



## Original Contribution

Rural ED transfers due to lack of radiology services<sup>☆</sup>

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## ABSTRACT

**Purpose:** Our objectives were to determine the frequency of patient transfers to a tertiary care emergency department (Tertiary ED) due to a lack of radiology services in rural hospital EDs (Rural EDs), and examine the community and patient attributes that are associated with these transfers.

**Methods:** This was a retrospective chart review of patients transferred to a Tertiary ED from Rural EDs. Transfers excluded from the study included pediatric patients (age <18 years old) and patients transferred for trauma surgeon evaluation. Only those patients who were transferred for radiology services were included in the final analysis.

**Results:** Over a 12-month period, 1445 patients were transferred to the Tertiary ED with 73.8% (n = 1066) of this population being transferred from a Rural ED. Excluding 381 trauma and pediatric patients, 64.3% (n = 685) of patients were transferred from a Rural ED and were included in the study. Of these 685 transfers, 24.5% (n = 168) were determined to be due primarily to a lack of a radiology service.

**Discussion:** Lack of radiology services in Rural EDs leads to numerous patient transfers to the Tertiary ED each year. A disproportionate number of these transfer patients are African American. These transfers place additional financial and social burdens on patients and their families. This study discusses these findings and alternative diagnostic options (ie, telemedicine and ultrasound video transfer) to address the lack of radiology services available in Rural EDs. The use of these alternate diagnostic options will likely reduce the number of patient transfers to Tertiary EDs.

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## 1. Introduction

Many Rural emergency departments (EDs) do not have radiology services available 24 hours a day to assist in the diagnosis of emergent conditions. This can be attributed to a lack of equipment, qualified personnel to run the equipment, or qualified personnel to interpret images. (A Rural ED was defined as an ED located outside of a Metropolitan Statistical Area (MSA) [1].) The imaging modalities in question most commonly are computed tomography (CT) or ultrasound (US). When CT or US are needed to diagnose or refute an emergent condition, patients are often transferred from a Rural ED to a Tertiary ED to obtain the needed imaging. This approach delays diagnosis and treatment while consuming valuable resources [2]. Additionally, many patients transferred for diagnostic radiology services ultimately do not need further treatment (ie, a negative result from the diagnostic test) [3]. Thus, the lack of real-time radiology interpretation, technologist support, or equipment availability in Rural EDs can result in higher medical and social costs for the patient [3]. Determining the frequency, reason(s), and ultimate disposition of transfers can help us to better understand this issue and the role that alternative methods, such as telemedicine, may play in

reducing the financial and social costs passed on to these patients, many of whom do not have the financial or social capital to pay them.

A number of patients are transferred from a Rural ED to the Tertiary ED due to the lack of radiology services every year. What is unknown is the frequency at which these transfers occur, the type of radiology service patients are transferred for, and the characteristics associated with these patients such as poverty level, insurance status, and race.

In this study we sought to determine the frequency of adult, non-trauma patient transfers from Rural EDs to a Tertiary ED due to a lack of radiology services by conducting a retrospective chart review. Secondary objectives included examining transfers according to payer source, race, and poverty level compared to their respective county and state averages. In addition, we sought to determine how community attributes such as poverty and minority population rates correlated with the rate of transfers.

## 2. Materials and methods

A retrospective chart review was completed on all patients transferred to a Tertiary ED from Rural EDs over a 12-month period (June 1, 2008, through May 31, 2009). The study period was chosen to correlate with the most recent complete census data. The study was conducted at a high-acuity, urban, Tertiary ED, designated as both a pediatric and adult Level 1 trauma center with multiple residency training programs. Radiology services are available 24 hours a day at the Tertiary

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**Table 1**  
Percentage of patients transferred by race compared to state and county averages

Race	Transferred	Transferred for lack of a radiological service	County average*	Georgia average**	South Carolina average**
African American	711 (49.2%)	105 (64.0%)	44.8%	38.1%	32.5%
White	691 (47.8%)	59 (35.9%)	53%	61.9%	67.5%
Other	43 (3%)	4 (not included)	2.2% (not included)	(not included)	(not included)
Total	1445	164	100%	100%	100%

\*  $P < 4.298 \times 10^{-6}$  comparing transferred patients to county averages.

\*\*  $P < 2.2 \times 10^{-16}$  comparing transferred patients to GA and SC averages.

ED. The Tertiary ED volume during the study period was approximately 80,000 patient visits per year from Georgia and South Carolina communities. (Due to its geographic location on the border of Georgia and South Carolina, the Tertiary ED receives patients from Georgia and neighboring South Carolina communities.)

