Evidence-Based Practice Habits: Putting More Sacred Cows Out to Pasture

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For excellence in practice to be the standard for care, critical care nurses must embrace evidence-based practice as the norm. Nurses cannot knowingly continue a clinical practice despite research showing that the practice is not helpful and may even be harmful to patients. This article is based on 2 presentations on evidence-based practice from the American Association for Critical-Care Nurses' 2009 and 2010 National Teaching Institute and addresses 7 practice issues that were selected for 2 reasons. First, they are within the realm of nursing, and a change in practice could improve patient care immediately. Second, these are areas in which the tradition and the evidence do not agree and practice continues to follow tradition. The topics to be addressed are (1) Trendelenburg positioning for hypotension, (2) use of rectal tubes to manage fecal incontinence, (3) gastric residual volume and aspiration risk, (4) restricted visiting policies, (5) nursing interventions to reduce urinary catheter-associated infections, (6) use of cell phones in critical care areas, and (7) accuracy of assessment of body temperature. The related beliefs, current evidence, and recommendations for practice related to each topic are outlined. (Critical Care Nurse. 2011;31:38-62)

If we want excellence in practice to be the standard for care, critical care nurses must embrace evidence-based practice as the norm. We cannot knowingly continue a clinical practice despite research that shows that the practice is not helpful and may even be harmful to the patients we serve. This article is devoted to putting some clinical sacred cows out to pasture. It is based on 2 presentations on evidence-based practice from the American Association of Critical-Care Nurses’ (AACN) National Teaching Institute in 2009 and 2010.

The Institute of Medicine defines evidence-based practice as “the integration of best research, clinical expertise, and patient values in making decisions about the care of individualized patients.” One would hope that clinicians would strive for this goal in all practice decisions. Unfortunately, philosophical goals and clinical realities are not always congruent. Many practice decisions that were originally based on intuition and tradition have not changed despite compelling evidence that change is warranted. The classic example (addressed in the first article in this series, “Seven Evidence-Based Practice Habits: Putting Some Sacred Cows Out to Pasture”) is the use of instillation of normal saline into an endotracheal tube before suctioning to “loosen secretions.” Not only does this practice not loosen secretions, it harms patients and may be a major contributing factor to ventilator-associated pneumonia.

Cutting-edge practice decisions are commonly based on research or the best available evidence. It is the older practice habits or “sacred cows” that are more challenging to change because the practices are considered routine and beyond dispute.

The implementation of evidence-based practice at the bedside takes commitment and an effective process. Excellent process models to assist in
this goal have been published. Table 1 lists 9 evidence-based practice models that offer step by step approaches and frameworks to use. The typical process prescribed by the models is to ask a clinical question, determine whether solid evidence exists to support a particular practice, compare current practice with the research recommendations, and make appropriate clinical changes based on the evidence. Although the process is seemingly simple, articulating the implementation is more challenging, although not impossible. Once the research or evidence is collected, it must be evaluated for strength and quality by using levels of evidence. AACN recently published an updated guide for level of evidence in Critical Care Nurse. Table 2 provides examples of other evaluation tools that may be used to assist clinicians in the evaluation of research and evidence in deciding if the evidence is compelling enough to recommend a change in practice.

This article addresses 7 practice issues that were selected for 2 reasons. First, they are within the realm of nursing, and a change in practice could improve patient care immediately. Second, these are areas in which the tradition and the evidence do not agree and practice continues to follow tradition or “sacred cows.” The topics to be addressed are as follows:

1. Trendelenburg positioning for hypotension
2. Use of rectal tubes to manage fecal incontinence
3. Gastric residual volume (GRV) and aspiration risk
4. Restricted visiting policies
5. Nursing interventions to reduce urinary catheter–associated infections
6. Use of cell phones in critical care areas
7. Accuracy of assessment of body temperature

The related beliefs, current evidence, and recommendations for practice related to each topic are described.

### Trendelenburg Positioning for Hypotension

Use of the Trendelenburg position was originally intended to improve surgical exposure for abdominal procedures. In the late 1800s, Friedrich Adolf Trendelenburg and one of his students, W. Meyer, first

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### Table 1 Evidence-based practice models

<table>
<thead>
<tr>
<th>Model</th>
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<tbody>
<tr>
<td>Iowa model</td>
</tr>
<tr>
<td>Stetler’s model</td>
</tr>
<tr>
<td>Rosswurm and Larrabee’s model</td>
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<tr>
<td>Johns Hopkins Nursing model</td>
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<tr>
<td>ACE Star Model of Knowledge Transformation</td>
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<tr>
<td>ARCC (Advancing Research and Clinical Practice Through Close Collaboration) model</td>
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<tr>
<td>AHRQ (Agency for Healthcare Research and Quality) model</td>
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<tr>
<td>PARIHS (Promoting Action on Research Implementation in Health Services) framework</td>
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<tr>
<td>Colorado model</td>
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### Table 2 Systems for evaluating levels of evidence

<table>
<thead>
<tr>
<th>System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Association for Critical-Care Nurses (AACN)</td>
<td>A level strategy for grading; level A is the strongest evidence and M is manufacturer’s recommendation only</td>
</tr>
<tr>
<td>Modified HICPAC Categorization Scheme for Recommendations</td>
<td>5-scale system</td>
</tr>
<tr>
<td>Grades of Recommendation, Assessment, Development and Evaluation (GRADE System)</td>
<td>Used to evaluate evidence for Surviving Sepsis Guidelines</td>
</tr>
<tr>
<td>American Heart Association</td>
<td>Used an 8-level scale with 4 classifications to support recommendations for Basic Life Support and Advanced Cardiac Life Support</td>
</tr>
</tbody>
</table>
1960s, however, Weil and Whigham described the position as a supine head-down tilt of at least 45º. From a practical aspect, patients placed in the Trendelenburg position had to be prevented from sliding head-down off the table. Despite these adverse outcomes for patients, the practice of placing patients in the Trendelenburg position persists.

**Related Beliefs and Current Evidence**

The use of the Trendelenburg position for hypotension and shock has been studied for more than 50 years. The proposed physiological benefit is the shift of intravascular volume from the lower extremities and abdomen to the upper part of the thorax, the heart, and the brain, thus improving perfusion to heart and brain. It is estimated that a head-down position results in a 1.8% displacement of blood volume. In the 1960s, however, Weil and Whigham reported deleterious effects of using the Trendelenburg position in animals and humans. In a hemorrhagic shock model with rats, mortality and hemodynamic responsiveness were least favorable in the head-down position; in humans with hypotensive shock, blood pressure decreased, lung volumes were compromised, and the risk of retinal detachment and cerebral edema increased.

Cardiovascular response to the Trendelenburg position appears to be influenced by the presence of hypotension and the patient’s ability to maintain homeostasis. For example, in normotensive patients placed in the Trendelenburg position, little deleterious hemodynamic effect is observed. Even in elderly normotensive patients, who may have some degree of impairment of vaso-motor control owing to their age, no deterioration was noted in cardiac hemodynamic parameters with use of the Trendelenburg position.

Hypotensive patients appear to have different and more varied cardiovascular responses to the head-down position, and they show no improvement in blood pressure or cardiac index. As well, key components of tissue oxygenation are not improved with the Trendelenburg position. Most investigators have concluded that use of the Trendelenburg position in hypotensive patients has no cardiovascular benefit.

Hewer, in his 1956 review of complications of the Trendelenburg position, discussed the untoward effects on lung ventilatory mechanics and pulmonary gas exchange. These effects included reduced vital capacity even at 20º head-down tilt, increased work of breathing, and impaired respiration causing hypercarbia and hypoxemia. In the head-down tilt position, the cephalad shift of abdominal contents increases abdominal pressure, impairs diaphragmatic function, and impedes lung expansion. In the Trendelenburg position, mechanical impedance of the lung and chest wall increases and is associated with increased resistance and decreased tidal volume. Ventilation and perfusion abnormalities, evidenced by an increase in intrapulmonary shunting, are also reported in the Trendelenburg position. Not surprisingly, as body weight increases, lung resistance and gas exchange abnormalities also increase significantly, which has important clinical implications for obese critically ill patients; thus the Trendelenburg position should be avoided in such patients.

