



# The Correlation of Traumatic Hand Injury with Distance to Treatment

Joshua Anthony<sup>1</sup>, Hunter Rooks<sup>2</sup>, Kevin Sexton, MD<sup>3</sup>, R. Bruce Shack, MD<sup>3</sup> and Wesley Thayer, MD, PhD<sup>3</sup>

<sup>1</sup>School of Medicine, Meharry Medical College, Nashville, TN, <sup>2</sup>School of Medicine, University of Tennessee, Knoxville, TN,

<sup>3</sup>Department of Plastic Surgery, Vanderbilt University, Nashville, TN, <sup>4</sup>School of Medicine, Vanderbilt University, Nashville, TN



## INTRODUCTION

Hand trauma is the most frequently treated injury in emergency departments throughout the United States. Wrist, hand, and finger injuries represent 11.6% of all traumatic injuries treated in the ED, totaling 4.6 million visits in 2007.<sup>1</sup> Of all nonfatal, work-related electrical injuries, 34.9% involve the hands, fingers, or wrist.<sup>2</sup> According to a national study, 80% of respondent hospitals reported inadequate hand surgery coverage.<sup>3</sup> Additionally, the number of hand surgery fellows has decreased by 46%.<sup>4</sup>

Nationally, 80% of adult ED visits in 2011 were due to lack of available providers. Adults living outside major metropolitan areas (MMAs) were more likely to go to the ED than those living in MMAs due to lack of available care.<sup>5</sup> In Tennessee, lower per capita income (PCI) and mean household income (MHI) correlate with a fewer number of hospitals offering hand specialists and hand call. Medically underserved areas (MUAs) also show lack of access.<sup>6</sup> This data suggests a need to examine economic status and distance from an accommodating hospital as factors in patient care.

In Tennessee hospitals, we have previously shown a lack of hand-specialists in both elective and emergency surgery. Of the 111 hospitals with an ED or operating facility, only 37% of hospitals offer elective hand surgery and have a hand specialist on staff. Only 7% offer emergency surgery and have a hand specialist available at all times (24 hours, 7 days per week [24/7]). Of these, 2 have the ability to service all traumas of the hand.[1] In Tennessee, Level 1 Trauma facilities are required to provide hand specialists and 24/7 basic hand call. However, of the 8 Level 1 facilities in Tennessee, only 2 provide 24/7 basic hand call.<sup>6</sup>

As a result of most hospitals' inability to take emergent hand trauma, patients must be transferred to accommodating hospitals, delaying treatment. Consequently, effective results of treatment may decrease. Additionally, the distance required for patients to travel for treatment may reduce their ability to return to the treating facility. Ultimately, the distance may result in an increase in patient complications. **This study looks at a number of patients with hand traumas treated at Vanderbilt University Medical Center (VUMC) between 1999 and 2011 to determine if patient complications increase with distance from their home to VUMC.**

## METHODS

Using the TRACS database for the Vanderbilt University Medical Center, we examined admissions and transfers to the hospital from the years 1999-2011 for hand related trauma incidents. Using patient zip codes we extrapolated distance from place of injury or transfer site to VUMC. Distances were calculated with Mapquest.com by using the shortest geographical distance and rounding to the nearest whole number.

The codes chosen to review as revisional surgeries are most commonly performed for re-operation after hand injury. Specifically, we looked at tenolysis codes 25295, 26440, 26442, 26445; capsulectomy and capsulotomy codes 26520, 26525; malunion or non-union codes 25400, 26546.

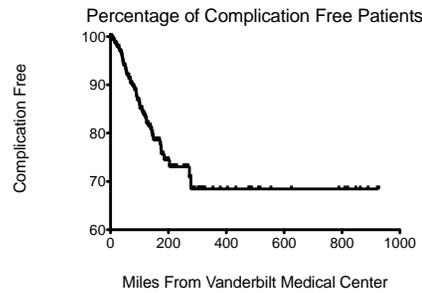
The distance for each patient was then cross reference against the number of complications presenting upon arrival at VUMC as well as surgical CPT codes after arrival. Complications were defined using ICD-9 codes. Mean household income and per-capita income in county of patient residence were also identified as a possible confounder affecting treatment complications.

