Research at the bedside makes a difference for our patients, and also for our nurses. However, it is now time to broaden our focus from research on interventions or events at a narrow point in time to research that addresses care across the continuum. This continuum may start at the point of injury, such as the battlefield through en route care delivered during the 8000-mile journey home for our wounded warriors, or for critically ill patients as they move between the emergency department, operating room, and intensive care unit. This focus also requires researchers to consider “care within context,” that is, research- and evidence-based practice tailored to the unique conditions of the care environment. Beyond conducting research and developing new knowledge is the challenge of translating evidence into practice. A culture of inquiry is a critical element in the successful translation of evidence into practice. In a culture of inquiry, nurses are encouraged to question and evaluate their practice, provide evidence-based care, and actively participate in and lead clinical inquiry. This article draws from a program of applied clinical research reflecting care across the continuum within both military and civilian health care settings and discusses how the application of these research findings and the advancement of a culture of inquiry make a difference for both patients and nurses. (American Journal of Critical Care. 2015;24:283-289)
Research at the bedside makes a difference for our patients, and also for our nurses. How can we continue to enhance the difference this research makes? As we look for strategies to optimize outcomes further, one strategy may be to broaden our research focus from studies on interventions or events at a narrow point in time to research that addresses care across the continuum. The continuum may start at the point of injury on the battlefield through the 8000-mile journey home for our wounded warriors, or for critically ill or injured patients who receive care in the emergency department, operating room, and intensive care unit (ICU). Another strategy is to advance a culture of inquiry. In a culture of inquiry, nurses are empowered to question and evaluate their practice, to provide evidence-based care, to actively participate and lead clinical inquiry, and to systematically translate evidence into practice. This article uses examples from a program of applied clinical research within both military and civilian health care settings that reflect care across the continuum, introduces 2 models that guide the translation of evidence into practice, and discusses how research at the bedside and the advancement of a culture of inquiry make a difference for both patients and nurses.

Care Across the Continuum

By necessity, research often focuses on a specific event at a specific point in time (eg, pressure ulcer prevention in the ICU). However, as we think about advancing care, a broader research focus that reflects care across the continuum is essential. Care across the continuum is important for military health care. A critically injured combat casualty receives care at a minimum of 4 hospitals and undergoes at least 4 transports (ranging from 15 minutes on a helicopter to 10 to 12 hours on a critical care air transport flight from Germany to the United States) during the rapid evacuation from the battlefield and along the continuum of care back to the United States. To optimize care and outcomes under these dynamic conditions, research must address care not only at a specific point in the continuum of care (eg, at a field hospital), but also care provided as patients move across the various settings in the care continuum. As an example of research across the continuum, a series of studies were completed to describe en route pain and pain management strategies for military patients undergoing aeromedical evacuation from the war zone to Germany. One finding was that the most severe pain occurred during transport from the ground facility to the aircraft. This finding indicates the need for a solution to en route pain management that begins during the preflight phase of care and extends through transport, while taking into consideration that 10 to 30 patients may be transported simultaneously.

The principle of care across the continuum also applies to civilian health care research. In developing this paper, American Association of Critical-Care Nurses (AACN) journals from the past 5 years were reviewed for research reflecting care across the continuum. A few studies focused on care coordination, transitions, and handoff communication. However, no research was found that explicitly investigated problems extending across multiple locations where critical care is provided (eg, pressure ulcer prevention in the emergency department, ICU, operating room). To make a difference in patient care and outcomes, we need to identify and study collaborative solutions across the continuum of care.

Care Within Context

When studying care across the continuum, it is also important to consider the care environment (ie, care within context). For my research, the care environment may be the austere environment of a battlefield hospital, during military aeromedical evacuation, or in a critical care unit in the United States. To identify research questions specific to care across the continuum and within context, my research partner, Dr Joe Schmelz, and I asked 5 questions:

About the Author

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Corresponding author: Elizabeth Bridges, University of Washington School of Nursing, 1959 NE Pacific, Box 357266, Seattle, WA 98195 (e-mail: ebridges@u.washington.edu).
1. What do we do on a day-to-day basis that we will also do in the deployed setting?
2. What is unique about the deployed setting?
3. Who are our patients?
4. How does the deployed environment affect the patients and the care provided?
5. Where is the nursing in the question?