Little research is available on the effect of Trendelenburg position on intracranial pressure; however, some agree that it is likely to increase intracranial pressure because of the increased central venous pressure, but the effects on cerebral blood flow are uncertain. Distension of the internal jugular vein has been measured and is increased in head-down tilt, but internal jugular blood flow is unchanged. Researchers disagree on the effect of the Trendelenburg position on intracranial pressure and cerebral blood flow, with some concluding that those factors do increase, while others conclude that cerebral hemodynamics are not affected. One clinical protocol that uses Trendelenburg positioning for postural drainage of the lungs in patients with brain injury originally incorporated criteria based on changes in intracranial pressure and cerebral perfusion pressure and now also includes reduced brain tissue oxygenation for more precision, as the basis for returning the patient to supine or head-up position.
In reviewing the literature related to the physiological effects of the Trendelenburg position and its use to treat hypotension and shock, we encountered a number of limitations that made it difficult to draw definitive conclusions. Studies were conducted with a variety of populations (e.g., animals, healthy volunteers, or normotensive patients), sample sizes were relatively small, the methods used various degrees of head-down positioning that ranged from 10° to 30° and the length of time in this position also varied, and various endpoints were measured. Despite these study limitations, most of the findings are consistent in that they show no demonstrated benefit of the Trendelenburg position for hypotension or shock. Thus the evidence does not support the use of head-down tilt for hypotension.

**Recommendations for Practice**

Trendelenburg position increases venous return but has little or no beneficial effect on cardiac output or blood pressure; the improvement, if any, is temporary. Pulmonary gas exchange is impaired in the head-down tilt position, thus overall oxygen delivery may not improve at all. As well, the deleterious effects on lung mechanics and oxygenation are more exaggerated in obese patients. Cerebral blood flow and intracranial pressure most likely increase in the Trendelenburg position, and the effect may be deleterious in some patients with brain injuries. The gravitational movement of mucus and gastric secretions to the oropharynx may increase the potential for aspiration. Table 3 provides a summary of the evidence and physiological response to the Trendelenburg position.17,21,24,25,27,28

Alternatives to Trendelenburg positioning, such as passive leg lift, may provide greater benefit for initial management of hypotension or prediction of fluid responsiveness with minimal or no untoward effect.34,35 Raising the patient’s legs while keeping the head of the bed horizontal relative to the patient’s trunk produces an approximate volume shift of 150 to 300 mL to the upper part of the thorax.34,35 This shift increases aortic volume, may not activate baroreceptors, and avoids risk of gastric aspiration. In one study,25 researchers reported the same adverse cardiovascular and pulmonary effects for passive leg raising as for Trendelenburg positioning in 18 cardiac surgery patients. Others have shown that this maneuver correlates with the response to fluid loading and is predictive of the need for fluid when a patient’s cardiac output, stroke volume variation, or blood pressure respond positively to the leg lift maneuver.34,35

The evidence, despite the aforementioned limitations, does not show a demonstrated benefit of the Trendelenburg position for patients with hypotension and/or hypovolemic shock, and such positioning is associated with impaired ventilation and oxygenation and may have other deleterious effects as just mentioned. Despite these findings, a survey of critical care nurses about practices related to use of Trendelenburg position conducted in the late 1990s showed that 80% of the respondents would consider using Trendelenburg positioning to improve hypotension.36 Although little new research has been done since that time, dissemination of information related to the deleterious effects and lack of benefit of this position has continued.37 A repeat survey would be useful to determine if this tradition-based practice persists.

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**Table 3** Physiological effects of Trendelenburg positioning in hypotensive patients

<table>
<thead>
<tr>
<th>Cardiovascular</th>
<th>Pulmonary</th>
<th>Tissue perfusion</th>
<th>Gastrointestinal</th>
<th>Neurological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight increase in mean arterial pressure</td>
<td>Reduced vital capacity</td>
<td>No change in oxygen delivery</td>
<td>Cephalad shift of abdominal contents</td>
<td>Possible increase in intracranial pressure associated with increase in central venous pressure</td>
</tr>
<tr>
<td>No increased preload</td>
<td>Increased work of breathing</td>
<td>No change in oxygen extraction</td>
<td>Increased abdominal pressure</td>
<td>Distention of internal jugular vein</td>
</tr>
<tr>
<td>Dilated right ventricle</td>
<td>Decreases in PaO₂</td>
<td>No change in oxygen consumption</td>
<td>Impaired diaphragmatic function</td>
<td></td>
</tr>
<tr>
<td>Decreased right ventricular ejection fraction</td>
<td>Increases in mechanical impedance of lung and chest wall</td>
<td></td>
<td>Impeded lung expansion</td>
<td></td>
</tr>
<tr>
<td>Decreased cardiac output</td>
<td>Decreased tidal volume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in systemic vascular resistance</td>
<td>Decreased lung compliance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increases in PaCO₂</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Use of Rectal Tubes to Manage Fecal Incontinence

Critically ill patients with incontinence are at high risk for perineal skin damage, which may also increase the patient’s risk for pressure ulceration, secondary dermal injury, and infection.38-40 Urinary and fecal incontinence harm the protective skin barrier through excessive moisture that macerates the skin, compromising its defensive functions for the body. Digestive enzymes and bacteria inherently found in feces alter the pH and irritate the skin, increasing the risk of incontinence-associated dermatitis and infection.38,40,41 Nursing management of critically ill patients with acute diarrhea is focused on protecting the skin as well as containing the diarrhea. Research to effectively manage acute fecal incontinence is limited; however, evidence is evolving and best practice guidelines are available to guide practice.40,42

Related Beliefs and Current Evidence

Use of rectal tubes to divert fecal material away from the skin and into a collection bag, a traditional approach, is the least safe intervention and the procedure is poorly defined.40,42,43 Little research exists to support the use of traditional rectal tubes (eg, mushroom catheter with a soft flared tip, urinary catheter with a balloon); however, these devices have been used in practice without clear evidence of the efficacy and safety of the devices for management of fecal incontinence.44

Best practice for the management of fecal incontinence, to minimize skin breakdown (ie, incontinence-associated dermatitis and pressure ulcers), starts with an evaluation of the cause of the diarrhea.45,47 Begin by reviewing the patient’s medical history, current medications, and treatments that may increase gastric motility or diarrhea. Table 45,47-49 provides a list of factors to consider in evaluating the etiology of the patient’s diarrhea.

Fecal incontinence may be a secondary consequence of the patient’s disease or treatment (eg, antibiotics), so several interventions can be implemented to protect the skin before placement of a device in the rectum to divert stool. Nursing interventions to minimize skin breakdown from fecal incontinence should be implemented early by anticipating excessive moisture or diarrhea on the basis of the patient’s current plan of care (Table 5).

When fecal incontinence is excessive or incontinence-associated dermatitis is progressing, the use of fecal containment devices may be indicated. These devices can be divided into 2 categories: fecal pouches or indwelling retention devices (tubes). When choosing a fecal containment device to move effluent away from the perigenital skin, critical care nurses should assess the patient’s perineal skin and factors believed to be associated with the diarrhea.

Fecal collectors, also called anal bags/pouches, when applied correctly are an effective option to control and contain liquid feces.38,40,57 Fecal collectors are external devices that consist of a self-adhering skin barrier and attached pouch that connects to a drainage bag, providing a closed system to move liquid stool away from the skin. This system is external, providing less risk to the patient’s rectal sphincter and internal mucosa.40,57 When applied correctly, fecal collectors can prevent skin breakdown, minimize odor, track output accurately, decrease exposure to fecal material, minimize caregiver time, enhance patients’ comfort, and save money.40 In a study57 conducted in Europe, the fecal collector was evaluated in 120 hospitalized patients. The vast majority (96%) of nurses reported that the device preserved perineal skin integrity, and none of the patients had adverse skin breakdown while the device was in place. Additional benefits of a fecal collector include the following: it can be used indefinitely, as needed, to manage diarrhea; it will not interfere with gastrointestinal activity as

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**Table 4 Possible risk factors to consider in evaluating the cause of acute fecal incontinence**

<table>
<thead>
<tr>
<th>Type</th>
<th>Risk factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease processes</td>
<td>Gastrointestinal and hepatic diseases</td>
</tr>
<tr>
<td></td>
<td>Sepsis</td>
</tr>
<tr>
<td></td>
<td>Spinal cord injury</td>
</tr>
<tr>
<td></td>
<td>Enterotoxins</td>
</tr>
<tr>
<td>Medications</td>
<td>Nonsteroidal anti-inflammatory drugs, antimicrobial agents,</td>
</tr>
<tr>
<td></td>
<td>angiotensin-converting enzyme inhibitors, β-blocking agents,</td>
</tr>
<tr>
<td></td>
<td>digoxin, lactulose, diuretics</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Enteral tube feeding (consult nutritionist to determine optimal tube feeding formula and rate to minimize diarrhea)</td>
</tr>
</tbody>
</table>
diarrhea resolves; and it will not compromise the rectal sphincter and mucosa.

