TelEmergency: A Novel System for Delivering Emergency Care to Rural Hospitals

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Providing rural emergency medical care is often difficult because of limited resources and a scarcity of medical providers, including physicians trained in emergency medicine. Telemedicine offers promise for improving the quality of care in rural areas, but previous models were not well designed to provide affordable care to unstable or potentially unstable patients. The TelEmergency program was developed to overcome these limitations by providing quality, affordable medical care to patients in rural emergency departments (EDs) using specially trained nurse practitioners linked in real time by telemedicine with their collaborating physicians at the University of Mississippi Medical Center Adult Emergency Department. Since its inception in October 2003, the TelEmergency program has evaluated and treated more than 40,000 patients in 11 rural EDs throughout Mississippi, with a high degree of satisfaction from patients and hospital administrators. This article details the development and implementation of this system and describes the patient population that has been evaluated. [Ann Emerg Med. 2008;51:275-284.]

INTRODUCTION

Providing quality emergency care in rural areas is a common problem in the United States. Although the hourly census of patients who present at smaller rural emergency departments (EDs) is typically lower compared with that of urban EDs, the acuity of individual patients can be high. The difficulties in caring for these higher-acuity patients is compounded by limited medical resources and a lack of training in emergency medicine by many health care providers staffing rural EDs.[1-3]

Although a residency-trained, board-certified emergency physician is considered the gold standard when an ED is staffed, rural EDs frequently are unable to attract such individuals and in some instances any physicians whatsoever.[1-3] Many rural EDs in our state are staffed by individuals who vary in training from board-certified internists and family practitioners to physicians who are either currently in residency or have left postgraduate medical education without completing any residency at all. In an effort to overcome this physician shortage and decrease costs, some facilities in our state began to staff their EDs with nurse practitioners alone, without physicians present in the hospital.

In Mississippi, nurse practitioners are allowed to practice medicine independently if they are within 15 miles of their collaborating physician. Despite this requirement, we observed through coordinating intrafacility transfers that often the collaborating physicians were not available to assist in patient care in a timely fashion, if they were available at all. Many critically ill ED patients were thus being treated by a nurse practitioner with inadequate training and experience, without readily available physician backup. This situation was far from ideal for the patients and the nurse practitioners who were forced to practice outside the scope of their training and licensure.

Telemedicine offers promise for improving the quality of care in rural areas, but previous models were not well designed to provide affordable care to unstable or potentially unstable patients. Previous models relied on physician-to-physician consultation, usually required the presence of a subspecialist to provide the consultation, and in emergency medicine lacked Current Procedural Terminology codes for telemedicine providers to bill for their services.[4,5] The TelEmergency program was developed to overcome these limitations by using specially trained nurse practitioners, linked in real time by telemedicine with their collaborating physicians at the University of Mississippi Medical Center Adult Emergency Department (UMMCAED). Between October 2003 and October 2006, the TelEmergency program has evaluated approximately 40,000 patients in rural EDs in Mississippi.

Nurse Practitioners

In the TelEmergency model, nurse practitioners and collaborating TelEmergency physicians treat ED patients at multiple geographically distant sites. Nurse practitioners were chosen rather than physician assistants or other midlevel practitioners because of the availability of nurse practitioners and the familiarity with nurse practitioners of hospitals and patients in our state. With the cooperation of the Mississippi State Board of Medical Licensure and the Mississippi Board of Nursing, we obtained a waiver allowing nurse practitioners who participated in our pilot program to collaborate with physicians who were more than 15 miles away by using a telemedicine link.

The nurse practitioners recruited were required to have specific qualifications. These include a master's degree in nursing from an accredited institution (National League for Nursing or Commission on Collegiate Nursing Education), certification as a family nurse practitioner with a current unrestricted license (registered nurse and nurse practitioner) to practice in the United States and eligibility for licensure in Mississippi, current basic cardiac life support, advanced cardiac life support, and pediatric advanced life support and completion of the Mississippi Nurse's Association Controlled Substance Workshop. We gave preference to nurse practitioners who had completed 1 year of clinical experience as a nurse practitioner and those who held a second certification as acute care nurse practitioner. If the nurse practitioner was not dually certified, we recommend registration into an acute care nurse practitioner post-master's program.

We designed an educational program specifically for the TelEmergency nurse practitioners. It consists of approximately 40 hours of continuing medical education on topics believed to be critical to the evaluation, diagnosis, and treatment of ED patients, combined with clinical and procedural training. A list of the lecture topics is given in Figure 1. The TelEmergency nurse practitioners are required to complete 4 examinations based on the lectures and case presentations from a required text before completion of their clinical rotation.

