Advanced practice providers (APPs) are increasingly being used in a variety of healthcare settings to provide care, treatment, and services to patients with cancer. They are also being deployed to acute oncologic settings to enhance patient care delivery and address the ever-evolving needs of patients in academic medicine. In response, the University of Texas MD Anderson Cancer Center developed a series of innovative clinical programs staffed by acute care APPs. These provide an opportunity to rapidly adapt to the acute care needs of patients with cancer while fostering the professional development of APPs within the full scope of their oncologic clinical practice.

**AT A GLANCE**
- Innovation in patient care delivery can be most effective when collaboration exists between teams.
- APPs can play a key role in improving the delivery and continuity of patient care in acute care settings.
- The ability to quickly adapt to the changing needs of patients within an evolving healthcare system is critical to success.

**KEYWORDS**
critical care; advanced practice nurse; physician assistant; oncology

**DIGITAL OBJECT IDENTIFIER**
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**Delivery of Clinical Services**

Mobilizing advanced practice providers to enhance patient care

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The rapidly evolving pace of the healthcare landscape requires healthcare institutions to do even more to keep up with the increasing demand for safer, more efficient patient care and transparent reporting of quality outcomes. As one of the nation’s original three comprehensive cancer centers, the University of Texas MD Anderson Cancer Center has used a multidisciplinary approach to provide cancer care and cancer prevention services since its designation in 1971. This large academic cancer center provided care to about 135,000 patients (of these, more than 41,000 were new to the institution) in fiscal year 2016 and responded to patients’ unique challenges and needs by rapidly implementing several creative clinical programs. The purpose of this article is to describe the implementation of three programs staffed primarily by advanced practice providers (APPs) under the auspices of the Division of Acute Care Services (ACS), as well as resulting improvements in clinical care. This article will provide additional insight into how organizations that think resiliently can effectively implement new programs and processes to adapt to the changing needs of patients, as well as to an ever-evolving healthcare system.

**Acute Care Services**

ACS was created in 2011 to enhance patient care by providing clinical support across the continuum of patient care delivery, including treatment, hospitalization, and emergency care. More specifically, the ACS programs are intended to fill the gaps by fostering collaborative intervention in the direct treatment and management of critically ill patients. The three ACS programs (the Nocturnal Program, Acute Care Procedure Team, and Clinical Decision Unit) are clinical structures with administrative and physician supervision to support the independent clinical practice and professional development of the APP staff.

**Nocturnal Program**

The Nocturnal Program was the first program developed within ACS. It was conceived in response to a critical assessment of the after-hours inpatient medical needs of patients and the perceived imbalance between the inpatient census and acuity of some services and the allocation of appropriate in-house resources. Prior to the Nocturnal Program, one fellow provided in-house, after-hours coverage for about 180 patients with hematologic malignancies, and one resident provided inpatient support to about 110 patients with solid tumor malignancies. Conversely, the patients in surgical oncology (about 50) were covered by an in-house fellow and resident, whereas patients in other surgical subspecialty services (about 90 patients) relied on on-call fellows taking calls from home. Broad consensus existed across multiple disciplines to reevaluate the after-hours support structure to better align inpatient care with the mission to...
deliver high-quality, safe care across all patient care environments within the organization. It was an opportunity to improve and expand the after-hours care delivery model previously described in the literature (Howie & Erickson, 2002; Kleinpell, Ely, & Grabenkort, 2008; Winne et al., 2012). In addition, new restrictions placed on trainee work hours prompted the transition to APP roles (Accreditation Council for Graduate Medical Education, 2016).

The in-house, after-hours team consists of APPs and moonlighting physicians assigned to cover the medical and surgical intensive care units, as well as the hematology-oncology, solid tumor malignancies, pediatrics, and surgical subspecialties. With about 12 APPs and six moonlighting physicians per night, the program provides nursing staff and patients with essential direct access to inpatient medical providers seven days a week. The design of the program is a key to its success. The Nocturnal Program providers (i.e., APPs and moonlighting physicians) receive a coordinated handoff from primary services to ensure the communication of patient care issues, make frequent rounds on inpatient units, deliver a rapid response to emerging or acute clinical conditions, and communicate, as appropriate, with on-call attending physicians.

