ACNP intensivist: A new ICU care delivery model and its supporting educational programs

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Abstract
The purposes of this article are to describe a physician (MD)/acute care nurse practitioner (ACNP) intensivist model for delivery of critical care services in a tertiary academic medical center and to describe an innovative nurse practitioner educational program developed to support the model. In an effort to address the current shortage of intensivists, Vanderbilt Medical Center has developed and refined a multidisciplinary intensivist MD/ACNP teams to provide expanded critical care services. The ACNPs, in collaboration with intensivist MDs, function as intensivist teams and are responsible for developing and executing the daily medical plan, bedside procedures, and emergency response. These teams provide 24-h a day coverage of tertiary level ICUs, and provide several unique benefits over traditional resident ICU staffing models. As the concept of the MD/ACNP intensivist team has developed, Vanderbilt University School of Nursing ACNP Program has expanded its curriculum to provide graduates with the knowledge, skills, and experiences to safely manage unstable critically ill patients. Multidisciplinary critical care teams of MD intensivists who work in collaboration with ACNP intensivists address the current shortfall of intensivists and represent a cost-effective means for expanding ICU coverage and increasing ICU bed availability while maintaining Leap Frog ICU staffing compliance.

Introduction
Currently, each year over 23 million days of care are provided in intensive care units, with a related cost of almost 0.66% of the US gross domestic product in 2005 (Halpern & Pastores, 2010). This increased patient volume has created a high demand for critical care services in the United States, and it has been accompanied by a dramatic shortage of intensivist trained physicians (MDs). Conservative estimates indicate that by 2020 the United States will need 4300 MD intensivists, but only slightly more than 2000 will be actively practicing (Krell, 2008). This overwhelming shortage is expected to result in “the disintegration of critical care delivery in the United States” (Krell, 2008). In 2003, Congress directed the Health Resources and Services Administration (HRSA) to examine the critical care workforce and assess its adequacy in caring for an increasingly aging adult population. This report concluded: (a) there is a growing demand for intensivist services, (b) a substantial and growing MD intensivist shortage exists, (c) evidence indicates that patient outcomes improved with around-the-clock availability of intensivists, and (d) organizational changes in healthcare delivery have the potential to improve access and quality of care for patients needing critical care services. (HRSA Report to Congress: The Critical Care Workforce: A Study of the Supply and Demand for Critical Care Physicians. Requested by: Senate Report 108–81.)

Based on the anticipated increasing shortfall of adequately trained MD intensivists, institutions are being forced to consider organizational changes in the delivery
of critical care services. The purposes of this article are to describe a physician (MD)/acute care nurse practitioner (ACNP) intensivist model for delivery of critical care services in a tertiary academic medical center, and to describe an innovative nurse practitioner (NP) educational program developed to support the model.

Background

The ACNP role was formalized in 1995 with the scope of practice written broadly to include the management of patients who are critically ill, acutely ill, and chronically ill (Kleinpell, 1997). To manage patients who are critically ill as well as those who are acutely and chronically ill, ACNP educational programs must present both didactic content and clinical experiences that address the unique management of all three subpopulations. While this prepares ACNPs for a variety of career paths, both in hospital and out-patient settings, it does not specifically address the management of complex, unstable critically ill patients who require rapid high-impact decision making along with invasive procedures needed for stabilization.

As early as 2004, it was estimated that only 37% of the patients in ICUs were managed by intensive care trained MDs (Kelley et al., 2004). It is anticipated that by 2020 the need for MD intensivists will be 22% below the number required, and by 2030 the shortfall is predicted to be 35% (Angus et al., 2000). In 2003, the HRSA published a report confirming a substantial shortage of MDs trained to care for critically ill patients, and a growing need for intensivists (HRSA Report to Congress). One solution to meeting the patient care needs in ICUs is to incorporate ACNP intensivists into the multidisciplinary professional team managing these patients (Kleinpell, Ely, & Grabenkort, 2008), thus creating a new MD/ACNP intensivist model for the management of patients who are critically ill.