The nasopharyngeal airway (nasal trumpet) has been studied as a device to contain fecal incontinence in critically ill patients. With this method, a soft nasopharyngeal airway is inserted into the rectum and connected to a drainage collection system. Research on this method of fecal containment is limited; however, initial results indicate that the device was well tolerated by patients, was practical for nurses, and effectively contained fecal matter without untoward effects for patients.

Traditional rectal tubes (e.g., mushroom catheter with a soft flared tip, urinary catheter with a balloon) for management of liquid stool are considered the least safe approach for management of diarrhea. These devices are inserted into the rectal vault and held in place by inflating the balloon or mushroom tip of the catheter. Table 6 outlines the advantages and disadvantages of these traditional devices for fecal diversion. The use of balloon tubes or mushroom catheters is an adaptation of the device for fecal containment, and because of the lack of evidence to support their safe and effective use and the availability of other fecal containment systems, these devices should be avoided in current practice.

### Table 5 Evidence-based management of fecal incontinence

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Evidence-based intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess patient's risk for fecal incontinence; anticipate fecal incontinence associated with disease, medications, interventions</td>
<td>Protect the skin with moisture barrier products in anticipation of diarrhea</td>
</tr>
<tr>
<td>Assess the patient for risk of pressure ulcers and excessive moisture and prolonged immobility by using a valid and reliable risk assessment tool</td>
<td>Complete a risk assessment daily and with a change in patient’s condition; implement interventions based on specific findings on risk assessment</td>
</tr>
<tr>
<td>Assess skin during the cleansing process Cleanse the skin with no-rinse cleanser, moisturize and protect the skin with each episode of incontinence</td>
<td>Using soap and water with a washcloth is not optimal for basic skin care. Soaps are frequently alkaline and further damage the protective acidic mantle of the skin. Washcloths may increase friction and damage fragile skin. No-rinse bathing/perineal cleansing wipes are pH balanced, gentle on the skin, and enhance removal of organic debris. Research shows that no-rinse bathing products are effective in reducing bacteria on the skin. Incontinence overhydrates skin but removes essential oils that need to be replenished by applying moisturizers and moisture barrier products.</td>
</tr>
<tr>
<td>Assess the need for moisture absorbing incontinence pad to wick effluent away from the skin</td>
<td>Use a single moisture-absorbing or wicking underpad under the patient to pull effluent/moisture and liquid stool away from skin. Avoid the use of diapers, especially with immobile patients, as diapers trap fecal material against the skin and exacerbate skin damage. Limit layers of linens beneath the patient; multiple layers of linen can inhibit bed redistribution technology and air flow from reaching the skin. Excessive linen entraps moisture, creates crinkles and pressure, and may increase the risk of pressure ulcers.</td>
</tr>
<tr>
<td>Assess the need for air flow near the skin and advanced bed redistribution technology (follow hospital protocol for advanced bed therapy); avoid excessive linen</td>
<td>Obtain bedside commodes and implement a toileting schedule to minimize incontinence epidose</td>
</tr>
<tr>
<td>Assess patient’s mobility and encourage toileting</td>
<td>Consider consult a nutritionist for diarrhea believe to be related to tube feeding</td>
</tr>
<tr>
<td>Assess nutritional needs and evaluate tolerance of tube feeding</td>
<td>Fungal infection may be managed effectively with the application of topical antifungal barrier creams</td>
</tr>
<tr>
<td>Evaluate skin for fungal infection associated with fecal incontinence</td>
<td>Consider fecal collectors or bowel-management system</td>
</tr>
<tr>
<td>Assess skin, development of incontinence-associated dermatitis, as well as frequency and consistency of stool to determine need for a fecal containment device</td>
<td>Remove fecal containment devices when liquid stool resolves</td>
</tr>
<tr>
<td>Assess resolution of cause of diarrhea, changes in diarrhea flow, consistency, and skin condition to determine need for ongoing fecal containment device</td>
<td></td>
</tr>
</tbody>
</table>
Bowel management systems (BMSs), also called fecal management systems, are medical device systems designed to direct, collect, and contain liquid stool in immobile patients. Several BMSs are commercially available and approved by the Food and Drug Administration for up to 29 days of use for management of liquid stool. Several studies have been conducted to evaluate the effectiveness and safety of using BMSs for diarrhea management. Padmanabhan and colleagues evaluated the outcomes of 42 patients in whom a BMS was used to contain diarrhea. The researchers found that the device did not harm the rectal mucosa (by performing endoscopy at baseline and after removal of the BMS), perigenital skin condition improved in 92% of the patients, and the health care providers reported that the system was easy to manage. Keshava et al conducted a prospective study of inpatients admitted for burn management or to the geriatric unit. Twenty-two patients with diarrhea were managed with a BMS. Mean duration of therapy was 14 days. Proctoscopy after tube removal showed normal rectal tissue, and the health care providers in that study also reported ease of use of the device. In a quality improvement study, researchers found that the combination of interventions to prevent pressure ulcers along with the introduction of a BSM in their critical care unit resulted in a significant decrease in the frequency of pressure ulcers. Although a direct correlation cannot be made between the BMS and the reduction in frequency of pressure ulcers, use of a BMS to contain diarrhea and manage excessive moisture combined with strategies for preventing pressure ulcers resulted in good outcomes for patients.

Critical care nurses should assess the need for a BMS to manage severe diarrhea with the goal of removing the devices as soon as possible.

**Recommendations for Practice**

Management of fecal incontinence to minimize incontinence-associated dermatitis and pressure ulcers begins with an accurate nursing assessment of the patient’s risk for fecal incontinence, early proactive perineal skin hygiene to protect skin and minimize irritation, and critical evaluation of when an external fecal containment device or BMS is needed. Evidence-based interventions (Table 5) should be used in the care of patients with fecal incontinence.

### Gastric Residual Volume and Aspiration Risk

Little evidence supports the use of measurement of GRV to assess gastric emptying and tolerance of tube feeding, yet the practice of assessing GRV while a patient is receiving tube feeding persists. Several assumptions may exist related to the assessment of GRV. First, the nurse may assume that GRV provides information about normal and abnormal gastric emptying. Second, the nurse may think that an elevated GRV indicates delayed gastric emptying and intolerance of enteral tube feeding. Third, a high GRV may be believed to result in a higher risk...
for aspiration that may lead to aspiration pneumonia. In fact, the evidence has demonstrated that checking a GRV in enteraly fed patients does not improve patients’ outcome or reduce complications.65,71 So why do we continue to check GRV, and what evidence supports continuing this practice?

Related Beliefs and Current Evidence

The lack of definition of how to measure GRV accurately creates a challenge in clinical practice.68,69 Most guidelines suggest the use of a large-volume syringe (60 mL) for aspiration of fluid because smaller syringes may collapse the gastric tube.64,66 However, use of a syringe may not consistently result in aspiration of the total volume of fluid present in the stomach.70,73 GRV is more easily obtained from large-bore gastric tubes (eg, 14F-16F diameter) than small-bore gastric tubes (8F-12F diameter). Metheny and colleagues74 reported that larger GRVs were detected 2 to 3 times more often with large-bore gastric tubes than with gastric tubes with a smaller bore. Other variables that affect measurement accuracy include the position of the tube port in the gastric antrum, the patient’s position, and the tube’s location near the gastroesophageal junction.68,72 GRV with enteral feeding tubes placed beyond the pylorus is questionable because of the small size of these tubes and the physiological properties of the small bowel to continuously propel gastric contents forward, unlike the gastric antrum.66 Similarly, if a gastric tube migrates near the gastroesophageal junction, GRV will be negligible in most cases.60 Frequent monitoring (eg, every 4 hours) of GRV is indicated as one method to monitor gastric tube location. After obtaining radiographic confirmation of accurate placement of a gastric tube, observing the appearance and changes in the volume of gastric aspirate may assist in monitoring for migration of the gastric tube.75

Another debate about the monitoring and interpretation of GRV is defining what constitutes a high gastric residual.64,66-68 Under normal conditions, saliva and gastric fluids accumulate at approximately 188 mL/h in the stomach; thus any order to withhold tube feedings for a GRV less than 188 mL is inappropriate.64 Published reports vary in providing guidance for what constitutes a high gastric residual, ranging from 150 mL to 500 mL of aspirate.64,65,66,68,71,72 Best evidence suggests that a single high GRV should be monitored for the following hour, but enteral feeding should not be ceased or withheld for an isolated GRV greater than 250 mL.65,68 Serial hourly elevated GRVs greater than 250 mL may require withholding enteral feeding for an hour in conjunction with evaluation for prokinetic agents to promote gastric motility and assessment of possible causes for decreased gastric tolerance, including a change in the patient’s acuity.64,66,68 Elevation of GRV is anticipated to be greatest in the first few days of enteral feeding. Questions remain unanswered on when to stop checking GRV to evaluate tolerance of enteral feeding.