CASE STUDY 1: NOCTURNAL PROGRAM
Because of the highly complex nature of the population of patients undergoing stem cell transplantation (SCT), the Nocturnal Program partnered with the primary service to assist with early evaluation of patients undergoing SCT who are admitted overnight in the emergency department. Prior to this, patients could experience delays of as many as several hours before being seen by the primary service.

An exemplar that demonstrates the success of this model was when a patient undergoing SCT presented to the emergency department with anemia and required a blood transfusion. The patient was transferred to an inpatient unit, transfused blood products, and subsequently experienced symptoms of dyspnea and shortness of breath. Because of the ongoing partnership between the Nocturnal Program APPs and the SCT service, these symptoms were assessed and treated during routine evaluation of the patient. Early intervention initiated by the Nocturnal Program APP resulted in resolution of the patient’s acute condition.

Acute Care Procedure Team
In 2008, the Centers for Medicare and Medicaid Services (CMS) introduced regulations identifying several preventable hospital-acquired conditions that would no longer be approved for payment; hospital-acquired vascular catheter–associated infections were identified within the preventable conditions report (CMS, 2008). In an effort to minimize catheter-associated infections, ACS introduced the Acute Care Procedure Team in 2013. The goal of this team is to improve patient care and safety through decreased complications, infections, and failure rates. The APP-led team assumed responsibility from surgical oncology fellows for providing ultrasound-guided central venous catheter (CVC) insertions and implanted port removals in the Infusion Therapy Center. Shortly thereafter, the procedural services offered were expanded to include provision of ultrasound-guided paracentesis and lumbar punctures in the emergency, inpatient, and outpatient settings.

Since the program’s inception, these APP proceduralists have achieved a lower CVC insertion complication rate (0.65%) than the surgical oncology fellows (1%). Because of these successes, this team developed standardized protocols for bedside paracentesis and lumbar punctures that streamline access and facilitate therapeutic care. In addition, the team established a procedural simulation training program that all APPs must successfully master prior to performing procedures in a patient care setting. Each procedure, including materials, equipment (i.e., ultrasound), and electrocautery, is replicated in the simulation laboratory as part of a standardized training regimen that exposes APPs to meaningful risk-based scenarios. The use of APPs in this setting has provided consistency and overall improvement in patient care outcomes.

“The use of advanced practice providers in this setting has provided consistency and overall improvement in patient care outcomes.”

Clinical Decision Unit
Historically, patients receiving care, treatment, and services to evaluate an outpatient condition and determine the need for inpatient admission or discharge were managed in the emergency department until inpatient bed availability was secured. This caused delays in patient care, contributed to overcrowding in the emergency department, and ultimately resulted in an emergency department length of stay that negatively affected the patient care experience. Consequently, ACS established a 16-bed, short-term, observational Clinical Decision Unit in November 2014. The Clinical Decision Unit is a designated outpatient hospital unit where adult patients in need of additional monitoring, diagnostic evaluation, or treatment may be placed while a clinical decision is being made to either admit the patient for...
FIGURE 1. MOBILE PROCEDURE TEAM PARACENTESIS WORKFLOW

1. Provider identifies that patient may need therapeutic paracentesis and pages proceduralist via on-call calendar

2. Provider/on-call proceduralist discussion involves the following:
   - Medical record number
   - Anticoagulation medication history
   - Hemodynamic status
   - Reason for procedure
   - Laboratory results to obtain

3. All calls for paracentesis must be evaluated by proceduralist with ultrasound. Proceduralist assessment of patient involves the following:
   - Ultrasound that shows 3 cm zone of acidic fluid without encroachment of the bowel (to prevent bowel injury)
   - Anatomic site limited to right lower quadrant and left lower quadrant
   - Coagulopathy (international normalized ratio must be greater than 2 AND platelet less than 20,000, OR if patient has tense ascites with warning signs of respiratory distress, procedure should not be delayed to correct coagulopathy)

4. Procedure indicated?

   - Yes
     7. Less than 3 cm zone identified on ultrasound
     8. Refer to interventional radiology if diagnostic tap needed, or have primary team reconsult when more fluid reaccumulates.