My primary research and practice focus has always been on hemodynamic monitoring. This work ranges from the accurate performance of hemodynamic monitoring, integration of hemodynamic data into care, and answering the age-old question: “which do you believe—the a-line or the cuff?”11-18 One aspect of ensuring accuracy in invasive pressure monitoring is removing microbubbles from the pressure system.11 As an example of care within context, the removal of microbubbles takes on greater importance in aeromedical evacuation, as gas expands at altitude (Boyle’s law). My colleagues Lt Col Karen Evers, USAF (ret), and Dr Susan Woods, and I studied the effects of microbubble expansion at altitude on the dynamic response characteristics of the system, conducting research both in an altitude chamber at 10000 feet (3000 m) and in the back of a military cargo aircraft used for aeromedical evacuation. As expected, microbubble expansion at altitude adversely affects the dynamic response, such that the system would be unacceptable for monitoring during this critical phase of care. We then validated a protocol that included an easy, systematic process to minimize microbubbles in the system.19 The new protocol optimized the pressure monitoring system both on the ground and at altitude.19

These same 5 questions can be used to identify research specific to your practice area by simply exchanging the word “deployed” with the definition of your care setting. As discussed next, these questions helped us to develop interventions for use in the ICU and operating room to decrease pressure ulcers in high-risk cardiac patients.

**Use of Frameworks to Guide the Translation of Evidence into Practice**

Beyond the challenges of conducting research and creating new knowledge is the challenge of evidence translation. Nieva’s Knowledge Transfer Framework (Figure 1),20 is a framework that was useful in identifying the steps involved with translation of research and strategies to prevent hypothermia.10

**A Need for New Knowledge: “There Will Be No Hypothermia in Theater”**

In early 2002, the military research community was challenged by the pronouncement: “There will be no more hypothermia in theater.” As outlined in Nieva’s framework, the first step is the creation of knowledge. In response to this challenge, our team of Air Force nurse scientists, Lt Col Joe Schmelz, Col Don Johnson, Lt Col Marla De Jong, Lt Col Karen Evers, and I, set out to identify the most effective strategies to prevent hypothermia in combat casualties under the austere conditions found in theater (ie, an area where military events occur, such as Iraq or Afghanistan). We were further challenged by the stipulation that whatever solution we came up with had to weigh less than 7 lb (3 kg), be portable, use minimal or no electricity, and pass safety testing for use in both helicopters and fixed-wing aircraft. We completed a series of studies evaluating commercial off-the-shelf products in a model of severe hemorrhagic shock under ambient conditions that mimicked evacuation from the battlefield on rotary and fixed-wing aircraft. The solution we identified, which included a baffled reflective blanket, a head cover, and a heating pack, reflects the principle that to prevent hypothermia in patients with severe

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**Figure 1** Knowledge Transfer Framework from the Agency for Healthcare Research and Quality.

Reprinted from Nieva et al.20

<table>
<thead>
<tr>
<th>Process</th>
<th>1</th>
<th>Diffusion and dissemination</th>
<th>2</th>
<th>Adoption, implementation, and institutionalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge creation and distillation</td>
<td>1</td>
<td>Creation of dissemination partnerships/knowledge transfer teams</td>
<td>Development of interventions</td>
<td></td>
</tr>
<tr>
<td>Distillation of key knowledge and practices</td>
<td>2</td>
<td>Targeted dissemination/persuasion</td>
<td>Adoption and implementation</td>
<td></td>
</tr>
<tr>
<td>Mass diffusion of key knowledge and products</td>
<td>3</td>
<td></td>
<td>External institutionalization/routinization</td>
<td></td>
</tr>
</tbody>
</table>

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hemorrhage one must not only prevent heat loss, but also give heat back to the body.\textsuperscript{21,22} As scientists, we met our mandate by creating new knowledge and identifying a technical solution to hypothermia in the field. However, to prevent hypothermia, the creation of new knowledge was only the first step.