Additional driving forces that support the need for an intensivist ACNP specialization are: (a) an increasing number of older and frail adults who are requiring ICU management of critical illnesses; (b) an increase in healthcare costs, which is necessitating more cost-effective and innovative management of critically ill patients; and (c) a reduction in the number of house officer resident hours (Kleinpell et al., 2008; Krell, 2008; Yeager, Shaw, Casavant, & Burns, 2006). These conditions support the need to develop cost-effective multidisciplinary care models that will address these issues. The multidisciplinary MD/ACNP intensivist care model is one solution to the current shortfall in the number of MD intensivists, and it provides a cost-effective care model that complements the future healthcare reform strategies. The third factor, unique to academic medical centers, that supports the ACNP intensivist specialty is the reduction in MD resident hours. While the reduction in the number of hours a resident can work per week has been a positive change for residents, it has added an additional layer of complexity to providing critical care services as a result of the reduction in on-site providers. This is particularly evident in tertiary ICUs where the management of critically ill patients requires a continuous on-site provider. Specifically, the MD/ACNP intensivist model links ACNPs, who have been educated as intensivists, with MD intensivists to provide expert care to more patients than a single MD could safely manage. The MD/ACNP intensivist model speaks to the recommendation of the Leapfrog Group that proposes in ICUs the “NP should be available to reach a critically ill patient within 5 minutes along with an intensivist response by pager” (Kleinpell et al., 2008). This model also addresses the need for a cost-effective delivery of care, by providing 24-h a day/7 days a week coverage using ACNPs with MD intensivist backup. The creation of multidisciplinary professional teams, which includes MD/ACNP intensivists, provides the practice model for stabilizing and managing complex critically ill patients in a safe and cost-effective manner.

Research supports the utilization of ACNPs as intensivists, and indicates that patient outcomes are similar for ACNPs when compared with MDs and residents. Gawlinsk, McCloy, and Jesurum’s (2001) study documented that patients managed by ACNPs who followed an extubation protocol had reduced time to extubation, a lower incidence of ventilator-associated pneumonia, and a shorter length of stay in the ICU. Other studies indicated that there was no difference in length of stay, mortality, or readmission when ACNP outcomes were compared with resident/MD outcomes (Burns & Earven, 2002; Cowan et al., 2006; Meyer & Miers, 2005; Rudy et al., 1998; Russell, VorderBruegge, & Burns, 2002). A separate study found that compliance with clinical guidelines for deep vein thrombosis (DVT) and stress ulcer prophylaxis and anemia management improved when an ICU-educated ACNP was incorporated into the team (Vicente et al., 2008). Based on a review of current research, Kleinpell et al. (2008) emphasized that ACNPs in ICUs reduce ICU length of stay, decrease the incidence of urinary tract infections and skin breakdown, and save an estimated $2,467,328.00 in hospital costs (Russell, VorderBruegge, & Burns, 2002). The MD/ACNP intensivist model supports the goals from the American College of Critical Care Medicine, which has stated that a multidisciplinary approach to the management of critically ill patients “enhances the quality of care” (Brilli et al., 2001).
Experience with MD/ANCP intensivist models

Over a 6-year period, Vanderbilt Medical Center developed multidisciplinary ICU teams to provide expanded coverage to five of their adult tertiary care ICUs, including the Surgical Intensive Care Unit, the Neurosurgical Intensive Care Unit, the Medical Intensive Care Unit, the Cardiovascular Intensive Care Unit, and the Burn Unit. Currently, within this model one MD intensivist partners with a number of ACNPs to provide care for a significantly larger number of ICU patients than the MD could usually provide alone. This medical team’s core consists of ACNP intensivists and MDs intensivists who provide billable medical services for ICU patients, in conjunction with other ancillary services. This team provides multidisciplinary rounds once or twice daily, with the ACNP intensivist providing first call for clinical problems. The ACNPs collaborate as they develop and execute the daily medical plan, perform invasive bedside procedures, and provide emergency responses. Typically, each ACNP provides care for 6–10 ICU patients, with the MD intensivist collaborating on a daily basis with approximately two to four ACNPs. The 24/7 coverage model requires approximately 9.6 full-time equivalent ACNPs for a 30 bed ICU. For example, implementing an eight patients to one ACNP ratio allows for patient coverage during a 12 h shift and the opportunity to adjust the patient:ACNP ratio based on patient acuity. This collaborative approach creates a cost-effective model where the MD intensivist’s expertise can be extended to more critically ill patients.

The intensivist teams are supplemented with ancillary services specific to the ICU population of interest, which may include pharmaceutical, dietetic, case management, social work, and wound care services. Representatives from these services, such as a pharmacist and a dietician, are present on rounds and provide support for the intensivist team. This allows the multidisciplinary intensivist team fully discusses all aspects of the daily plan for each individual ICU patient, while integrating the expertise from each ancillary service.

Several unique benefits arise from the intensivist team strategy. First, the team has the ability to deliver on site provider coverage 24 h a day. This is done by utilizing 1–2 ACNPs during the night, with on-call MD intensivist backup. Since the ACNPs take first call for clinical issues, the MD intensivist is primarily available for nighttime consultation regarding complex clinical issues, which can typically be done by phone. This coverage strategy meets the current Leapfrog ICU staffing guidelines with on-site nighttime critical care providers with MD intensivist physician backup available by phone (Factsheet: ICU physician staffing, 2009).