   - No
     9. Site other than right lower quadrant and left lower quadrant
     10. Refer to interventional radiology.
     11. Coagulopathy
     12. Discussion with on-call surgical fellow if benefit outweighs risk because of severe ascites. If patient is stable, attempt to correct coagulopathy prior to procedure.
     13. Postsurgical scars, wounds, catheters, or ostomies over procedure site
     14. Refer to interventional radiology.

5. Proceduralist to proceed with therapeutic paracentesis. The procedure must be logged in mobile procedure team sharepoint log.
   - Maximum fluid removal is three bottles for first-time paracentesis.
   - Blood pressure must be monitored during procedure and reassessed after each liter of fluid is removed.
   - For high-volume taps (more than five liters), the attending must approve the procedure, the patient must have received multiple prior high-volume taps (which must be documented), and the patient must receive postprocedure care.

6. Nursing communication given to notify primary team and mobile procedure team if findings of site leak, bleeding, or unstable vitals.

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hospitalization or discharge him or her from hospital care. The unit is uniquely staffed by two APPs from the Acute Care Procedure Team during daytime hours and by two APPs from the Nocturnal Program after hours. Using APPs from the two existing ACS programs has allowed the institution to flex providers to the Acute Care Procedure Team or the Nocturnal Program based on clinical support needs and the Clinical Decision Unit census.

Although more than 90% of patients placed in the Clinical Decision Unit are directly referred from the emergency department, the Clinical Decision Unit is accessible to clinicians in the outpatient clinics in need of observation services as well. Launching an independent APP practice outside of the emergency medicine or internal medicine departments has encouraged APP collaboration with both. For patients in the emergency department, the APPs are crucial in determining the appropriate diagnosis and treatment setting for patients in need of observation services. Once patients are placed in the Clinical Decision Unit, the APP sends a written communication to the primary provider, and the APPs provide patients with real-time assessment, evaluation, and treatment to effectively determine preparedness for discharge or transfer them to an inpatient level of care. Differential diagnoses for patients receiving observation services include chest pain, electrolyte imbalances, nausea with or without vomiting, dehydration, anemia, and abdominal pain with or without associated dysfunction in bowel motility. Within three months of opening the Clinical Decision Unit, the emergency department average length of stay for patients receiving observation services decreased by 18%, although the average number of patients placed in observation by the emergency department doubled.

CASE STUDY 2: CLINICAL DECISION UNIT
A 67-year-old male patient with a history of B-cell chronic lymphocytic leukemia presented to the emergency department at 3 pm. According to the patient’s wife, the patient had altered mental status for two weeks, with worsening symptoms during the morning of presentation. The patient exhibited the following characteristics:

- Heart rate of 113 beats per minute
- Blood pressure of 85/58
- Respiratory rate of 20 breaths per minute
- Oral temperature of 36.8°C
- Oxygen saturation of 93% on room air
- Headache, fatigue, and confusion; no fever, abdominal pain, or urinary incontinence

In addition, the patient’s physical examination was unremarkable except for tachycardia and hypotension, alert and oriented only to person and place, and urine albumin. His systolic blood pressure improved to the upper 90s. The Nocturnal Program APP team was notified that the patient had two episodes of left chest pain and what he described as a tuning fork in his left arm when he got up to go to the bathroom. The APP ordered immediate cardiac panel, an electrocardiogram (EKG) test, and chest x-rays. Results of the cardiac bloodwork are listed in Table 1.

After the emergency department physician assessment, the decision was made to place the patient in the Clinical Decision Unit for confusion, and IV antibiotics (ciprofloxacin and cefepime) were started for the urinary tract infection. Placement in the Clinical Decision Unit occurred at 7 pm. When the Clinical Decision Unit APP arrived, the patient was found to have improved mental status and was oriented to person, place, and time, and his systolic blood pressure had moved into the 120s with IV fluid hydration; other assessment parameters remained unchanged.