The greatest concern with withholding enteral feeding because of GRV or concern for aspiration is underfeeding critically ill patients. Elpern et al76 studied enteral feedings in an intensive care unit and found that tube feedings were frequently withheld or stopped for procedures, changes in patients’ body positions, high GRV, and diarrhea. Of the patients studied, a mean of 64% of the patients had their nutrition goals met, and the mean length of interruptions for enteral feeding was 5.23 hours per patient per day. McClave and colleagues67 reported similar results. In their study, only 14% of the patients received 90% goal feeding within 72 hours of starting enteral feeding. Reasons reported in this study for stopping enteral feeding included the following: placement of the patient supine for procedures or nursing care, high GRV, and preprocedure protocols. Little evidence supports the practice of stopping or withholding tube feeding to reposition patients or when placing patients supine briefly for routine care.67 Current evidence suggests reducing the time that enteral feedings are withheld before procedures to minimize underfeeding critically ill patients.66,67

The primary belief associated with high GRV is risk for aspiration by the patient. Aspiration has been demonstrated with GRVs from 5 mL to 500 mL.67 Aspiration is often clinically silent. No reliable clinical marker has been found for risk of aspiration, including GRV assessment.64,66,72,76 Risk for aspiration is increased with hemodynamic instability, increased acuity or critical illness (eg, sepsis), altered level of consciousness, neurological compromise, sedation, and mechanical ventilation. Interventions to minimize aspiration include elevating
the head of bed more than 30°, initiating continuous enteral feedings, using medications to promote gastric motility, and consideration of postpyloric feeding. Ongoing evaluation of patients’ tolerance of enteral feeding is also necessary to interpret GRV. Signs of intolerance may include bloating, abdominal pain, nausea, vomiting, and emesis.

Implementing and adhering to enteral feeding protocols (Figure 1) to minimize unnecessary cessation of enteral feeding is needed to optimize nutrition in critically ill patients. Isolated high GRVs should be reassessed in subsequent hours and accepting higher GRVs in the absence of signs of intolerance is necessary in clinical practice. Increasing GRV may be a symptom of another underlying problem manifesting itself as delayed gastric emptying. If serial measurements of GRV remain elevated, the cause should be explored rather than simply withholding enteral feeding, which is likely to result in underfeeding of critically ill patients.

**Recommendations for Practice**

Critically ill patients are at risk of aspiration because of severity of illness and interventions that compromise the gag reflex. Variables that increase a patient’s risk for aspiration include sedation, mechanical ventilation, neurological compromise/ altered level of consciousness, hemodynamic instability, and sepsis. Preventing aspiration begins with accurate and ongoing assessment of feeding tube placement (see AACN Practice Alert: Verification of Feeding Tube Placement), maintaining the elevation of the head of the patient’s bed at greater than 30°, and evaluating the patient’s tolerance of tube feeding. Assessment of GRV is not an effective method of determining aspiration risk. Table 7 outlines the evidence for GRV monitoring and interventions to prevent aspiration. Implementing an evidence-based enteral feeding protocol inclusive of increased acceptance of higher GRV along with physical assessment of the patient’s tolerance and intolerance of tube feeding will maximize the delivery of adequate nutrition to critically ill patients.

**Restricted Visiting Policies: A Thing of the Past?**

Restriction of visitors for hospitalized patients has been practiced for many decades. For example, in the late 1800s, restricted visiting hours were implemented in some hospitals and applied to nonpaying patients to establish order in general wards. In the early 1900s, paying patients were permitted to have visitors anytime, anywhere. The advent of intensive care units during the 1960s saw restricted visiting implemented to protect patients and family from exhaustion caused by too many visitors. The spectrum of “visiting” can be thought of as a continuum (Figure 2). Current attitudes and practices in critical care units span this continuum.

**Related Beliefs and Current Evidence**

Evaluation of the evidence related to friends and family visiting patients reflects both practitioner preferences and a focus on patient- and family-centered care. A landmark study by Molter in 1979 began to change the attitudes and practices of nurses with regards to visitation. Using the Critical Care Family Needs Inventory, the primary needs of families of critically ill patients were identified to be related to the need for information, support, comfort, assurance, and proximity to the patient. A subsequent study reported that in addition to these needs, families also have a need to be present in order to provide reassurance and support to the patient and to protect the patient.

The needs, preferences, and stressors of critically ill patients also have been examined. In a survey of critical care patients, 40 stressors were identified; number 4 was “missing your spouse,” and number 8 was “only seeing family and friends for a few minutes each day.” These investigators concluded that although some visiting restrictions were appropriate, the policies should be modified and flexibility should be exercised.

Perceived barriers to liberalized visiting and the rationales for restricting visiting in critical care units are multifactorial (Table 8). These concerns were distilled into 3 major groups in a recent study of 171 hospitals, of which 32% had unrestricted, open visiting. The categories are (1) Space: interference with patients right to privacy and confidentiality in instance of shared rooms; (2) Conflict: crowding and traffic, hindering the ability to care for patients and loss of structure and authority for nurses; and (3) Burden: to provide care for both patients and their visitors.

In the past several decades, many studies have been conducted related to the psychological and...
ENTERAL NUTRITION (EN) FEEDING GUIDELINE

Goals: 1) Initiate EN within 24-48 hours of admission ♦ 2) Deliver >90% of required calories on a daily basis.

Elevate HOB to 30-45°. ♦ Initiate Osmolite 1.2 (unless formula otherwise specified) at 25 mL/hour.

1st residual > Maximum GRV?
1) Refeed residual to maximum 400 mL; discard excess
2) Go to PROKINETIC GUIDE (Box A).
3) Continue feeds at same rate.

2nd consecutive residual > Maximum GRV?
1) Continue below

Q4H residual > Maximum GRV (350 mL ♦)?
1) Refeed gastric residual.
2) Continue feeds at same rate if at goal rate; ↑ feeds by 25 mL every 4 hours if not at goal rate.

MAXIMUM GASTRIC RESIDUAL VOLUME (GRV): 350 mL
(unless otherwise specified by physician)

1) Discard gastric residual.
2) ↓ feed rate by 50% (ie, 100→50 mL) to a minimum of 25 mL / hour.
3) Do not stop feeds.
4) If residuals > Maximum GRV after 4 doses of IV metoclopramide consider combination prokinetic therapy and/or small-bowel feeding tube. Refer to SMALL-BOWEL FEEDING GUIDE (Box B).

Rechecked residual > Maximum GRV?
1) Refeed residual to maximum 400 mL; discard excess
2) Hold feeds; recheck residual in 1 hour.

Box A: Prokinetic Guide
1) Initiate metoclopramide ♦♦ 10 mg IV Q6H (5 mg Q6H if ↓ renal function)
2) Continue metoclopramide if already receiving.
3) Do not stop feeds; continue ‘Enteral Nutrition Feeding Guideline’.
4) If residuals > Maximum GRV after 4 doses of metoclopramide, consider combination prokinetic therapy and/or small-bowel feeding tube. Refer to SMALL-BOWEL FEEDING GUIDE (Box B).

Box B: Small-Bowel Feeding Guide
1) Placement: Insert postpyloric feeding tube∗# Requires MD order
2) Feed resumption: Following confirmation of postpyloric tip position, resume feeds at previous rate, ↑ feeds by 25 mL Q4H if not at goal rate.
3) Aspiration prevention (In sedated/intubated patients only): Insert a large-bore nasogastric tube (NG) for gastric decompression. ♦ Clamp NG and discard gastric residuals Q4H (or place on straight drainage).
4) Tube maintenance: Flush postpyloric tube with 10-30 mL water every 4 hours
   If tube clogs, ♦ instill pancreatic enzyme mixture (8000 units crushed pancrelipase; 650 mg crushed sodium bicarbonate; 5-15 mL water) into postpyloric tube per policy. Resume feeds at previous rate,
   ↑ feeds by 25 mL Q4H if not at goal rate. Notify physician after 3 unsuccessful attempts.
5) If EN contraindications (above) or significant N/V or abdominal distention develop, notify physician and consider stopping small-bowel tube feeds.

Refer to “Enteral Nutrition Problem Solving Guide” on UCH Critical Care QI Committee Web site for further EN practice guidelines and recommendations.

* Unless contraindicated ♦ Evidence-based recommendation; all other information opinion-based.