Second, the intensivist model ensures an on-site billing provider (ACNP or MD intensivist) is available to provide critical care services during daytime and nighttime hours. This provides a unique benefit over services that use only resident coverage at night, because by Medicare rules, physician residents are non-billable providers. This MD/ACNP intensivist model creates increased billing revenue by increasing the time a billing critical care provider is on-site to provide services.

For academic institutions, these intensivist teams provide a unique environment for resident education as well. Because of the shared responsibility in patient care management, the ACNP–MD intensivist model increases the time available for MD intensivists to participate in resident training and education. Also the inclusion of residents in these ICU teams provides a learning environment that fosters interdisciplinary collaboration and education. Often residents provide new insights and evidence-based practice that benefit the multidisciplinary team, while the ACNPs educate the resident physicians on how best to utilize a multidisciplinary ICU team to achieve the best patient outcomes. Because the ACNP intensivists are long-term members of the ICU team, they provide continuity of patient care in an environment where residents typically rotate on and off the ICU team as their resident curriculum dictates.

ACNP intensivist education

The education of competent ACNP intensivists requires a specialized curriculum that provides both robust didactic content and clinical experiences. Vanderbilt University School of Nursing (VUSN) offers a unique ACNP intensivist subspecialty. This subspecialty within the ACNP program focuses on providing care for unstable critically ill patients with life-threatening illness and/or injury. The mission of this program is to educate ACNP intensivist for clinical practice in tertiary level multidisciplinary critical care facilities. This program builds on the strengths of VUSN’s ACNP program that has been in existence since 1995, and has a strong partnership relationship with the MD and ACNP intensivists of the Critical Care Anesthesiology Division, Surgical Critical Care, and the Allergy, Pulmonary, and Critical Care Medicine Division at Vanderbilt University Medical Center. The strengths of the VUSN ACNP program and the partnerships with these medical/surgical divisions has allowed for a strong multidisciplinary ACNP intensivist education program.

The curriculum is specifically designed to supplement the core ACNP curriculum with the addition of specialized didactic, simulation, and clinical rotations (Table 1). This program was originally piloted in the 2008 and 2009
Table 1  ACNP intensivist curriculum

<table>
<thead>
<tr>
<th>Fall semester</th>
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<tr>
<td>Advanced health assessment and clinical reasoning for the ACNP</td>
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<tr>
<td>Advanced health assessment applications for acute care nurse practitioners</td>
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<tr>
<td>Advanced physiologic and pathophysiologic foundations of acute care</td>
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<tr>
<td>Advanced pharmacotherapeutics for acute care nurse practitioners</td>
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<tr>
<td>Pathophysiology and collaborative management in acute care I</td>
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<tr>
<td>Spring semester</td>
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<tr>
<td>Scientific underpinnings for advanced practice</td>
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<tr>
<td>Pathophysiology and collaborative management in acute care II</td>
</tr>
<tr>
<td>Acute care nurse practitioner practicum/preceptorship a,b</td>
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<tr>
<td>Critical care concepts for the ACNP intensivist a</td>
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<tr>
<td>Summer semester</td>
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<tr>
<td>APN role within the U.S. Health Care System</td>
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<tr>
<td>Conceptualization and integration of evidence for advanced nursing practice pathophysiology and collaborative management in acute care III</td>
</tr>
<tr>
<td>Acute care nurse practitioner preceptorship a</td>
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<tr>
<td>Advanced ACNP intensivist preceptorship a</td>
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<tr>
<td>Advanced Critical Care Simulation Lab a,b</td>
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aCourse/clinical rotation with intensivist focus.  
bCourse with biweekly simulation training.

The new ICU care delivery model was formalized in 2010 with the assistance of an HRSA grant. Since the program pilot, a total of 37 students have graduated from the program. Moreover, following completion of the program, 25 graduates have gone on to practice in critical care at tertiary academic medical centers, including our own.

ACNP intensivists specializing in the care of highly unstable patients represent a unique subspecialty of NPs that require specific cognitive and somatic skills. The overall educational focus for student within the program is the development of the cognitive skills to allow for rapid diagnostics and clinical interventions. This cognitive skill set is unique to the critical care environment where ACNP intensivists are required to make high-stakes, time-dependent clinical decisions. Furthermore, the development of situational awareness, cognitive flexibility, and distributive cognition patterns are key components in educating and training new ACNPs for the intensivist role on a multidisciplinary team. In addition, advanced psychomotor skills needed for common critical care procedures are also introduced. The development of these skills is achieved through several distinct educational modes including didactic, high-fidelity simulation, and multidisciplinary bedside education during clinical rotations.