During his Clinical Decision Unit stay, the patient developed hypotension and was treated with 500 ml fluid bolus and albumin. His systolic blood pressure improved to the upper 90s. The Nocturnal Program APP team was notified that the patient had two episodes of left chest pain and what he described as a tuning fork in his left arm when he got up to go to the bathroom. The APP ordered immediate cardiac panel, an electrocardiogram (EKG) test, and chest x-rays. Results of the cardiac bloodwork are listed in Table 1. The EKG test found sinus tachycardia, low QRS voltage, and inferior myocardial infarction of indeterminate age.

At 9:45 am, the patient was found in his room without his gown and to have gotten up without assistance. Half of his leads had been removed. He stated he needed to go to the bathroom and kept asking for his wife, who had left the room. He appeared to be somewhat confused. His blood pressure was 99/70, his pulse was 102 beats per minute, his respiratory rate was 18 breaths per minute, his temperature was 36.7°C, and his saturation of peripheral oxygen was 94% on four liters of oxygen via a nasal cannula. Because of these findings, a cardiology consultation was scheduled. The patient was placed on telemetry, and chest x-ray showed an enlarged heart.

After the cardiology assessment, amidarone was ordered, and amidarone bolus and drip were initiated. Bedside ultrasound showed a large volume pericardial effusion. The patient was admitted to the

<table>
<thead>
<tr>
<th>CARDIAC ENZYME</th>
<th>PATIENT RESULT</th>
<th>NORMAL RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatine kinase</td>
<td>&lt; 20 IU/L</td>
<td>55–170 IU/L</td>
</tr>
<tr>
<td>Creatine kinase (muscle and brain units)</td>
<td>1 ng/ml</td>
<td>0.6–6.3 ng/ml</td>
</tr>
<tr>
<td>Troponin-1</td>
<td>0.09 ng/ml</td>
<td>0.00–0.03 ng/ml</td>
</tr>
<tr>
<td>Lactic acid level</td>
<td>1 mmol/l</td>
<td>0.7–2.1 mmol/l</td>
</tr>
<tr>
<td>B-type natriuretic peptide</td>
<td>374 pg/ml</td>
<td>0–100 pg/ml</td>
</tr>
</tbody>
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inpatient unit immediately after presenting to the catheterization laboratory for urgent pericardiocentesis.

**Implications for Practice**
The success and longevity of an effective healthcare organization or system relies on members’ ability to think resiliently by being open to adaptation and change as a means of providing quality and efficient care. Resilient thinking confronts the challenges of increasing complexity by creating systems that adapt to unforeseen demands of health care (McChrystal, Collins, Silverman, & Fussell, 2015). The initiation of ACS clinical programs presented a unique opportunity to rapidly mobilize APPs to address the evolving needs of patients in an acute care, oncologic setting.

In less than five years, the Nocturnal Program, Acute Care Procedure Team, and Clinical Decision Unit have not only become part of the unique blend of services offered to patients, but also have contributed to the professional advancement of APPs in their oncologic clinical practice. These services have opportunity for replication in other clinical facilities and can ultimately improve care delivery to patients.

**Conclusion**
Healthcare institutions are consistently under pressure to look for efficiencies in their healthcare delivery systems while continuing to provide safe, patient-centered care. Not only has the healthcare system become more complex, but so has the care of patients, particularly those receiving cancer care, treatment, and services. Institutions can adapt to these complex demands in a variety of ways, but the creative use of APPs should not be overlooked. This article proposed several strategies for improving patient care delivery in acute care settings by mobilizing APPs to address critical gaps in the patient care system of an academic cancer center. However, these strategies are not unique to academic centers or to cancer care. Innovation in patient care delivery is crucial to addressing the increasing demands for high-quality patient care across all healthcare settings.

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**REFERENCES**

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