Figure 1
University of Colorado Hospital’s protocol for enteral nutrition.

Developed by: J Greenwood (Vancouver General Hospital) in collaboration with the CCCCPGC 7/2003.

Abbreviations: CCCCPGC, Critical Care Clinical Practice Guidelines Committee; EN, enteral nutrition; GI, gastrointestinal; GRV, gastric residual volume; HOB, head of bed; IV, intravenous; MD, physician; N/V, nausea/vomiting; Q4H, every 4 hours; Q6H, every 5 hours; Q1, quality improvement; SBO, small-bowel obstruction; UCH, University of Colorado Hospital.

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physiological effects of visitors on patients and staff. If patients’ wishes regarding visiting are to be considered, nonstressful and flexible visiting is of primary importance. In one study, researchers reported that patients preferred usually no more than 3 visitors, for about 35 to 55 minutes, on average 3 or 4 times per day and that visitors offered reassurance, comfort, and calming.

Regarding the physiological effects of visitors on patients, research results indicate that visitors have no effect on patients’ blood pressure or heart rate. In a randomized study of a coronary care population, patients having a visitor at a frequency and length of time of the patient’s choosing had fewer cardiovascular complications than did patients whose visitors were permitted to visit only twice a day. The lower complication rate may be due to reduced anxiety and lower cortisol levels associated with time spent with their families and visitors.

Similarly, no physiological rationale exists for restricting visitors of patients with brain injuries. No deleterious effects on
neurological status related to visiting have been reported, and some patients experience a reduced intracranial pressure associated with visits by loved ones.93,94 Patients with traumatic brain injury were monitored during family conversations at the bedside. These patients experienced no change in intracranial pressure; systolic, diastolic, and mean blood pressure; heart rate; respiratory rate; arterial saturation; or restlessness when listening to family voices.95

The beneficial effects of liberal visiting policies on patients’ families are well supported. These effects include reduced family stress and burden; lower anxiety96; family’s ability to serve as a historian, protector, coach, facilitator, and voluntary caregiver97; providing basic care such as baths, mouth care, or massage improves respect, collaboration, perceived support of health care providers, and scores on a family-centered care survey.98

Another mechanism that supports flexible visiting and increases families’ participation in care of loved ones is including patients’ families in daily rounds with the health care team.99,100 Benefits of daily family rounds include the following: decrease in unexpected calls or disruptions of physician team rounds; structured time for clinicians to focus on one patient with that patient’s family; increased participation and active, constructive engagement with the staff; identification of families who may benefit from more formal care conferences; and greater satisfaction of patients and their families with the critical care experience.99 The total time commitment for nurses and physicians on a 12-bed neurotrauma unit was 1 hour or less per day.109 Daily rounds and early and routine family meetings can provide an opportunity to assess the family and foster communication, understanding, and collaboration between the family and health care providers.101

The American College of Critical Care Medicine charged an interdisciplinary group of physicians, nurses, and a clinical pharmacist to develop evidence-based guidelines for support of family-centered care. The authors reviewed numerous studies and made 43 recommendations for practice.101 Table 9 outlines the key recommendations relating to family visiting.

### Table 9

**Recommendations for family visiting from the American College of Critical Care Medicine**

<table>
<thead>
<tr>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open visitation to provide flexibility for patients and their families is permitted and established on a case-by-case basis</td>
</tr>
<tr>
<td>A visitation schedule that is determined collaboratively between patient, patient’s family, and nurse, taking into account the best interest of the patient</td>
</tr>
<tr>
<td>Whenever possible, family presence and participation is encouraged at rounds, and family presence is permitted during resuscitation</td>
</tr>
<tr>
<td>Family participation in patients’ care is encouraged as much as the patient’s condition and the family’s comfort level will allow</td>
</tr>
<tr>
<td>Clean and immunized pets are allowed to visit in the intensive care unit</td>
</tr>
</tbody>
</table>

*Based on evidence from Davidson et al.103*

### Table 10

**Practice implications for family visiting**

<table>
<thead>
<tr>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess and consider the needs of the patient and the patient’s family</td>
</tr>
<tr>
<td>Support flexible visiting hours through the development and implementation of less restrictive and more collaborative visiting protocols</td>
</tr>
<tr>
<td>Include patient’s desires and signage regarding accepting visitors in the protocols</td>
</tr>
<tr>
<td>Develop family presence on rounds program</td>
</tr>
<tr>
<td>Encourage family members to participate in patient care as much as possible when they are visiting</td>
</tr>
<tr>
<td>Address staff security concerns in visiting protocols</td>
</tr>
<tr>
<td>Educate patients’ families about the intensive care unit and visiting protocols, and have the family identify a key spokesperson/contact</td>
</tr>
<tr>
<td>Educate health care providers about evidence that supports open, flexible family visiting</td>
</tr>
</tbody>
</table>

### Recommendations for Practice

Critical care nurses, in their roles as advocates for patients and their families, are in a pivotal position to support patient- and family-centered care, which includes open, flexible visiting. Table 10 lists evidence-based practice implications.

The Joint Commission recently acknowledged the importance of family-centered care and visitation in providing support to patients. As of 2011, the Patient Rights Standard regarding hospitals’ respect, protection, and promotion of patients’ rights (RI.01.01.01) will have a new element of performance: “The hospital allows a family member, friend or other individual to be present.
Delirium in critically ill patients, especially older hospitalized patients, is an increasing concern that is associated with poor outcomes for patients. Multiple factors contribute to delirium, and indwelling urinary catheters have been identified as a specific risk variable. Bladder catheters can act as an informal restraint, limiting patients’ movement, especially when the clinical indication for the device is no longer evident. The presence of an indwelling urinary catheter in a delirious patient increases the risk of falls and the risk for traumatic dislodgment of the catheter and subsequent urethral trauma. Early removal of urinary catheter devices and implementation of normal toileting practices (eg, bedside commode, offering urinal), frequent rounds, use of moisture wicking underpads, reorientation with specific questions concerning elimination needs, and review of medications that may increase urgency/need to void are important nursing interventions in the management of patients with acute delirium.

Similarly, indwelling urinary catheters are not indicated as a primary intervention to manage moisture-related skin breakdown. Skin care interventions to manage incontinence, such as moisture barrier creams and moisture wicking products, should be explored before insertion of a urinary catheter. In the presence of stage III or IV pressure ulcers in the perineal region, an indwelling catheter may be necessary to assist with wound healing.

The need for a bladder catheter with concomitant thoracic patient-controlled epidural analgesia is increased when the patient is critically ill. This new element should provide further impetus to develop and implement flexible visiting protocols in the critical care areas. Perhaps the endorsement of open, flexible visiting is best stated by McAdam and colleagues: “families need to be recognized for contributions they make and invited ‘into the world and work’ of ICUs.”

Nursing Interventions to Prevent Catheter-Associated Urinary Tract Infections

Improving patients’ outcomes often requires rethinking practice, systems, and the “why” behind common interventions and devices used in the management of critically ill patients. The insertion of a urinary catheter device is one example in which reexamining the evidence and nursing care associated provides an opportunity to improved patients’ outcomes. Catheter-associated urinary tract infections (CaUTIs) are the most common hospital-acquired infection, accounting for almost 40% of all nosocomial infections. An estimated 80% of CaUTIs are associated with indwelling urinary catheters.

**Table 11** Evidence-based guidelines for placement of indwelling urinary catheters

<table>
<thead>
<tr>
<th>Clear Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary obstruction/retention</td>
<td>Fall prevention</td>
</tr>
<tr>
<td>Alteration in blood pressure or volume status</td>
<td>Routine urine specimens</td>
</tr>
<tr>
<td>Need accurate measurements of fluid input and output but the patient cannot use urinal or bedpan</td>
<td>Staff/patient request</td>
</tr>
<tr>
<td>Emergency surgery</td>
<td>Excoriated skin</td>
</tr>
<tr>
<td>Major trauma</td>
<td>Altered mental status</td>
</tr>
<tr>
<td>Urologic procedures</td>
<td></td>
</tr>
<tr>
<td>Bladder irrigation</td>
<td></td>
</tr>
<tr>
<td>Management of stage III or greater pressure ulcer</td>
<td></td>
</tr>
<tr>
<td>Comfort care for terminally ill patients</td>
<td></td>
</tr>
</tbody>
</table>

*Based on evidence from Hooton et al., Greene et al., Gould et al., and Saint et al.*