The educational components of this subspecialty builds upon the critical care content offered within the ACNP program, and extends the didactic and clinical experiences to incorporate the management of complex unstable patients. To accomplish this, the ACNP intensivist subspecialty curriculum includes faculty from nursing, medicine, pharmacy, and dietetics, who instruct students in both didactic and clinical environments.

Specific topics presented in the intensivist didactic courses (Table 2) include the advanced management of: cardiogenic and septic shock, acute lung injury, acute respiratory distress syndrome, neurosurgical and neurological emergencies, severe burn injuries, endocrine emergencies, and acute renal failure, as well as the integration of advanced pharmacology/pharmacokinetics, advanced nutritional support, and psychosocial needs of the unstable critically ill patients. These topics are originally presented in the ACNP curriculum and are then further expanded in the ACNP intensivist content. For example, while basic ventilator management is presented to all ACNP students, the ACNP intensivist specialty didactic content focuses on advanced ventilator management, including the decision-making process for the correct selection and utilization of modes of ventilation such as airway pressure release ventilation and volume diffusive respiration ventilators, and adjunctive ventilator therapies such as techniques for ventilation in the prone position. Understanding more advanced modes of ventilation requires the student to integrate the advantages and disadvantages of each system into their clinical decision making in order to determine the best mode of ventilation for each patient. Students are then expected to independently...
Table 3 Intensivist ACNP Simulation topics

- Critical care team management/crew resource management
- Team management (via a series of interprofessional simulations)
  - VF arrest
  - Air embolism and arrest
  - Sepsis
  - Narcotic overdose
  - Transfusion reaction
  - Pulmonary embolism
- Respiratory failure
- ARDS
- Difficult airway management
- Asthma in pregnancy
- Pulmonary embolism
- Head trauma/CHI
- SAH/ICH
- Anaphylactic emergency
- Aortic dissection/rupture (w/ thoracic CT and CXR interpretation)
- Trauma
- Ventilation workshop
- Chest tube/bronchoscopy workshop
- Shock: septic, cardiogenic, and hemorrhagic
- Ethics/breaking bad news

initiate and manage these advanced ventilation strategies, in conjunction with their preceptors, as part of their clinical education experience. The ultimate goal of this type of training in advanced ventilatory management would be to produce an intensivist NP who could independently intubate and initiate complex ventilator management in an unstable patient.

The use of high-fidelity simulations is key in the development of these new skills. At Vanderbilt, the School of Nursing has partnered with the School of Medicine’s Center for Experiential Learning and Assessment (CELA) simulation laboratory. The CELA simulation laboratory contains a number of simulation configurations, from a four bed ICU, two operating rooms, six-bed emergency department, or any combinations of these. These configurations, along with a number of advanced simulation mannequins, partial task trainers, and support staff allow students to experience a wide variety of complex critical care scenarios that are often unavailable to students rotating in the ICU’s.

The ACNP intensivist simulation curriculum revolves around the development of physical and cognitive skills necessary for ICU practice. During the course of the students ACNP intensivist training, students participate in 35–45 high-fidelity simulations incorporated throughout their curriculum, which cover a variety of topics (see Table 3). During these sessions partial task trainers provide introductory procedural training including airway management, arterial line placement, central line placement, chest decompression, and chest tube placement. These skills are then integrated into large clinical simulations focusing on complex diagnostic reasoning and intervention. Once students are able to master these clinically focused sessions, simulations incorporate trained actors to expand the scenarios to include patient family issues and conflict resolution among medical team members. The addition of these actors allow students to develop cognitive skills necessary for ICU practice, and include rapid consultation, family and patient interactions, and additional skills for breaking bad news to families.

Since its inception, the ACNP program has used ICUs as clinical sites, but with a different focus. Previously, the ICU clinical rotations have not incorporated the management of highly unstable patients. Current intensivist students are expected to integrate didactic and simulation-based learning, for management of critically ill patients during the course of their clinical education. Students are fully integrated onto functioning ACNP/MD intensivist teams, which requires an ongoing student presence among the teams, and active participation during clinical decisions. While the didactic content sets the foundation for the intensivist subspecialty, direct participation in the multidisciplinary intensivist teams prepares the students to become active members of intensivist teams postgraduation.