The clinical training consists of clinical hours in the UMMCAED and various skill laboratories, including a cadaver laboratory. The clinical hours vary from a minimum of 135 hours to approximately 200 clinical hours and must include at least 100 patient encounters under the supervision of attending emergency physicians at the University of Mississippi Medical Center Adult Emergency Department. At the end of the clinical and skill laboratory rotation, TelEmergency nurse practitioners are required to document the patient log, as well as the procedure log given in Figure 2.

All TelEmergency nurse practitioners must also obtain a Drug Enforcement Agency certificate and meet privileges and credentialing requirements at the hospitals in which they are to be employed. In addition, TelEmergency nurse practitioners are required to meet continuing education requirements, including attending quarterly performance improvement and educational "update" conferences, and to document the performance of a

Approach to the ED patient
Chest pain
Syncope
Hypertensive emergencies
Acute coronary syndromes
EKG Interpretation
C-spine trauma
Head trauma
Abdominal and blunt trauma
Penetrating trauma
Extremity trauma
Open injuries to the hand
Antiarrhythmics
Advanced cardiac life support drugs
Fibrinolytics
Intubation drugs
Stroke
Acute dyspnea
Obstetric emergencies
Acute abdominal pain
Acute gastrointestinal bleeding
Adult febrile patients
Pediatric febrile patients
Telemedicine equipment
Acute complications of diabetes
Anaphylaxis
The swollen and painful joint
Advanced airway management
Headache
Controlled substances
Seizures
Altered mental status
Wheezing
Advanced trauma life support
The poisoned patient
Electronic medical recordkeeping

Figure 1. TelEmergency didactic lecture series.

requisite number of selected clinical procedures to continue to remain active in the TelEmergency program.

Of the 34 TelEmergency nurse practitioners who have completed the requisite training, 27 have maintained the required continuing education and procedural documentation. Of these 27, a total of 23 are actively participating in the TelEmergency program at site hospitals, which gives us an ongoing retention rate of 68% during the past 28 months.

Collaborating Physicians

The TelEmergency program is an extension of UMMCAED, and all collaborating physicians are either faculty or senior residents at UMMCAED. The University of Mississippi

Arterial blood sampling (3)
Defibrillation/cardioversion (2)
Needle decompression (1)
Venous access, femoral (3)
Venous access, external jugular (1)
Dislocation reduction (1)
Closed fracture splinting (1)
Intubations, adult (5)
Intubations, pediatric (5)
Laceration repair (3)
Adult medical resuscitation (3)
Adult trauma resuscitation (3)

Figure 2. Nurse practitioner procedural requirements.

Medical Center Adult Emergency Department is an urban teaching ED, with an annual census of approximately 65,000 visits. Dedicated collaborating physician coverage for the TelEmergency program is provided 16 hours a day. Fifty percent of the dedicated collaborating physician coverage is provided by UMMCAED attending physicians and 50% by senior (postgraduate year 3 or postgraduate year 4) emergency medicine residents, with attending physician backup. Postgraduate year 3 and postgraduate year 4 residents participate in TelEmergency rotations of 4 and 6 weeks, respectively, as part of their residency training, whereas emergency medicine faculty members cover on average 2 TelEmergency shifts per month. Before covering any TelEmergency shifts, all collaborating physicians undergo an orientation session that familiarizes them with the use of the TelEmergency cameras and monitors, as well as the specific capacities and limitations of the participating hospitals and EDs.

TelEmergency coverage consists of 2 8-hour shifts, between 10 AM and 2 AM. Between 2 AM and 10 AM, a senior emergency medicine resident or faculty member who also has clinical responsibilities in the ED provides coverage because TelEmergency hourly census decreases considerably.

Collaborating physicians also perform performance improvement reviews on selected patient medical records during their TelEmergency shifts, which ensures familiarity with problem or potential problem cases and provides the collaborating physicians with an understanding of the overall TelEmergency system.

Technology

The technology used in the TelEmergency system was designed to create a system that was as simple as possible for the medical staff to use while still providing the necessary capabilities for the evaluation and treatment of ED patients. Several types of technologies were used to accomplish this goal.

Each remote hospital site uses Cisco 2600 Ethernet Router (Cisco Systems, San Jose, CA), interfacing with a full T-1 line,

which in turn runs to a 12-port Cisco Catalyst 2950 switch (Cisco Systems, San Jose, CA). The lines return to UMMCAED through a frame relay circuit into a Cisco 7204 Router (Cisco Systems, San Jose, CA), which then disperses the traffic into the UMMC gigabit backbone.

Remote sites use the Polycom ViewStation FX (Polycom, Inc., Pleasanton, CA) or the Sony PTZ camera (Sony Corporation, Minato-Kun Tokyo, Japan). We have a total of 22 cameras in the 10 EDs participating in the TelEmergency program. These cameras tie back into a Polycom MGC-50 bridge (Polycom, Inc., Pleasanton, CA) at University of Mississippi Medical Center. The TelEmergency nurse practitioner is able to connect the local camera into the bridge with a control pad, which is controlled by an AMX NI-2000 Room Control System (AMXLLC, Richardson, TX). When the TelEmergency nurse practitioner needs to consult UMMCAED for a new patient, he or she will use the touchpad to indicate to the physician that a consultation is needed.