The next phase of translation is to diffuse and disseminate. The Joint Theater Trauma System created a hypothermia prevention clinical practice guideline (CPG), which was disseminated through the theater. We were proud that the hypothermia CPG\textsuperscript{23} included recommendations based on our research and outlined care and monitoring requirements for each phase of the care continuum.

The final steps of translation can be characterized by strategies to promote sustainability or, more specifically, strategies to facilitate adoption, uptake, and institutionalization. Institutionalization refers to the integration of the innovation into the organization through actions such as a policy and as evidenced by its routine use in practice. In addition to emphasizing the CPG, hypothermia prevention kits consisting of the blanket, head cover, and warming pad were placed in every military medical unit. Compliance with the CPG and the incidence of hypothermia on admission were monitored, and all cases of hypothermia were examined as a part of process improvement. In the book, \textit{Better: A Surgeon’s Notes on Performance}, Gawande\textsuperscript{24} discussed how the US military’s commitment to “make a science of performance, to investigate and improve how well they use the knowledge and technologies they already have at hand” revolutionized the treatment of combat casualties. Gawande suggested that it is not the creation of new knowledge or technologies, but systems-level changes to ensure the use of existing knowledge and technologies, and vigilance over performance, that may be the critical factors in improving outcomes. Vigilance over performance answers the critical question: are we making a difference? In 2006, the Joint Theater Trauma System and the Joint Theater Trauma Registry were created to standardize and improve care across the theater and to monitor care processes and outcomes. Trauma nurse coordinators (ie, military nurses who collected injury demographics, care, and outcomes for both military and civilian casualties) were placed at military hospitals in Iraq and Afghanistan.\textsuperscript{25,26} Among the trauma nurse coordinators’ many responsibilities, they recorded critical information, including body temperature at admission and use of hypothermia-prevention strategies for all trauma patients.

Did we make a difference? Before implementation of the hypothermia CPG, 7% to 10% of combat casualties were hypothermic on admission, in contrast to 1% to 4% after CPG implementation,\textsuperscript{27,28} which was in contrast to a 13% to 43% incidence of hypothermia for severely injured patients admitted to US trauma centers.\textsuperscript{29,30} More importantly, there was a system-wide awareness of the issue, with everyone, from medics to chaplains, understanding the importance of hypothermia prevention.

On a broader note, hypothermia prevention is only one aspect of combat casualty care. In discussion with nurses across the military, it became apparent that the nurses were aware of the CPGs, but they could not consistently recall the content. One challenge was that the CPGs were medically focused. We needed evidence-based resources that reflected both medical and nursing care. I received a grant from the TriService Nursing Research Program (TSNRP), to create the \textit{Battlefield and Disaster Nursing Pocket Guide}\textsuperscript{31} to bring together evidence about care under operational conditions. The pocket guide was designed to be carried in a uniform pocket in order to put evidence on unique types of care (eg, hypothermia prevention, care of bomb-blast victim) directly into the hands of the nurses. With grants from TSNRP, we have distributed 22,000 copies of the guide to deploying nurses and medics from all 3 services. But similar to the CPGs, the pocket guide reflects only dissemination.

Our challenge is to ensure that our military nurses remain ready to provide this evidence-based care. Under a study funded by TSNRP, a systematic literature review was completed to create a list of operational nursing competencies. We revised and validated the list through expert panels and a survey of deployed nurses. With expert consultation from Dr JoAnn Grif Alspach, and with the pocket guide as a source document, we created an organizing framework, outlining the required competencies and training and performance standards. As a scientist, I could have ended the research by simply publishing these results. However, to make a difference, we needed to institutionalize the competency lists and put in place education, training, and tracking requirements to support their implementation. Although this process has taken several years, in January 2015, the board of directors of the Air Force Nurse Corps approved a policy establishing the competency lists as the standard for readiness education and training for the more than 5300 Air Force active duty, guard, and reserve nurses. Will this program make a difference? We hope that it does, by enhancing evidence-based operational care and ensuring that we retain the hard-learned lessons of the past 14 years, as we continue to provide world-class care to our wounded warriors.
Starting at the Bedside: A “Call to Action”