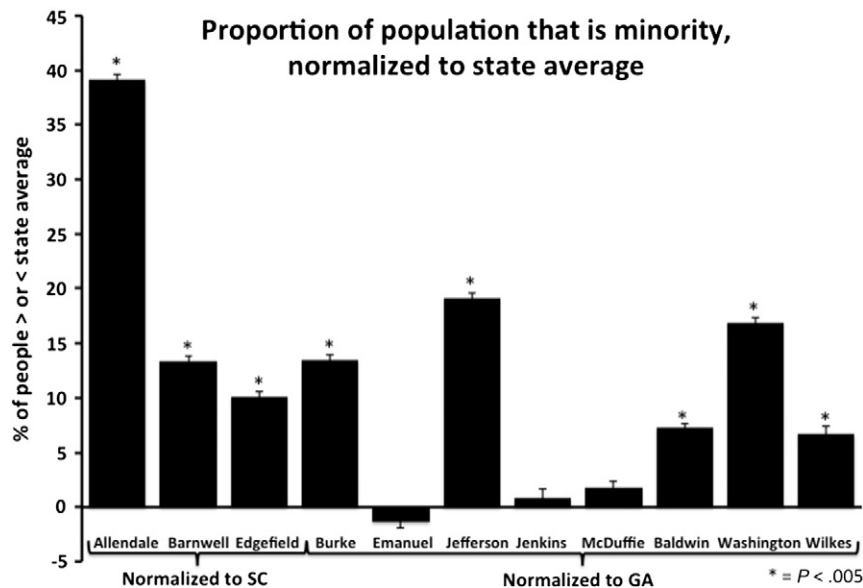
In terms of racial classification the sample consists primarily of whites and African Americans, with small numbers of patients of “other” racial backgrounds. Racial identification was self-reported in a free response format and recorded in patients’ medical records at the Rural ED. This data was also recorded in the medical record at the Tertiary ED. This retrospective study uses the same racial classification categories of the U.S. Census Bureau [4]. In this study there were four patients who self-identified as other than African American or white. Because of the extremely small number, patients in the “other” category were excluded from the analysis and the results include only African American and white patients.

All patient transfers to the Tertiary ED were managed through a centralized communications center and recorded in real time in a hospital database. Data elements in the database include: the reason for the transfer stipulated by the treating physician at the Rural ED, the insurance type, the services performed at the Rural ED, and some demographic information about the patient. The initial cohort of patients was derived using a standardized data sheet by a single abstractor who was blinded to the study purpose. A transfer to the Tertiary ED solely for radiology services was determined by examining both the reason stipulated for transfer by the treating physician at the Rural ED, and the treatment received at the Tertiary ED. If any procedure or specialty consultation was performed either before or after a radiology evaluation as part of the Tertiary ED evaluation, the transfer was classified as not being primarily for radiology services and excluded from the study.

Patient transfers were grouped by the counties where their respective transferring hospitals were located. Data were collected on all the counties with greater than five patient transfers to the Tertiary ED during the study period. Using the U.S. Census Bureau database, racial demographics, insurance rates, and poverty level for each county where the transferring hospitals are located were collected. These values were then compared to the respective state averages. Data on the patient’s place of residence was not collected. Because the time period for this study was from June 1, 2008, through May 31, 2009, the data from the U.S. Census Bureau was collected for 2008 and 2009 and the numbers averaged. Data on the racial makeup of the study counties was derived from the U.S. Census Bureau 2005–2009 American Community Survey [5]. Insurance status information was collected from the U.S. Census Bureau Small Area Health Insurance Estimates interactive data tool [6], and poverty level data were gathered from the Small Area Income and Poverty Estimates (SAIPE) [7]. The study period was determined to allow access to the best comparative data, as the Small Area Health Insurance Estimates and the Small Area Income and Poverty Estimates are several years old when published. The institutional review board at the Tertiary ED approved the study.

**3. Results**

Over the 12-month study period, a total of 1445 patients were transferred to the Tertiary ED. Of these, 1066 (73.8%) were transferred from a Rural ED. After excluding 381 trauma and pediatric patients, a total of 685 patients transferred from a Rural ED remained. Of these transfers, 168 (24.5%) were determined to be due primarily to a lack of a radiology



**Fig. 1.** Proportion of the population that is minority for each county with the highest percentage of transfers for radiological purposes. The data is normalized to the respective state minority populations. Source: 2005–2009 U.S. Census Bureau American Community Survey.

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