At UMMCAED, the AMX control units tie back into an NI-4000 Room Control System (AMXLLC, Richardson, TX), and the control system ties into an AMX Modero Color Video Touch Panel (AMXLLC, Richardson, TX) and into 2 Polycom VS4000 cameras (Polycom, Inc., Pleasanton, CA). The touch panel allows the physician to move the cameras at both the near site and the far site. The touch panel also serves as a system to keep the calls prioritized that have arrived from the various TelEmergency nurse practitioners throughout the state. The queue is set up to list the calls from the various hospitals in the order in which they arrived, unless there is an emergency request from a TelEmergency nurse practitioner. All active patients are continuously displayed on a 60-inch Panasonic plasma screen, which allows the collaborating physicians at UMMCAED to continuously monitor the emergency departments at those remote sites.

When the physician is available for consultation, he or she presses the hospital's name on the touch panel. A point-to-point call is then executed through the AMX and Polycom equipment. Once in the point-to-point call, the physician has full control over the far camera and can carry on a normal conversation with the TelEmergency nurse practitioner and patient at the far hospital, as well as use the zoom and pan features to visually inspect a particular area of interest, such as a patient finding or a cardiac monitor.

Though our original intent was to view radiographs through the Polycom equipment, it became apparent that the image quality was insufficient for proper interpretation of the radiographs. After testing various radiograph digitizers, we decided on the Radlink LaserPro16 (Radlink, Inc., Redondo Beach, CA) and have been satisfied with the results.

The average cost for a remote site using 2 patient rooms set up for TelEmergency consultation is $60,214 and for a remote site using 3 TelEmergency rooms, $63,868. The cost of equipment at the University of Mississippi Medical Center Adult Emergency Department as currently configured is

$207,556. The up-front cost for equipment was subsidized by a grant from the Bower Foundation, and the TelEmergency program pays for any equipment upgrades and for all maintenance.

Reimbursement

A large barrier to effective telemedicine services in emergency medicine has been reimbursement. There was no federal Medicare reimbursement for telemedicine services until 1997. The Balanced Budget Act of 1997 directed the Health Care Financing Administration to make part B payments for professional consultations by telemedicine, but these rules were so restrictive that from April 1999 through December 2000 the Health Care Financing Administration paid only 235 total telemedicine claims.

Medicare expanded its payment for telemedicine services in 2001 after the passage of the Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act of 2000. Among other things, this act created CPT codes for office or outpatient visits, psychotherapy, and pharmacologic management, allowing for payment to a provider who furnishes telemedicine services at a distant site at the same rate that would have been paid if the service had been furnished without the use of a telecommunications system. It expanded the areas covered and removed the requirement for the practitioner requesting telemedicine service to be present.[6] This act expanded the reimbursement for telemedicine services, but it does not provide CPT codes for ED services. This lack of reimbursement was a major barrier in the creation of our TelEmergency system.

Because of the lack of CPT codes for ED services, we constructed our TelEmergency system to be reimbursed in a manner that to our knowledge is unique in telemedicine. The participating hospitals use the TelEmergency nurse practitioner and bill for the medical care provided by the TelEmergency nurse practitioner by using existing ED CPT codes. The participating hospital then pays the TelEmergency system an additional, set, hourly rate to collaborate with the TelEmergency nurse practitioner through the telemedicine linkage. The combined hourly rate, although greater than what is standard for nurse practitioners in our area, is less than the cost of staffing with on-site physicians. After discussion with the administrators of the participating hospitals, we estimate the hourly cost of staffing with physicians to be approximately US $100 per hour, or $72,000 for 24 hours of daily coverage in a 30-day month. As a general rule, none of the physicians available to these institutions have any specialized training in emergency medicine, and many have not completed any residency. To provide coverage using only nurse practitioners who do not participate in the TelEmergency program and therefore lack the additional training provided to the TelEmergency nurse practitioners, we estimate the rate at $50 per hour, or $38,000 per month. With our fee for collaboration currently at $20 per hour, the TelEmergency system would provide 24-hour ED coverage with a specially trained nurse practitioner, with real-time telemedicine backup provided by

trained emergency practitioners, for approximately $53,000 per month. All telemedicine hardware is provided by the TelEmergency system, initially through a startup grant from the Bower Foundation. The only additional requirement is that the participating hospitals maintain a T-1 line to support the telemedicine connection. We believe this system allows for participating hospitals to provide a level of ED care that is at least similar, if not superior, to that provided to rural EDs by physician staffing services that use practitioners without formal training in emergency medicine while still realizing a significant cost savings.

