Care Policy and Research (AHCPR) in Washington, DC.

According to a study jointly sponsored by the AHCPR and Arkansas Children's Hospital in Little Rock, the mortality rate among children admitted to a pediatric ICU declined by 45% between 1983 and 1993. The survival rate involved patients diagnosed with severe asthma, bronchitis, and pneumonia.[1]

SOURCE

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Health officials cited the findings in calling for continuing investments in critical care medical research and technology. Advancements in mechanical ventilation and other ICU-related technology were cited as examples of factors that have led to the higher survival rate. Also identified as a possible factor was the development of pediatric ICUs that are larger in size and staffing today than a decade ago.

Survival rates differ by age

The results were also used to urge greater private-sector and government investment in pediatric critical care. Officials expressed growing concerns over financial shortfalls created by managed care and system-wide changes in Medicare hospital payments from one based on costs, to one based on fixed fees and prospective payment formulas.

"A great deal has been known about the effects of technological improvements in adult critical care. One of our goals here was to assess the impact of change on children's ICUs," according to **John M. Tilford**, PhD, a researcher in the department of pediatrics at Children's Hospital.

Declines in mortality risk were greatest among younger infants. The risk for children younger than one month improved by 39%. A 28% improvement was reported among infants between one and 12 months of age. The study reviewed data from 16 pediatric ICUs across the country. **(For a breakdown of data among the ICUs, see chart, below.)**

According to researchers, the improvements in mortality risk also has altered the way pediatric intensivists evaluate costs and quality measures using a commonly accepted severity-of-illness system to monitor risk-adjusted outcomes. Several severity adjustment systems are available in adult critical care, including the Acute Physiology and Chronic Health Evaluation III scale.

Pediatric ICUs use a proprietary system called the Pediatric Risk of Mortality scoring system, known as PRISM III. "Improvement in mortality risk substantially deteriorated the [assigned values]

Pediatric intensive care unit (PICU) characteristics

PICU	Median Age (months)	PICU Admits	Mortality Rate (%)	Surgical Patients (%)	Trauma Patients (%)
A	27.1	587	4.8	46.0	10.1
B	42.0	370	3.2	36.5	11.1
C	36.0	595	4.2	36.3	5.7
D	30.4	802	3.4	30.9	6.1
E	39.4	1152	5.1	30.1	12.0
F	26.0	954	9.1	55.9	10.9
G	59.0	211	2.4	26.5	29.4
H	49.8	680	3.5	30.0	11.9
I	35.1	559	4.8	38.3	16.1
J	31.5	492	1.8	39.2	7.1
K	46.0	695	3.0	33.8	1.4
L	35.5	146	2.7	36.3	13.0
M	25.9	1250	4.9	28.6	9.3
N	39.3	598	6.7	27.2	16.2
O	33.8	418	4.1	42.1	13.4
P	36.7	1229	3.0	31.7	15.1
Average	35.0	677	4.5	35.2	10.9

Source: Tilford JM, Roberson PK, Lensing S, et al. Differences in pediatric ICU mortality risk over time. *Crit Care Med* 1998; 26:1,737.

of the original PRISM severity system," researchers concluded. As a result, standardized mortality ratios across the 16 pediatric ICUs showed "substantial disparities."

The latest findings may require a revision of the current values in PRISM III to adjust for the improved mortality risk's effects on pediatric ICU cost and quality.

Reference

1. Tilford JM, Roberson PK, Lensing S, et al. Differences in pediatric ICU mortality risk over time. *Crit Care Med* 1998; 26:1,737-1,743. ■

Objectives are unreliable on life support withdrawal

Study offers no clear guidance on predicting costs

Objective methods to determine whether ICU patients whose outlook is futile should be kept alive and worth the cost in hospital life support efforts may be misleading and should not be used by nurses or physicians as a guide, according to researchers at the University of Vermont School of Medicine in Burlington.