**Related Beliefs and Current Evidence**

Obviously the easiest way to prevent a CaUTI is to avoid insertion of the device. When an indwelling urinary catheter is needed to monitor a patient, however, prevention of CaUTIs begins by understanding the clinical indication for the device and removing the catheter when the clinical condition has resolved. The primary use of a urinary catheter is for close monitoring of a patient’s hemodynamics and fluid balance, surgical procedures, and urologic diseases. The literature suggests that urinary catheters are not indicated to prevent falls, for management of patients with altered mental status, to avoid skin excoriation, or to obtain urine specimens. Table 11 provides a list of clear indications for insertion of urinary catheters as well as a list of conditions in which a catheter is not indicated.
another area for opportunity to reexamine practice and reduce CaUTIs. Research results indicate that an indwelling urinary catheter can be safely removed in conjunction with thoracic patient-controlled analgesia therapy.116,117 Early removal of the catheter in these studies was associated with earlier ambulation, shorter length of hospitalization, lower CaUTI rate, and lower incidence of postoperative urinary retention.118,119 Once a patient with a thoracic patient-controlled epidural for analgesia is hemodynamically stable, the evidence suggests that removal of the bladder catheter should be considered.116-118

Knowing the clear indication for the bladder catheter and minimizing catheter duration are important first steps in preventing CaUTIs. Exploring options for elimination when an indication for an indwelling catheter is not clear is essential to reduce unnecessary insertion of devices. Daily reevaluation of the need for the indwelling device, discussing a discontinue order with the prescribing provider, and prompt removal are also important steps to reduce the risk for infection.

Many critically ill patients need an indwelling urinary catheter to monitor fluid balance and hemodynamic status. In the event that a bladder catheter is necessary, nursing interventions in the management of the bladder catheter may assist in the reduction of CaUTIs. Table 12 summarizes current evidence to help prevent CaUTIs.

Placing an indwelling urinary catheter device is a fundamental skill taught to all nurses. Opinions vary on whether to use sterile or aseptic technique for the placement of the device to reduce CaUTIs.108,118 Part of the challenge is defining sterile and aseptic technique within the clinical context of the skill.121 Willson and colleagues120 conducted a review of the literature and found that aseptic technique for urinary catheter placement was most often defined as the use of sterile gloves, mask, sterile barriers, perineal washing using an antisepic cleanser, and no-touch insertion technique. Current recommendations suggest that maintaining aseptic technique and using sterile equipment while inserting the catheter are both important elements to minimize infection.106,108,109

Part of urinary catheter care includes care of the urethral meatus. Research on meatal care with antiseptic cleansers, creams, lotions, or ointments found them to be to be no better than routine perineal care provided with soap and water at reducing CaUTIs.106,118,120,122,124 Some evidence suggests that antiseptic agents may actually increase the risk of infection by irritating the urethral meatus.120 Current guidelines suggest “routine hygiene” (eg, cleansing of the meatal surface during daily bathing) is all that is needed to maintain an indwelling urinary catheter.106,108,109

Securing the indwelling urinary catheter is strongly recommended in the guidelines of the Centers for Disease Control and Prevention.100 Research evidence describing the effectiveness of securing a urinary catheter and the prevention of CaUTIs is limited.100,120,122,124,125 The practice of securing a catheter is primarily based on clinical experience and expert opinion (ie, Society of Urologic Nurses and Associates).125 which suggests that securing the urinary catheter prevents urethral trauma, erosion, and inadvertent removal and increases patients’ comfort.124 A number of devices for securing catheters are available, and many experts recommend applying the device to the upper thigh in women and the abdomen in men.124,125

Maintaining a closed system to prevent CaUTIs is supported by current guidelines.106,108,110 Catheter and drainage systems are designed with prepackaged seals to prevent inadvertent disconnection and act

**Table 12** Recommendations for practice to reduce occurrence of catheter-associated urinary tract infections

<table>
<thead>
<tr>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the indication for the indwelling urinary catheter. Use automatic stop orders and reminders to request an order to remove the device when the indication is resolved.109</td>
</tr>
<tr>
<td>Use aseptic technique with sterile equipment to insert the device.106,108,109 Aseptic technique is most often defined as the use of sterile gloves, mask, sterile barriers, perineal washing using an antiseptic cleanser, and no-touch insertion technique.120</td>
</tr>
<tr>
<td>Perform routine meatal care with soap and water during daily bathing.106,108,109 Use of antiseptic cleansers, creams, lotions, or ointments is no better than perineal care provided with soap and water.106,118,120,127 Antiseptic agents may irritate the urethral meatus and increase the risk of infection.120</td>
</tr>
<tr>
<td>Maintain a closed system108,109,110 with the drainage bag below the level of the bladder.</td>
</tr>
<tr>
<td>Use a catheter securement device.124,125</td>
</tr>
<tr>
<td>Explore elimination options to prevent reinsertion (eg, bladder scanner, bedside commode, urinal, moisture wicking underpads, nursing rounds).120,127</td>
</tr>
</tbody>
</table>

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as a physical barrier to the migration of microbes. If drainage system seals are broken in practice, a systems analysis of the most common barriers to maintaining the closed system should be explored. For example, if the emergency department uses bladder catheter systems without metered drainage collection devices, the critical care nurse may need to break the system to obtain a metered urometer for hourly monitoring. System analysis could suggest a change to all metered catheter kits, streamlining products and enhancing compliance with evidence-based practice guidelines. Maintaining the collection bag below the level of the bladder is another important practice recommendation, as it minimizes reflux into the catheter itself and prevents retrograde flow of urine. Emptying the drainage bag frequently and before all patient transports is a simple and effective strategy to reduce CaUTIs. Resist the habit of placing the drainage bag between the patient’s legs during transport. All health care providers need to work together to keep the drainage bag below the bladder.

The effectiveness of ultrasound bladder scanners as a strategy to reduce CaUTIs is not well studied, and further research is needed to demonstrate effectiveness of this monitoring intervention. However, the clinical benefits of bladder scanners include effective diagnosis of urinary retention, reduction of unnecessary intermittent catheterizations, enhanced comfort for patients, and cost savings associated with inappropriate catheterizations. Ultrasound bladder technology provides an assessment tool to assist with early removal of indwelling invasive urinary catheters.

The evidence to support the use of urinary catheters coated with an antimicrobial agent (silver alloy or antibiotic) to reduce CaUTIs is inconclusive. The clinical evidence defining the safety, efficacy, and appropriate use of silver-coated urinary catheters in randomized controlled trials supports the use of such devices in reducing CaUTI in patients with short catheter durations; however, the magnitude of reduction in infection did not differ significantly from uncoated catheters in all trials. Current guidelines do not recommend routine use of coated catheters in all hospitalized patients to reduce CaUTI.

In a recent systematic review and meta-analysis, Meddings et al found that urinary catheter reminders and stop orders appeared to reduce CaUTI rates. Implementing systems that provide physicians and nurses with routine reminders to evaluate the need for the bladder catheter reduced the rate of CaUTIs by 56% (P = .005). Automatic stop orders in this study reduced the rate of CaUTIs by 41% (P < .001). Overall use of urinary catheters was also found to be decreased in several of the studies analyzed in that meta-analysis.

Recommendations for Practice

Indwelling urinary catheters are commonly used devices in the management of critically ill patients, and evidence-based nursing interventions are needed to prevent infection. One intervention, in isolation, is less effective than a bundle of interventions in preventing CaUTIs. Focusing nursing care on the basis of best-practice interventions is necessary to minimize critically ill patients’ risk for developing a CaUTI. Using a multidisciplinary approach to prevent CaUTIs is the most effective method of improving patients’ outcomes. Several programs are available to assist organizations in developing CaUTI prevention programs (eg, from the Association for Professionals in Infection Control and Epidemiology Inc). Using these programs along with frequent publication of the teams’ efforts in reducing CaUTIs will support the momentum of this change. Ensuring that management of indwelling urinary catheters is based on best evidence is essential to improving patients’ outcomes.

Use of Cell Phones in Critical Care Areas

Cellular phone technology is used every day by millions of people in all walks of life, businesses, and professions. Cell phones have become an integral tool of the medical community as a means of fast and convenient communication, yet cell phone restrictions remain in critical care units. What is the science behind the restrictions?

Related Beliefs and Current Evidence

In many hospitals, cell phones are used as a primary means of communication with medical staff in case of emergency and have become an essential clinical resource for accessing information in the care of critically ill patients. In a recent survey, 70% of medical personnel indicated that they carry their mobile devices to areas such as the operating room and critical care...
units despite strict restrictions, and 95% ranked their ability to use mobile phone technology in the hospital as very important or important. Despite the vast array of uses and popularity in the health care arena, mobile technology remains banned in many hospitals nationwide. These bans originated in the era of analog telephone devices and have remained in place despite numerous technological advances. Current policies often state that cellular telephones must be turned completely off when arriving in the hospital or in the critical care areas, a difficult policy to enforce. These rules are based on the premise that cellular devices when in the “on” position transmit detrimental electromagnetic interference. The examination of effects of electromagnetic interference are outlined in Table 13.