Participating Hospitals and EDs

The creation of the TelEmergency model was instigated in part because of input from hospital administrators throughout our state. A major factor in the use of unsupervised nurse practitioners was the inadequate number of physicians available for staffing. Some of the hospitals currently participating in our program have a hospital staff consisting of only 2 primary care physicians. In these cases, the staff physicians were understandably reluctant to provide ED coverage in addition to their other clinical responsibilities, whereas nonstaff physicians were not available or were too expensive for such low-volume EDs. The characteristics of the communities served by the participating hospitals in the TelEmergency program are listed in Table 1. All participating hospitals are located in rural communities that range in population from 519 to 6,415, whereas the population of their home counties ranges from 8,488 to 38,041. The hospitals are on average 93 miles from the University of Mississippi Medical Center, with a range of 39 to 183 miles. Hospital characteristics are given in Table 2.

As in the participating hospitals, there is also variability in the EDs staffed by TelEmergency. This information is also given in Table 2. The EDs served by TelEmergency range from 2 to 6 beds, with an average of 3.6 beds. The average yearly ED census ranges from approximately 3,000 to 9,500, with a mean of 5,500. The total yearly census of the combined 10 hospitals is approximately 50,000. No participating hospital uses TelEmergency exclusively for ED coverage; rather, it is used to complement their existing physician coverage. On average, the EDs use TelEmergency for 281 hours a month, with a range from 71 to 505 hours per month. Ten of the 11 hospitals that have participated during the TelEmergency project remain involved in the program.

Patient Evaluation Protocols

Initially, all patients were required to be treated and evaluated by both a nurse practitioner and a collaborating physician, but this was unwieldy in the evaluation of nonurgent patients and increased the wait time for minor complaints. We created a set of protocols to identify patients whom the nurse practitioners could assess and treat primarily, as well as patients requiring immediate consultation and transfer. These criteria are listed in Figure 3A, B, and C.

Table 1. Emergency department characteristics.

Hospital Name	Mississippi Hospital Site	Town Population*	County Population*	Distance From UMC, Miles	UMC Primary Referral Center
Pioneer Community Hospital of Aberdeen	Aberdeen	6,415	38,041	183	No
Humphries Co. Hospital	Belzoni	2,663	11,206	76	No
UMC Lexington	Lexington	2,025	21,609	60	Yes
Quitman Co. Hospital	Marks	1,551	10,177	167	No
Franklin Co. Hospital	Meadville	519	8,488	89	No
Scott Regional Hospital	Morton	3,482	28,423	39	Yes
Claiborne Co. Hospital	Port Gibson	1,840	11,831	77	Yes
Prentiss Co. Regional Hospital	Prentiss	1,158	13,962	62	No
Perry Co. Hospital	Richton	1,083	12,236	114	No
Lawrence Co. Hospital	Monticello	1,726	13258	66	Yes

UMC, University of Mississippi Medical Center.
*Source: US Census Bureau 2000.

Table 2. Hospital characteristics.

Hospital Name	Start Date	End Date	Total Yearly ED Census	ED Beds	TelEmergency Cameras	Avg h/mo	Avg Patients/12-h Shift	Total 12-h Shifts	Total TelEmergency Patients
Pioneer Community Hospital–Aberdeen	5/1/2005	n/a	3,700	2	1	71.9	5.8	40.5	234
Humphreys County Memorial Hospital	10/1/2003	n/a	5,600	4	3	321.0	4.1	702.3	2,900
University Hospitals and Clinics, Holmes Co.	10/1/2003	n/a	n/a	6	4	216.8	6.8	452.7	3,084
Magee General Hospital	3/1/2004	1/31/2005	7,500	5	1	165.1	13.1	151.4	1,976
Quitman County Hospital	10/1/2003	n/a	n/a	3	2	166.6	4.3	329.3	1,403
Franklin County Memorial Hospital	6/1/2005	n/a	7,800	2	1	90.3	8.1	36.0	292
Lawrence County Hospital	8/1/2004	n/a	n/a	3	2	505.6	9.9	633.3	6,266
Scott Regional Hospital	12/1/2003	n/a	n/a	4	3	117.7	12.9	222.1	2,869
Claiborne County Hospital	10/1/2003	n/a	n/a	3	2	268.3	5.2	580.8	3,036
Jefferson Davis Community Hospital	1/1/2005	n/a	8,400	2	1	301.3	7.8	233.0	1,818
Perry County Hospital	10/1/2003	n/a	n/a	3	2	281.1	4.6	610.4	2,819
Average				3.4	2	227.7	7.5	362.8	2,427
Total				37	22	2,505.6	82.6	3,991.7	26,697

Patients are divided into 3 categories: category 1 patients, who may be treated by the nurse practitioner alone; category 2 patients, who are treated in conjunction with the collaborating physician in a nonurgent period; and category 3 patients, who mandate immediate consultation with the collaborating physician and for whom expedited transfer to a facility offering a higher level of care is recommended. These categories were created with input from nurse practitioners and collaborating physicians in our system and are thought to be a reasonable compromise between nurse practitioner autonomy and collaborating physician oversight. The patients who are classified as category 1 are similar to those who are treated independently by nurse practitioners in the Fast Track at the University of Mississippi Medical Center Adult Emergency Department. These categories are meant to be used only as guidelines, and nurse practitioners are encouraged to involve the collaborating physician in the care of patients if there is any uncertainty about the most appropriate means of diagnosis and treatment.