In fact, existing objective measures for evaluating the cost-effectiveness of withdrawing life support are unreliable. Physicians may never have an objective means of making decisions to withdraw life-support from patients whose outcomes are deemed terminal during the hospitalization.[1]

Furthermore, even when accepted survival scoring systems such as the widely accepted APACHE III (Acute Physiology and Chronic Health Evaluation III) are used, the cost savings are likely to be quite small. Part of the reason is that decisions to withdraw life support involve a relatively small group of patients.

Another factor is that the results of systems such as APACHE III when used in calculating survival in terms of cost savings don't deviate much from results obtained when physicians use individual clinical judgments, according to researchers.

With the number of ICUs commonly grappling with whether to withdraw life support once physicians decide that further medical care is futile, clinicians have tried to rely on objective measures to justify their decisions.

"If it is reasonable to withdraw support from patients who are extremely unlikely to benefit from ICU care, objective means of identifying patients receiving medically futile care should be useful," according to **Laurent G. Glance**, MD, a University of Vermont anesthesiologist and study co-author.

In a wide-ranging retrospective study of more than 4,000 non-cardiac patients, a prognostic scoring system to predict the cost-effectiveness of withdrawing life support from relevant patients did not prove significantly valuable as an objective measure.

The study involved a nine-year review of patients at a surgical ICU who had a probability of death of greater than 90% within 48 hours of admission. The study used a mortality risk estimate taken from APACHE III scores.

Investigators constructed a model to compare the cost-effectiveness of two clinical strategies. One involved patients who were discharged, died, or had life support withdrawn based on subjective criteria. The second involved patients who were discharged, died, or had life-support withdrawn

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based on subjective criteria but also were predicted to have a greater than 90% risk of mortality within 48 hours using a predictive scoring system.

"The use of scoring systems to assist in the decision to discontinue critical care is extremely controversial," Glance and his colleagues wrote, "Although prognostic scoring systems would be expected to have advantages over clinical judgment, the explanatory power of APACHE III . . . is only slightly better than physician judgment."

Reference

1. Glance LG, Osler T, Shinozaki T. Intensive care unit prognostic scoring systems to predict death: A cost-effectiveness analysis. *Crit Care Med* 1998; 26:1,842-1,849. ■

Nurses may soon be able to 'see' patient vital signs

High-tech system turns data into visual models

An artificial computer intelligence system that can collect thousands of data bits on patients' vital signs in the ICU, converting them into easy-to-read three-dimensional graphic models is currently being tested.

The technology will enable nurses and other clinicians to quickly detect potentially dangerous deviations from a patient's normal or ideal vital signs and would allow sufficient time to remedy the situation if a problem were to exist.

Nurses also would save time when routinely monitoring critically-ill patients. Instead of periodically recording each patient's vitals and having the data analyzed and periodically interpreted by physicians, the intelligence tool permits faster readings and data analysis.

Researchers at the University of Pennsylvania Medical Center in Philadelphia presented the "smart" ICU monitoring system at a meeting of the American Society of Anesthesiologists last October. However, the technology is not yet ready for practical applications, and it may be a while before it is put into actual use.

"We've designed a system that takes accepted, available information and translates it into a graphic analysis that can spot dangerous deviations from 'ideal' vital-sign ranges and remedy problems quickly," says **C. William Hanson III**, MD, chief of anesthesia and critical care medicine at UPMC.

The computer application collects patient data such as heart rate, blood pressure, and blood flow measurements and converts the vital signs into graphic models that can be instantly viewed and analyzed. When downloaded, nurses get a visual picture of the vital signs in the form of colored graphs for comparisons.

The system utilizes neural networks and fuzzy logic — two common artificial computer intelligence tools used in other industries to assist in running elevators, air conditioning units, and subway systems. The tools collect key data that can alert managers of changes in conditions that could affect consumers. ■

CE objectives

After reading this issue of *Critical Care Management*, participants in the continuing education program should be able to:

- Explain key reasons that hospitals have failed to reduce hospital-based readmission rates.
- Cite changes in nursing behaviors that can improve weaning results in mechanically ventilated patients.
- Determine which patients are best suited for an ICU fast-track protocol.
- Discuss factors that have led to the higher survival rate of children in pediatric ICUs. ■