Statistical analyses were calculated using Fisher's exact model and Spearman correlation. All tests were two-tailed, with a significance level of 0.05. All analyses were performed using Prism statistical software.

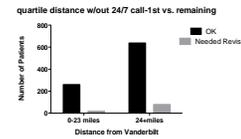
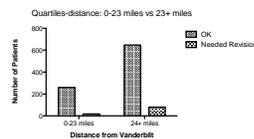
## RESULTS



**Figure 1.**<sup>6</sup> Distribution of services by county. The red areas represent counties have hospitals that provide hand specialist on-call coverage.

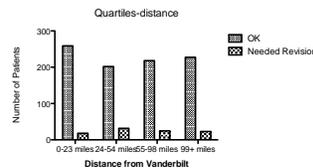


**Figure 2:** Out of 1004 patients in this study 98 experienced a complication following surgery. As patient distance increases so does the percentage of complications (p<0.0001).



**Figure 3.** Patients located greater than or equal to 24 miles away from Vanderbilt University Medical Center were more likely to have complications than those who were located less than 24 miles away (p = 0.0322).

**Figure 4.** Counties without 24/7 emergency hand specialist service that were located less than 24 miles away were found to be less likely to have patient complications than patients located in counties more than 24 miles away and without 24/7 emergency hand specialist service.



**Figure 5.** Complications occurred in 18 patients located 23 miles or less; 32 patients located 24 to 54 miles; 25 patients located 55 to 98 miles; 23 patients located 99 miles or more. Revisions were not needed in 259 patients ≤ 23 miles; 202 patients 24 to 54 miles; 218 patients 55-98 miles; 227 patients ≥99 miles.

## DISCUSSION

Hand injuries are the most common nonlethal reason for ED visits, and as a result, any lack of available hand care has the potential to affect a significant portion of our injured patient population. Our previous studies demonstrated that there is a shortage of hand specialist care in TN hospitals.<sup>(14)</sup> We also demonstrated that these shortages are more common in medically underserved and socioeconomically limited areas.<sup>(12)</sup> It is not clear however, that such gaps in care availability could actually lead to worse outcomes as long as patients can be transferred in a timely fashion to a referral center with the capacity to treat these injuries. We hypothesized that as a result of most hospitals' inability to take emergent hand trauma, patients must be transferred to accommodating hospitals, delaying treatment that might lead to worse outcomes for injuries to the hand. More specifically, we suspect that our patients who travel from farther away have less access to skilled occupational therapists and/or more out of pocket expense related to follow-up care that might limit their overall outcome. To assess this, we reviewed hand injury patients treated at Vanderbilt University Medical Center (VUMC) between 1999 and 2011 to determine if patient complications increase with distance from their home to VUMC.

As hypothesized, distance from treating facility does appear to play a role in patient outcomes. Figure 1 data shows that as distance of a patient's county of residence from VUMC increased, percent of patients without complication decreased (p<.0001). When looking at distance specifically, patients living in zip codes ≤ 23 miles from VUMC were significantly less likely to need revision than patients living ≥24 miles from VUMC (p = 0.0322). Of patients who underwent revisional surgeries, the non-significant distance vs. number of surgical CPT codes suggests that once patients are treated by VUMC, risk of complications is stabilized. This further suggests that patient travel distance represents a fundamental effect on patient outcomes.

## CONCLUSIONS

- There is a lack of emergency hand care services in TN.
- Distance from treating facility appears to play a role in patient outcome.
- These observations also strongly correlate with hospital presence in a medically underserved area.
- If our findings translate to other services, patients who travel farther for their care, which is the trend in which our health care system is moving toward, might experience poorer outcomes.

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## ACKNOWLEDGEMENTS

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Kevin Sexton, 8/3/2012