Patient Characteristics

Between October 2003 and October 2006, the TelEmergency program grew from an initial 4 hospitals to a total of 10. During that period, the TelEmergency program evaluated more than 40,000 patients. Details of these patients are given in Table 3, whereas their diagnoses are given in Table 4.

Approximately two fifths (40.5%) of all patients were evaluated collaboratively by nurse practitioners and collaborating physicians, whereas 59.6% were treated independently by nurse practitioners. Overall, our patient population demonstrated a slight female predominance (54.8% female to 45.2% male patients). A majority (62.3%) of our patients were black, whereas 37% were white and less than 1% were of other ethnicity. The average age of the patients was 58 years, with a range from 0 months to 111 years. Pediatric patients (younger than 16 years) composed 23% of the patients, whereas 18% of patients were 65 years of age or older, with 11% being older than 75 years. The majority of patients (62%)

Patients with the following complaints meet category I criteria and can be evaluated, treated, and referred by the nurse practitioner, without required consultation with University of Mississippi Medical Center:

- Abdominal pain: stable vitals, no significant physical examination findings, age <50 y
- Allergic reactions not associated with shortness of breath, wheezing, or hypotension
- Animal bites not involving the hand or face
- Cerumen removal
- Chronic peripheral vascular disease
- Conjunctivitis
- Constipation/diarrhea
- Contact dermatitis
- Dental pain
- Dizziness: vital signs stable, no significant physical examination findings, age <50 y
- Fatigue without associated symptoms
- Follow-up wound check, cast check, or suture removal
- Foreign body removal (uncomplicated and not involving the eye)
- Gastritis: suspected food poisoning, no associated dehydration with limited duration
- Gynecologic disorders: vaginitis, insignificant abnormalities in menstruation, cramps
- Hemorrhoids
- Hypertension that is asymptomatic and accompanied by a diastolic pressure of <120 mm Hg
- Incision and drainage of simple abscess not involving rectal area
- Intravenous hydration/antibiotics >8 y old
- Low back pain that is chronic and not associated with neurologic findings
- Migraines: patient states typical migraine, no new features, stable vital signs, afebrile, no significant physical examination findings, no trauma
- Minor burns
- Minor eye injury: corneal abrasion
- Minor lacerations or abrasions
- Nausea/vomiting
- Otitis media, otitis externa, ear pain >3 mo old
- Pharyngitis: no sign of abscess or airway compromise
- Pregnancy without bleeding, pain
- Prescription refills: nonnarcotic or controlled substance until next business day
- Puncture wounds not requiring exploration
- Sexually transmitted diseases, excluding PID
- Skin rashes, pruritus
- Sprains/strains
- Swollen lymph nodes
- Uncomplicated hepatitis or exposure to hepatitis
- Upper respiratory infection, congestion, cough, flu
- Urinary tract infections >6 mo old
- Work releases
- Wound care

Any of the above conditions with the presence of a complex medical history or at the discretion of the nurse practitioner may require consultation with the University of Mississippi Medical Center.

If the nurse practitioner consults with University of Mississippi Medical Center by telemedicine, proper notation should be documented in the patient's medical record stating that the consult was made, name of the physician, and their recommendations.

PID, Pelvic inflammatory disease.

Figure 3A. Category I (consultation not required).

Patients presenting to EDs with the following complaints require consultation with the University of Mississippi Medical Center ED physicians by telemedicine:

- Abdominal pain: all patients with acute pain or >50 y old
- Abnormal vitals signs: SBP <100 or >180 mm Hg, pulse rate <50 or >110 beats/min, RR >24 breaths/min, temperature >101.5°F
- Age <1 or >75 y (all patients!)
- Alcohol or drug withdrawals
- Allergic reaction with shortness of breath, wheezing, or hypotension
- Arrhythmias
- Bleeding: significant bleeding from any orifice
- Burns: any third-degree; second-degree of more than 10% total body surface; burns of the face, hands, feet, perineum; electrical injury; inhalation injury
- Chest pain: all patients
- Coma or change in mental status
- Complicated lacerations
- Drug overdose
- Fever, <6 mo old
- Fever and toxic appearance or of unknown origin, <1 y old
- Foreign body of the eye
- Fractures with vascular impairment or displacement
- Head trauma
- Headache associated with neurologic findings, fever, or meningeal signs
- Heat illnesses: hyperthermia, temperature >40.5°C (105°F); or hypothermia, temperature <35°C (95°F)
- Hypertension: diastolic blood pressure of ≥120 mm Hg, with or without symptoms
- Intravenous hydration/antibiotics in children <8 y old
- Neurologic deficits
- Pain management: chronic, oncologic
- Patient with complex medical history
- PID
- Postoperative-related problems
- Postpartum pelvic pain
- Pregnancy complications (ie, abdominal pain, bleeding, fever)
- Psychiatric patients with abnormal findings
- Puncture wounds requiring exploration
- Seizures
- Shock
- Shortness of breath
- Sickle cell crisis
- Testicular pain
- Upper abdominal pain not clearly of gastrointestinal origin (possible cardiac)
- Urinary tract infection/dysuria/hematuria in children <4 mo old
- Vaginal bleeding: saturation of full-size pad 1 or more per 2 h

Any symptom that the nurse practitioner is concerned about regardless of its presence on this list requires consultation with University of Mississippi Medical Center by telemedicine.

Any patient with the following test or laboratory ordered requires consultation with the University of Mississippi Medical Center by telemedicine: EKG, computed tomography scan, cardiac enzymes, lumbar puncture (if in the nurse practitioner's scope of practice), C-spine radiographs.

Figure 3B. Category II (consultation required).

Patients with the following complaints meet category III criteria and require emergency consult for stabilization and transfer. The nurse practitioners will consult with University of Mississippi Medical Center emergency physician on all patients presenting with the following conditions:

- Acute head injury
- Advanced airway management: intubation
- All resuscitations
- Burn management
- Dizziness with unstable vital signs
- Multisystem trauma evaluation and resuscitation
- Serious or complex medical emergencies
- Shock of any cause

Transfer of these patients should not be delayed because of the telemedicine consultation but should be used through the stabilization of these patients. Definitive treatment of these patients should not occur in the outlying EDs. Referral should be made to the closest appropriate facility able to provide the services needed.

The University of Mississippi Medical Center Helicopter transport service (AirCare) can be used as deemed appropriate by the University of Mississippi Medical Center TelEmergency physician on duty.

Figure 3C. Category III (consultation required and possible transfer).

were discharged directly from the ED at the TelEmergency participating site, compared with 18% who were admitted to the participating hospital and 18% who were transferred to other hospitals, including 7% to the University of Mississippi Medical Center. A small number of patients (0.05%) left before being seen, whereas 1% left against medical advice and 0.6% died while in the TelEmergency site ED.

The most common complaints (12.4%) were musculoskeletal, followed by abdominal pain/nausea and vomiting (11.7%), chest pain (10.7%), and upper respiratory infection (9.9%). In patients admitted to participating hospitals, the most common complaints were chest pain (34.2%) followed by asthma/chronic obstructive pulmonary disease (18.2%), diabetes/general medicine (15.4%), and abdominal pain/nausea and vomiting (10.7%). Upper respiratory infection and otitis media were complaints in more than 54% of pediatric patients. Trauma represented a relatively small percentage of our patients (6.2%).

Performance Improvement

The overriding goal of our performance improvement program is to ensure that patients receive appropriate treatment in a timely fashion. If the program is unsuccessful in achieving that goal, then all other measurements are meaningless. The TelEmergency program's performance improvement director reviews all cases involving complications from treatment, adverse drug reactions, and patient deaths monthly. Trends of missed intubations, negative outcomes, investigation requests (by collaborating physicians), and other indicators of education or skill needs were also continually monitored by the performance improvement director.

With the development of patient evaluation protocols, we thought that adherence to these protocols was an important

Table 3A. Patient characteristics.

Dispositions	%
Admitted	18.2
Discharged	62.1
LBBS	0.05
Left AMA	0.9
Died in ED	0.65
Burn center	0.03
Transferred	18.3
Transferred to UMC	5.9
Consultations	
Nurse practitioner and collaborating physician	40.5
Nurse practitioner only	59.5
Sex	
Male	45.2
Female	54.8
Race	
Black	62.32
White	36.98
Hispanic	0.66
Native American	0.04

LBBS, Left before being seen; *AMA*, against medical advice.

Table 3B. Patient disposition by age.