Policies regarding patient safety concerns related to electromagnetic interference have been focused primarily on the distance between the cellular device and medical equipment. This has also been the focal point of clinical studies related to electromagnetic interference. Mechanical ventilators have been identified as one of the most critical pieces of medical equipment and therefore have been the most commonly examined biomedical technology. Most studies define cell phone interference as anything from a change in screen appearance, to false alarms, to complete shutdown of the ventilator. In several studies, researchers reported that the maximum distance between the cellular devices and various ventilators that would cause interference with the ventilator function was 100 cm. In another study, researchers identified 9 hazardous incidents involving ventilators that occurred at a median distance of 3 cm (range, 0.1-300 cm) from cellular device to ventilator. Only one of those incidents occurred when the cell phone was more than 100 cm away from the ventilator, and that incident was linked to older generation cellular technology.

Other biomedical equipment that has been examined for the effect of electromagnetic interference includes devices such as pulse oximeters, cardiac monitors, carbon dioxide detectors, and defibrillators. For those items, it was determined that the maximum distance for interference was only 20 cm away. The evidence suggests that the range of electromagnetic interference with various types of medical equipment is 0 to 300 cm (9 feet). However, clinically significant electromagnetic interference with biomedical devices can occur when a cellular phone is less than 100 cm from the device.

Based on analysis of the evidence, new guidelines must be developed that would change current hospitalwide bans of cell phone technology. Current evidence support the Medicines and Healthcare Products Regulatory Agency recommendations of 2004, which state that a total ban is not necessary. To address the concern of distance between the cellular device and biomedical equipment, the notion of a “1-meter rule” should be established. Using that rule, medical personnel as well as patients and family members would be able to use their mobile technology as long as they were more than 1 m away from critical care equipment. This practice provides extra safety, in that interference is most likely to occur when the cell phone is within 3 cm to 20 cm (1 to 8 in) of biomedical devices.

Table 13 Electromagnetic interference: effects on medical technology

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of use</td>
<td>The number of times the device is used in a day</td>
</tr>
<tr>
<td>Time of use</td>
<td>The time of day when the device is used</td>
</tr>
<tr>
<td>Distance from device</td>
<td>The distance between the device and the medical equipment</td>
</tr>
<tr>
<td>Shielding</td>
<td>The degree of shielding that the medical device has against electromagnetic interference</td>
</tr>
<tr>
<td>Interference</td>
<td>The amount of electromagnetic interference is closely linked to the characteristics of the cellular phone</td>
</tr>
</tbody>
</table>

Electromagnetic radiation is emitted intentionally or unintentionally by devices that generate electromagnetic fields, and such radiation may affect the functioning of medical devices. The reception of electromagnetic interference by biomedical technologies used throughout the hospital is a cause for concern about patient safety. The effect of electromagnetic interference on biomedical technology is based on 3 key variables:

- Interference is associated with the distance between the cellular device and the medical equipment.
- The degree of shielding that the medical device has against electromagnetic interference.
- Amount of electromagnetic interference is closely linked to the characteristics of the cellular phone.

Testing of effects of electromagnetic interference on biomedical devices in clinical studies most commonly involves testing the maximum level of frequency required to accept or receive a phone call and the radiation emitted toward the biomedical equipment and the corresponding reaction. Research is needed to explore the degree of shielding built into different pieces of medical equipment to protect against electromagnetic interference, with rigorous evaluation of each brand of equipment used within the hospital.

Evaluation of characteristics of cellular devices and range of interference, minimal to maximal radiation release and proximity to cellular tower, and the location of cell phone use in the hospital.
Another recommendation is to create specific, well-marked “cell phone areas” in convenient locations throughout the hospital that afford use of cell phones without concern for electromagnetic interference. In a recent study,141 creation of rooms where cell phone use was acceptable on an adolescent inpatient unit increased satisfaction among patients. Adolescents rely heavily on their cell phones to remain connected to family and friends while hospitalized. Once allowed to go to a cell phone–friendly room, the patients were able to remain compliant with hospital rules while still staying in touch with their “outside lives.” Revision of current policies related to cell phone use that are based on research will be useful in increasing satisfaction of patients, patients’ families, and health care professionals.

Recommendations for Practice

Hospital policies that ban use of cellular phone devices are not only impractical to enforce, they also exclude a key tool that is used as a vital source of information for health care providers. A review of current evidence indicates that this position is outdated and unnecessary. Less restrictive guidelines such as the 1-meter rule and/or cell phone–friendly areas should be applied to new policies. Revising current policies related to cell phone use that are based on research will be useful in increasing satisfaction of patients, patients’ families, and health care professionals.

Accuracy of Assessment of Body Temperature

Accurate measurement of body temperature is essential in the management of critically ill patients. Unfortunately an accurate, noninvasive method to measure core temperature has yet to be established.142-144 Understanding the differences in body temperatures measured at various body sites, technology limitations, and “user error” is important when evaluating body temperature values in critically ill patients.

Related Beliefs and Current Evidence

In practice, assumptions may be made about the accuracy of the temperature measurement device and the relationship of the temperature measured to the core temperature. Physiological temperature can be defined as central (core) and peripheral temperatures. Central temperature is a stable temperature reflective of 60% of the body mass and is tightly regulated by the body.144-146 Near core temperatures, peripheral temperatures, may vary over time or be influenced by extreme environmental and physiological variables,141 but under normal conditions correlate closely with core temperature.144 The most accurate core temperature is obtained via a pulmonary artery catheter; although infrequently used, this method is considered the “gold standard.”143,144,146,149 Table 14 provides the evidence on which sites are used for core and near-core temperature measurements.

To interpret and track trends in body temperature correctly, clinicians should consider site-specific temperature as well as device limitations and accuracy in obtaining the temperature. Researchers comparing body temperature measured with various devices and methods with core temperatures considered the temperature device to be accurate if the mean difference in temperatures obtained was ±0.3°C and to be precise if the standard deviation was from 0.3°C to 0.5°C.144,147,149,150 A mean difference in temperature greater than 0.5°C between devices would represent a clinically significant difference.147 It is unclear whether critical care nurses in clinical practice differentiate the accepted difference in temperature measurements obtained with different devices and how the clinical interpretation of the measurement plays into subsequent clinical decisions.

Errors in accurate temperature measurement are most often associated with choice of measurement site, instrument-related errors, and operator error.143,144,148 Temperature monitoring devices require accurate application to provide intended measurement data; however, user error causes erroneous temperature measurements.141,147 Device limitations

<table>
<thead>
<tr>
<th>Table 14</th>
<th>Temperature measurement sites and devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites for measurement of core temperature143,144,146,149</td>
<td>Sites for measurement of near core temperature144,149</td>
</tr>
<tr>
<td>Distal part of esophagus</td>
<td>Mouth</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>Bladder</td>
</tr>
<tr>
<td>Tympanic membrane</td>
<td>Rectum</td>
</tr>
<tr>
<td></td>
<td>Temporal artery</td>
</tr>
<tr>
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<td>Axilla</td>
</tr>
</tbody>
</table>
Table 15 Summary of different temperature modes, variation from core temperature, clinical advantages and disadvantages