As part of the 3-year HRSA grant, the ACNP intensivist students are being surveyed at the time of graduation and 6 months postgraduation. Initial data indicate that the graduates viewed their clinical rotations as “above average” to “excellent,” with the major recommendation from all students for a more structured orientation to each of the five ICUs. Given the fact that the first cohort of ACNP intensivist students graduated in August 2011, data from the postgraduation survey is still pending. Of particular interest in the postgraduation survey will be not only the graduates’ impression of how well prepared they perceived themselves as they joined respective intensivist teams, but also facilitators and hindrances to the development of their new role as an ACNP intensivist. In addition, differences in perceived level of performance and required expertise based on their setting will also be explored. These data will then be used to refine not only the didactic content, but also the simulations developed for future ACNP intensivist students.

Overall, this program relies on a combination of clinical rotations through various ICUs, advanced didactic content, and a robust high-fidelity simulation curriculum. All of these educational methods include multidisciplinary instruction to provide the best evidence-based education to prepare students for practice in critical care centers. Unique to this program has been the ability to combine educational and practice efforts throughout Vanderbilt’s medical center to promote strong advanced practice nursing educational and clinical practice goals.
Implications for DNP education

A further expansion of this program is being piloted through collaboration between the Vanderbilt University School of Nursing’s Doctor of Nursing Practice (DNP) program and Division of Anesthesiology/Critical Care Medicine. The DNP-intensivist fellowship program combines a 2-year post Masters DNP curriculum, which focuses on the preparation of practice scholars, with a 2-year critical care clinical fellowship in the Vanderbilt ICUs. This program is an expansion of the current interdisciplinary training model between School of Nursing and the Division of Critical Care Anesthesia of the School of Medicine offered in the Masters ACNP intensivist track. As part of this new DNP-intensivist focus, a 2-year long critical care fellowship acts as the major component of clinical training. This fellowship is completed concurrently with the DNP coursework, and acts to strengthen the clinical portion of the DNP program through mentored clinical practice and educational opportunities. The clinical fellowship combines active daily patient care in a tertiary ICU specific to students’ areas of clinical interest, with a specific clinical curriculum delivered in biweekly tutorial style sessions. Daily patient care provides critical care NP fellows with the opportunity to advance their hands-on skills and intellectual background in the care of critically ill surgical patients. The educational program, co-taught and facilitated by a physician and NP intensivist, broadly covers the clinical and cognitive components essential to the multidisciplinary practice of critical care. The critical care NP fellow provides care for assigned ICU patients, attends didactic conferences, leads academic case discussions, and clinical conferences.

Unique to this fellowship is critical care training blending of intensivist physicians and ACNPs’ expertise with DNP-intensivist fellow education into an expanded interprofessional educational program. This DNP fellowship would allow additional access to tertiary level ICU clinical environments and faculty necessary to mentor DNP students. The ultimate goal is to produce a doctorally prepared ACNP intensivist who has expanded expertise, both in clinical knowledge and interprofessional team experience. Currently, the DNP-intensivist fellowship is in a pilot phase with one student enrolled in the program. Data collection is currently underway for programmatic evaluation for this pilot program.

Conclusion

The changing environment of the American healthcare system has placed new pressures on the effort to provide high level ICU care for patients. The decrease in resident work hour regulations, a growing body of older Americans who need ICU care, and shrinking reimbursement pools are necessitating new ideas to meet the needs of patients who are critically ill in the United States. One model that has emerged is to utilize highly trained ACNPs as part of a multidisciplinary team to provide more complete patient coverage. This MD/ACNP intensivist model has been in practice at Vanderbilt University Medical Center since 2005. It continues to grow and be refined, but is now a standard care model in Vanderbilt’s ICUs. The MD/ACNP team model now provides round-the-clock coverage with immediate response to patient needs. This model has absorbed the loss of resident “frontline” coverage from work hour restrictions and has allowed for increased patient capacity. The movement of the ACNP components of the teams to billing provider status has allowed greater collection on previously unbilled services performed by residents or occurring outside the scope of a single MD practitioner. An important component to the success of this model has been the continued development of a multidisciplinary ACNP intensivist training program through a combined effort between the Vanderbilt Schools of Nursing and Medicine faculty. This new educational model looks to supply highly trained ACNPs to staff multidisciplinary teams at critical care centers, such as Vanderbilt and elsewhere. Because this educational model employs the team approach as well as specialized ICU curricula, ACNPs trained as intensivists are better prepared to join ICU teams and successfully manage unstable critically ill patients. By expanding the educational components of the ACNP curriculum to focus on a subspecialty of an intensivist, this healthcare delivery model provides a unique approach to expanding critical care teams to meet an increasing patient demand in light of an intensivist physician shortage. This approach provides 24/7 onsite critical care providers and creates a team that is able to bill for all of the services provided while meeting the needs of complex, critically ill patients.

References