Characteristics	Admit, %	Discharged, %	Transfer, %	Total, %
	18	65	17	
Mean age	55.94	30.24	43.53	37.1
<1 y	12	69	19	1.8
<36 mo	10	81	9	11
<16 y	7	82	10	24.3
16–64 y	48	60	61	58
≥65 y	43	35	22	18
>75 y	46	33	21	10.0

outcome measurement to follow. A randomized medical record review of patients evaluated independently by the nurse practitioners has been instituted. Each quarter, 40 cases treated independently by nurse practitioners are reviewed by collaborating physicians. These charts are evaluated for:

1. adequate documentation appropriate for visit complaint
2. documentation of vital signs
3. appropriate treatment and documentation of patient response
4. documentation sufficient to support final diagnosis
5. appropriate referral and follow-up plan
6. documentation of patient education and outpatient instructions
7. controlled substance usage

Reviewed records are then returned to the nurse practitioner for review, with notations attached. Ongoing projects include medical record reviews for patients with specific diagnosis such as acute coronary syndromes, major trauma, and cardiac arrest.

Patient Satisfaction

In addition to ensuring quality patient care, we thought that ascertaining patient satisfaction with their experience with the

Table 4. Ten most common patient complaint categories by age.

Complaint categories	%
All patients	
Musculoskeletal	12.40
Abdominal pain/nausea vomiting	11.75
Chest pain	10.75
Upper respiratory infection	9.94
General medical/diabetes	7.17
Pulmonary/COPD/asthma	7.13
Trauma	6.16
Genitourinary/pregnancy	5.52
Ear	4.30
Headache	3.68
Admitted patients	
Chest pain	34.26
Pulmonary/COPD/asthma	18.16
General medical/diabetes	15.37
Abdominal pain/nausea vomiting	10.74
Congestive heart failure	6.84
Genitourinary/pregnancy	3.97
Neurologic/stroke/altered mental status	3.09
Musculoskeletal	2.79
Ear	2.57
Upper respiratory infection	2.21
Patients <1 y old	
Upper respiratory infection	40.28
Ear	14.58
Abdominal pain/nausea vomiting	13.19
Pulmonary/COPD/asthma	10.42
General medical/diabetes/electrolyte	9.03
Genitourinary/pregnancy	4.86
Dermatologic/rash	3.47
Throat	1.39
Eye	1.39
Trauma	1.39
Patients >75 y old	
Chest pain	18.42
General medical/diabetes/electrolyte	16.15
Abdominal pain/nausea vomiting	14.02
Musculoskeletal	13.35
Pulmonary/COPD/asthma	11.48
Congestive heart failure	6.81
Neurologic/stroke/altered mental status	5.87
Trauma	5.07
Genitourinary/pregnancy	4.94
Upper respiratory infection	3.87

COPD, Chronic obstructive pulmonary disease.

TelEmergency program was important. To measure patient satisfaction, telemedicine patients were periodically surveyed during their visit. These surveys were completed by the patient or family member and returned at discharge. To date, a total of 434 responses have been received, representing 2% of TelEmergency patients.

In this survey, overall patient satisfaction with the TelEmergency program was very high, with 93.6% of patients stated they were comfortable or very comfortable with the system. A high percentage (98.7%) stated that they were able to communicate with the collaborating physician without difficulty. A majority (87.3%) believed that their care was as good as or better than they would have received with a physician alone. Overall, 91.2% of patients stated that they were more likely to come back to the rural ED because of TelEmergency, whereas 85.6% rated their overall care as good or excellent.

Hospital Administrator Satisfaction

Under the TelEmergency model, we are contracted by the participating hospitals to provide care for their patients, who then charge the patient or any second-party payers for the care we provided as contractors. Given the current financial climate, hospital administrators are interested in not only the quality of care and patient satisfaction but also the financial issues. We therefore created a questionnaire that addresses these issues, to be completed by hospital administrators. Eight of the 11 hospital administrators completed and returned the anonymous survey.

All administrators surveyed believe that the level of care has improved or remained the same in the ED. Seven of eight administrators (87.5%) think the TelEmergency program is cost equivalent or less expensive than their previous means of providing coverage for their EDs. The same proportion (87.5%) think that ED volume and admissions from the ED have increased. To date, 7 of 8 administrators surveyed have a favorable overall impression of the TelEmergency program.

A good indicator of participating hospital satisfaction can also be deduced by the fact that 7 of 8 hospitals that have participated in the program for greater than 1 year have elected to continue participating in the system. To date, we have had only 1 hospital that is no longer active in the TelEmergency system. In that case, a disagreement on the use of the TelEmergency nurse practitioner arose. Briefly, that hospital insisted on using the TelEmergency nurse practitioner with a local physician rather than the TelEmergency program serving as collaborating physician during regular business hours while using the TelEmergency program on nights and weekends. Such use was one of the primary motivations that led to the creation of the TelEmergency system and was diametrically opposed to the spirit of the program. In addition, this practice exposed the TelEmergency program and the TelEmergency nurse practitioner to unnecessary liability. TelEmergency service was therefore discontinued at that hospital.