<table>
<thead>
<tr>
<th>Site of temperature measurement</th>
<th>Variation from core temperature</th>
<th>Best practice: advantages (+) and disadvantages (–)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary artery</td>
<td>Reference standard</td>
<td>+ True core temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Highly invasive</td>
</tr>
<tr>
<td>Oral</td>
<td>&lt;0.4°C</td>
<td>+ Ease of use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Oxygen up to 6 L and endotracheal tube do not influence accuracy(^{146,147,155})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Research has shown that administration of warmed gases and oxygen through an endotracheal tube does not cause significantly different oral temperature compared with core temperature(^{155})</td>
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<tr>
<td></td>
<td></td>
<td>– Accurate placement of probe in the mouth (posterior sublingual pocket) is necessary for correct temperature reading(^{142,146,147,149})</td>
</tr>
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<td></td>
<td></td>
<td>– May be influenced by fluids and tachypnea(^{155})</td>
</tr>
<tr>
<td>Esophagus</td>
<td>&lt;0.1°C</td>
<td>+ Correlates closely with pulmonary artery temperature(^{144,147,150})</td>
</tr>
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<td></td>
<td></td>
<td>Optimal placement requires the esophageal temperature probe to be positioned at the point of maximal heart tones (left atrium) in the distal part of the esophagus(^{144,146}) and at an insertion depth between 32 and 38 cm.(^{150})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Minimal lag time for temperature measurement(^{144,147})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Temperature fluctuates according to depth of probe; accurate placement is key(^{150})</td>
</tr>
<tr>
<td>Bladder</td>
<td>&lt;0.2°C</td>
<td>+ Easy to perform with urinary catheterization; low risk of dislocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Temperature is accurate during dates of increased diuresis(^{154})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Accuracy of temperature influenced by low urine flow(^{144,150})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Lag time estimated up to 20 minutes during therapeutic hypothermia interventions(^{150})</td>
</tr>
<tr>
<td>Rectum</td>
<td>&lt;0.3°C</td>
<td>+ Easy to perform</td>
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<td>– Invasive; placed in rectal vault; may be expelled with intestinal motility</td>
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<tr>
<td></td>
<td></td>
<td>– Lag time estimated up to 15 minutes(^{144,150})</td>
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<td></td>
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<td>– Accuracy of readings influenced by stool in the rectum</td>
</tr>
<tr>
<td>Temporal artery</td>
<td>&lt;0.4°C</td>
<td>+ Minimally invasive temperature closely correlated with core temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Temporal artery is not significantly affected by thermoregulatory changes; therefore perfusion should be stable in most conditions and closely reflect core temperature.(^{144,150,157})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Current research has provided mixed results as to accuracy of this device in different practice settings, patient populations, and physiological conditions.</td>
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<td>– Diaphoresis may influence accuracy of temperature readings.</td>
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<tr>
<td></td>
<td></td>
<td>– Accuracy of temperature measurement procedure required for correct temperature reading from the forehead and behind the ear.(^{155,156})</td>
</tr>
<tr>
<td>Tympanic membrane</td>
<td>Not recommended for temperature monitoring(^{142,143,144,147,150,155,159})</td>
<td>– Tested in multiple populations of patients; however, user error and patient’s anatomy reduce accuracy of temperature obtained.(^{142,143,144,147,149})</td>
</tr>
</tbody>
</table>

\(^{a}\) Based on evidence from Hooper and Andrews,\(^{143}\) Sessler,\(^{144}\) Crawford et al,\(^{145}\) Torossian,\(^ {146}\) Forbes et al,\(^{147}\) Bridges and Thomas,\(^{148}\) Hooper et al,\(^{149}\) Polderman and Herold,\(^ {150}\) O’Grady et al,\(^{151}\) Exacon Scientific,\(^{152}\) Konopad et al,\(^{153}\) and Fallis.\(^{154}\)

include the range of temperatures in which the thermometer has been tested. Few devices have been rigorously tested in all populations of patients and during extremes in temperature (hypothermic and hyperthermic states), yet multiple devices are used in these extremes of body temperature to assess patients. When sensing temperature “lag” in patients with therapeutic hypothermia, both the temperature-measuring device and the physiological temperature site are variables that should be considered with clinical trending of...
temperature and subsequent therapeutic interventions. In some practice settings, the measurement of a newly elevated temperature triggers an automatic order set that includes many tests that are costly and disruptive to the patient. Knowing which temperature measurement technique is best to assess a patient may minimize the frequency of obtaining inaccurate temperature readings. Also, it is important to remember that temperatures obtained from 2 different body sites should not correlate exactly but should be “close in range” (ie, <0.5°C apart). Table 15 provides a summary of different temperature measurement modes, their advantages and disadvantages, and the mean variation in temperature from the core temperature measured in the pulmonary artery.

Recommendations for Practice

Despite how commonly body temperature is assessed in the management of critically ill patients, the best noninvasive device to measure core temperature accurately remains to be developed. Although no ideal device has been developed yet, critical care nurses can make good clinical decisions based on the type of device used to measure the temperature, the patient’s characteristics, and the user’s competence. Understanding device limitations and knowing that temperatures obtained from 2 devices should differ by less than 0.5°C are important to clinical interpretation of temperature measurement and assessment. Optimally, the same method of temperature assessment should be used throughout an episode of care to enable more accurate tracking of trends in temperature. Noting trends in temperature data, evaluating other vital signs, and assessing parameters in a patient with a new fever should guide clinical decisions, not a single temperature reading.

Closing: Moving Evidence Into Practice

As Thomas Paine said in 1776, “A long habit of not thinking a thing wrong, gives it a superficial appearance of being right.” The practices reviewed in this article are all within the domain of nursing, and it is important as nurses that we challenge tradition and “habits in our nursing practice.” As we continue to perfect the art of nursing, we must also remember the science of nursing. Science is dynamic and ever changing. Clinical practices should be based on evidence whenever possible. The challenge is in getting the evidence in the right hands and encouraging and empowering the clinicians at the bedside to make clinical changes, moving nursing practice away from habits of tradition. Practicing by best evidence improves patients’ outcomes, and critical care nurses are instrumental to the process of examining and implementing the evidence in practice, putting sacred cows out to pasture.


**Learning objectives:**
1. Understand how embracing evidence-based practice can immediately improve patient care
2. Recognize 7 areas of clinical practice in which tradition and the evidence do not agree
3. Identify recommendations for practice related to 7 older practice issues or “sacred cows”

---

1. What is a physiological effect of Trendelenburg positioning in hypotensive patients?
   - a. Increased right ventricular ejection fraction
   - b. Increased lung compliance
   - c. Increased abdominal pressure
   - d. Increased tidal volume

2. What is a potential benefit of passive leg lift for initial management of hypotension?
   - a. Decreased aortic volume
   - b. Decreased aspiration risk
   - c. Baroreceptor activation
   - d. Upper thorax volume shift of 500 mL

3. What is the least safe intervention to divert fecal material away from skin?
   - a. Fecal pouches
   - b. Traditional rectal tubes
   - c. Bowel management systems
   - d. Rectally-inserted nasopharyngeal airway

4. What is an evidence-based intervention to manage fecal incontinence?
   - a. Cleanse the skin with a no-rinse cleanser
   - b. Use soap and water with a washcloth for basic skin care
   - c. Use diapers for immobile patients
   - d. Use multiple layers of bed linen to pull liquid stool away from skin

5. What has evidence demonstrated about gastric residual volume (GRV) measurement in enteral feeding?
   - a. Elevated GRV indicates enteral tube feeding intolerance.
   - b. Elevated GRV indicates delayed gastric emptying.
   - c. A high GRV increases aspiration pneumonia risk.
   - d. Measuring GRV does not improve patient outcomes.

6. What is considered a best practice for enteral tube feedings?
   - a. Withhold enteral feeding for an isolated GRV greater than 250 mL
   - b. Use a 30 mL syringe to aspirate GRV
   - c. Consider postpyloric feeding in patients with consistently high GRV
   - d. Discontinue tube feedings to reposition patients

7. What is considered a physiological effect of visitors on hospitalized patients?
   - a. Decreased cortisol levels
   - b. Increased systolic blood pressure
   - c. Decreased arterial saturation
   - d. Increased intracranial pressure

8. What is an appropriate indication for urinary catheter insertion?
   - a. Fall prevention
   - b. Routine urine specimen collection
   - c. Skin excoriation management
   - d. Comfort care for terminally ill patients

9. What is considered a best practice to prevent catheter-associated urinary tract infections in hospitalized patients?
   - a. Minimizing catheter duration
   - b. Using silver alloy-coated urinary catheters
   - c. Routinely using ultrasound bladder scanners
   - d. Performing daily urinary meatal cleansing with antiseptic agents

10. The “1-meter rule” provides extra safety because electromagnetic interference is most likely to occur within what distance of biomedical devices?
    - a. 3 to 20 mm
    - b. 3 to 20 cm
    - c. 3 to 20 m
    - d. 3 to 20 km

11. What site of temperature measurement most closely correlates with pulmonary artery temperature?
    - a. Bladder
    - b. Rectum
    - c. Temporal artery
    - d. Esophagus

12. What is correct about monitoring urinary bladder temperature?
    - a. It has a high risk of dislocation.
    - b. Temperature is not accurate during periods of increased diuresis.
    - c. Estimated lag time is up to 20 minutes during therapeutic hypothermia.
    - d. Its accuracy is uninfluenced by low urine output.

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**Test answers:** Mark only one box for your answer to each question. You may photocopy this form.

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<th>My expectations were met</th>
<th>This method of CE is effective for this content</th>
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<td>Yes</td>
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<td>Q easy Q medium Q difficult</td>
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Mary Beth Flynn Makic, Kathryn T. VonRueden, Carol A. Rauen and Jessica Chadwick

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