In practice, the need for evidence translation often begins with a clinical event. Another translation framework, the Roadmap for Participatory Research (Figure 2),32 which has direct relevance to clinical practice, starts with a “call to action,” a practice issue for which there may or may not be an evidence-based solution. At the University of Washington Medical Center (UWMC), our “call to action” was an increased incidence of occipital pressure ulcers in our high-risk cardiothoracic ICU patients. During hospitalization, critically ill patients often move between multiple diagnostic and care areas; thus, the solution to preventing pressure ulcers for these patients needed to reflect care across the continuum. We conducted a literature review but did not find any strategies to address this issue. Teams of nurses from the operating room and ICU stepped forward to address this issue. Through a systematic process, they identified pressure-redistributing strategies (eg, gel and foam occipital pads for the operating room and a waffle pad for the ICU). The operating room team garnered support from anesthesia providers by presenting data outlining the issue and recommended solutions. The entire health care team supported the practice changes, and a process was put in place to ensure that all high-risk patients were used for all high-risk patients. As noted by Gawande,24 it is not only these technical solutions, but system-level initiatives and vigilance over performance that are critical to improving outcomes. The ICU and operating room teams implemented a collaborative plan to enhance communication, ensure that all preventive strategies were used when high-risk patients moved across the care continuum, and monitor and assess patients in collaboration with our wound clinical nurse specialists. Did we make a difference? Yes, for both our patients and our nurses. At the time of our call to action, there were 8 occipital decubitus ulcers within a year. Since implementation of this initiative in 2011, only 1 occipital decubitus ulcer (from a hair braid) has been found among these high-risk patients. Additionally, the nurses who were involved have enhanced their ability to address clinical questions systemically by using research methods. They are champions for sustainment and are taking on new initiatives. Further, they have confidently presented their work to hospital leaders, at local and national forums, and they are currently writing a manuscript summarizing their work.

Advancing a Culture of Inquiry

At UWMC, a core construct of our professional practice model is a culture of inquiry (see Table). Central to the culture is clinical inquiry. Our definition of clinical inquiry expands upon the AACN definition33 and emphasizes creation of new knowledge and the systematic use of evidence at the bedside. Underpinning this culture of inquiry are several assumptions. First, a culture of inquiry is inextricably woven through our patient/family care and our professional practice. As such, we do not have a separate research council, rather a culture of inquiry

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Table: Example of the use of the Roadmap for a Participatory Research-Practice Partnership to inform a project to decrease the incidence of pressure ulcers.

<table>
<thead>
<tr>
<th>Phase I: Issue identification/clarification</th>
<th>Phase II: Solution building</th>
<th>Phase III: Implementation, evaluation, and sustainability</th>
</tr>
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<tr>
<td>Increased incidence of occipital pressure ulcers</td>
<td>Identified high-risk patients Needed a solution that crossed continuum No research addressed this issue</td>
<td>Operating room: offload head but not interfere with airway (gel pad) Intensive care unit: offload head with “waffle”-type cushion</td>
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<td>Identified high-risk patients Needed a solution that crossed continuum No research addressed this issue</td>
<td>Collaborative partnership to ensure solutions in place across continuum After implementation, went from 8 to 0 pressure ulcers per year</td>
<td>Ongoing review of use of all devices Reeducate staff Continue to follow up monthly</td>
</tr>
<tr>
<td>Operating room: offload head but not interfere with airway (gel pad) Intensive care unit: offload head with “waffle”-type cushion</td>
<td>Preoperative pressure ulcer risk tool Develop profile of patients at increased risk for occipital pressure ulcers</td>
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Figure 2 Example of the use of the Roadmap for a Participatory Research-Practice Partnership to inform a project to decrease the incidence of pressure ulcers.