DISCUSSION

The development of emergency medicine as a specialty has predominately occurred in relatively high-volume, high-acuity, urban EDs, which is reflected in the emergency medicine literature, in which the majority of published experience has originated in large urban centers. These centers are more likely to have diagnostic modalities such as computed tomography scanners and magnetic resonance imaging; specialists such as surgeons, cardiologists, and intensivists; and tools such as angiography, cardiac suites, and fluoroscopy that are generally

not routinely available in smaller rural EDs. Physicians working in these EDs are more likely to report American Board of Emergency Medicine certification and residency training than those working in rural EDs.[2]

Rural EDs face several disadvantages relative to urban EDs when it comes to patient care. The establishment of a diagnosis may be more difficult because of the absence of newer diagnostic modalities. Rural EDs often must delay treatment or use suboptimal treatments because of the lack of readily available consultants such as surgeons or interventional cardiologists. These disadvantages exist despite a similar number of admissions to critical care beds in rural EDs and urban EDs.[1] Rather than serving merely as "Band-Aid stations," rural EDs care for patients who are equally ill, with less manpower and fewer resources than their urban counterparts.[1]

One of the biggest difficulties rural EDs face is attracting and retaining skilled medical practitioners. Like other physicians, emergency physicians have a misdistribution based on population between rural and urban communities. Although 25% of the population of the United States lives in rural areas, only 15% of emergency physicians practice in rural communities.[1] Given the difficulties in staffing rural EDs with board-certified emergency physicians, it is widely acknowledged that other providers have a role in providing coverage. Possible providers include physicians who are not specifically trained in emergency medicine such as internists and family practitioners, as well as nonphysician providers such as nurse practitioners and physician assistants. In a joint policy statement, the American College of Emergency Physicians and the American Academy of Family Physicians acknowledge the role of the family physician in the provision of care in rural and remote areas[7]; however, the role of nonphysician providers was not addressed.

So-called midlevel practitioners have been involved in the treatment of ED patients for more than 25 years.[8] Nationwide, physician assistants are involved in 6.5% of visits, whereas nurse practitioners are involved in 1.8% of visits.[9] Visits associated with midlevel practitioners are similar to visits associated with physicians in ED care, diagnosis, and treatment.[10] Nearly 50% of EDs employ midlevel practitioners; however, it is unclear what percentage of EDs are staffed at times by a midlevel practitioner without a physician present.

Telemedicine uses technology to provide health care services to a patient located some distance from the health care provider. The original technology used to deliver real-time telemedicine was most likely the telephone, by which either a patient would interact directly with the physician or a practitioner evaluating a patient would discuss the patient over the telephone with a colleague or consultant. More recently, however, telemedicine has increasingly used advances in computer and networking technology to enable practitioners and patients to interact by using real-time audio and video. Telemedicine has been touted as a means to decrease health care disparities and to increase the fairness and equality of the distribution of services by increasing the access to health services, especially in remote areas.[11]

Although telemedicine offers great promise in improving patient care, progress has been limited because of a variety of issues, including the lack of efficacy data, high equipment and connection costs, and reimbursement.[6] We believe that the TelEmergency system that we have developed during the past 3 years goes a long way in overcoming these obstacles.

We believe that highly motivated nurse practitioners collaborating with experienced consulting physicians over an advanced teleconferencing system provides emergency care to patients in rural Mississippi that is similar in quality and more cost-effective than that delivered by physician staffing services. Although the criterion standard of emergency care remains hands-on delivery of care by a residency-trained, board-certified emergency physician, none of our participating hospitals are able to attract even 1 such physician because of geographic undesirability and financial limitations. Our system, although falling short of that ideal, nonetheless is a means of delivering care with real-time input from board-certified emergency physicians. In addition, it is a system with which patients and hospital administrators have expressed a high degree of satisfaction. Though further outcome study is necessary to ensure that we are meeting our goals in the quality of care we provide, we believe that our initial experience with the TelEmergency model has been a successful one and that it offers a potential of providing a feasible alternative to traditional staffing choices for rural EDs.

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**2008
Medical Toxicology
MOC Assessment of
Cognitive Expertise Examination**

The American Board of Emergency Medicine (ABEM), the American Board of Pediatrics (ABP) and the American Board of Preventive Medicine (ABPM) will administer the MOC Assessment of Cognitive Expertise examination (formally known as the recertification examination) in Medical Toxicology on Wednesday, November 12, 2008. This examination will be administered at computer-delivered testing centers throughout the United States.

Physicians must complete the examination registration process with the board through which they received their initial certification in Medical Toxicology. Physicians certified by an American Board of Medical Specialties member board other than ABEM, ABP, and ABPM who attained Medical Toxicology certification through ABEM must register for this examination with ABEM.

Physicians certified in Medical Toxicology by ABEM may register for the 2008 Medical Toxicology MOC Assessment of Cognitive Expertise Examination beginning March 3, 2008, using EMCC Online. ABP and ABPM diplomates should contact their Boards for registration information.

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