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assumptions is that all nurses have a leadership role. UWMC is a Magnet hospital. During the Magnet site survey, there is a meeting between the surveyors and leaders of research. In preparation for this meeting, we sent out a message to all our nurses, inviting the leaders of nursing research to attend. What was exciting, but not surprising, was that we were standing room only. The extraordinary teams of direct care nurses, many of whom were mentored by their clinical nurse specialists, shared their work and examples of how their work was making a difference to our patients and our organization. Central to the success of the presented work is the support of nursing and organizational leaders, modeling of a culture of inquiry by senior nursing leaders, and most importantly the enthusiasm and commitment by all nurses involved. Bedside nurses are role models for their peers, and they are the spark that has been critical in spreading a culture of inquiry throughout our organization. The importance of their work was recognized by Magnet in the site visit report:

The focus on nursing research [at UWMC] is clearly developed, disseminated and enculturated as evidenced by the consistent volume and sophistication of nurse-led and initiated research studies and the engagement of staff/direct care nurses in a majority of those studies. The nursing department is clearly a national leader in being engaged in clinical nursing research. Engagement in a culture of inquiry by nurses at all organizational levels exemplifies Porter O’Grady’s eloquent summary of the Institute of Medicine’s Report on the Future of Nursing:

The report emphasizes the need for nurses in each of these capacities [from nursing student to executive] to hear a specific call to leadership from within the role in a way that commits to making a significant and particular difference in advancing the role of the profession, its relationships, and the people nurses serve.35(p 36)

Finally, underlying the advancement of a culture of inquiry is recognition of the various uses of research, or more broadly—evidence. In 1985, Stetler suggested that nursing research utilization is instrumental, conceptual, and symbolic. The instrumental (or concrete) use of evidence to develop protocols and policy, and ultimately to improve outcomes, is a vital aspect of evidence translation. However, within a culture of inquiry, more subtle uses of evidence are equally important. The conceptual use of evidence results in new insights or changes in the way an individual thinks about a topic, and symbolic use reflects use of evidence to support an opinion or to influence the views of others.36-38

The recognition of various uses of evidence as a strategy to advance a culture of inquiry is embedded in talks I present at AACN’s National Teaching Institute on “Critical Care Studies You Should Know About.” Rather than summarizing research studies, this presentation uses studies as a starting point for a conversation about becoming a smart consumer of evidence. Underpinning the presentation are the 3 aspects of evidence use. The goal of the talk to inspire active engagement in care through the development of knowledge of a specific topic (conceptual use) and confidence in the ability to use research directly at the bedside and in policy development (symbolic and instrumental use), and to communicate effectively and advocate for evidence-based recommendations (symbolic use).

Finally, a culture of inquiry can be strengthened by academic-service partnerships. My colleagues from the University of Washington School of Nursing, Dr Joanne Whitney and Dr Karen Thomas, and I have appointments at Harborview Medical Center, Seattle Children’s Hospital, and UWMC, respectively. Our roles focus on advancing the culture of inquiry through our work with direct care and advanced practice nurses and administrators in support of 3 goals:

1. Infusing a culture of inquiry through all patient care activities
2. Building capacity for nurses to actively participate and lead in clinical inquiry
3. Creating structures/processes to facilitate

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Table Characteristics and assumptions of a culture of inquiry

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dissemination, adoption, implementation, and institutionalization and evaluation of evidence-based care

Are we making a difference? Each year in Seattle, more than 250 clinical nurses come together at the Seattle Nursing Research Consortium conference (http://seattlenursingresearch.org) to learn about and present their research and evidence-based practice. The support of the health care organizations and the passion exemplified by these nurses to advance their care are extraordinary. Many of these nurses go on to present at national forums, such as the National Teaching Institute, to publish, to return for advanced academic preparation, and then to return to mentor others. Yes, I think research at the bedside makes a difference.

FINANCIAL DISCLOSURES
None reported.

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Research at the Bedside: It Makes A Difference
Elizabeth J. Bridges

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