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Geographic Analysis of Trauma Readmissions in North Texas

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Due to the high cost and increased risk of mortality associated with unplanned patient readmissions, research has been aimed to identify risk-factors in patients with high hospital utilization and recidivism. The primary aim of this study was to characterize readmissions across multiple institutions in patients initially admitted to a single urban Level I trauma center. Analysis was carried out to test the hypothesis that a patient’s geographic location of residence can be used to predict readmission rates. Data was queried from a regional database that is comprised of more than 150 hospitals in the North Texas region. Patient ZIP code and county of residence were analyzed using binary logistic regression to determine significance of predictability of readmission by patient geography. Additional variables such as demographics, diagnosis, Elixhauser comorbidities, and insurance were also analyzed to create a full clinical and geographic regression model describing patterns in readmissions.
GEOGRAPHIC ANALYSIS OF TRAUMA READMISSION IN NORTH TEXAS

Derick J. Sanchez, B.S.

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GEOGRAPHIC ANALYSIS OF TRAUMA READMISSIONS IN NORTH TEXAS

INTERNSHIP PRACTICUM REPORT

Presented to the Graduate Council of the
Graduate School of Biomedical Sciences
University of North Texas
Health Science Center at Fort Worth
in Partial Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE
IN CLINICAL RESEARCH MANAGEMENT

By
Derick J. Sanchez, B.S.
Fort Worth, Texas
November 2016
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CHAPTER I
INTRODUCTION

Unplanned readmissions of patients have become an important topic of discussion since passing of the Hospital Readmission Reduction Program (HRRP) by the Affordable Care Act in 2010. The goal of this program is to curb excessive hospital resource utilization and healthcare costs by financially penalizing hospitals with large numbers of readmissions within 30 days of patient discharge. Although this program only evaluates and penalizes hospital activity for a select number of diagnoses, traumatic injuries are predicted to soon be included in this program’s efforts to decrease Centers for Medicare and Medicaid Services (CMS) charges and hospital costs. For these reasons, extensive research has focused on both overall unplanned readmissions and those specific to trauma.

Previous efforts to understand the factors that contribute to readmissions have identified various patient and demographic predictors such as diagnosis, comorbidities, history of hospital utilization, insurance type used, and socioeconomic status. This practicum study will expand on past studies by analyzing geographic factors in order to determine if a patient’s location can be used to predict their likelihood of readmitting following discharge.

Determining factors that are associated with unplanned readmissions is crucial in order to shift specialized treatment and follow up programs to high-risk populations. It is believed that improving the quality of care and providing efforts to improve post-discharge recovery in these patients will reduce readmissions and ultimately healthcare costs for hospitals (Overton, 2014).
CHAPTER II

BACKGROUND AND LITERATURE REVIEW

This practicum study will focus on patients who were initially admitted to Baylor University Medical Center (BUMC) a level I trauma center in Dallas, Texas. The level of a trauma center, according to the American Trauma Society, is a verification given to a center depending on the resources and care available. A level I trauma center, or most comprehensive level of trauma care, is a tertiary care facility capable of providing total care for every aspect of injury from prevention through rehabilitation (Source “Trauma center levels explained”). These centers offer 24-hour coverage by trauma surgeons and rapid availability of various specialties, including but not limited to, orthopedic surgery, neurosurgery, radiology, and critical care. Level I centers must have available the necessary staff to treat a wide spectrum of traumatic injuries while also meeting the minimum requirement for annual volume of severely injured patients. Trauma centers that are level II-IV can also treat a number of traumatic injuries, however patients with a higher severity of injury may be transferred to a higher level of care, as appropriate.

There are a wide range of injuries that are considered to be traumatic. A traumatic injury is defined as a physical injury with a sudden onset and severity which requires immediate medical attention (Source “Traumatic Injury”). These injuries are caused by a number of blunt, burn, or penetrating mechanisms and may result in systemic shock requiring immediate resuscitation. Examples of such mechanisms include motor vehicle collisions, gunshot wounds, stab wounds, falls, sports injuries, assault, and a number of other injuries that require immediate care.
Hospital readmission has been a topic under scrutiny due to its high healthcare cost and increased patient morbidity (Jencks et al., 2009). It is estimated that in 2015, hospital readmissions within 30 days of discharge accounted for $16.3 billion in healthcare cost while readmissions within one year of discharge accounted for $97.2 billion. Of this total annual cost, it is estimated that $17 billion are attributed to Medicare recipients alone (Goodwin et al., 2015). Since the passing of the Hospital Readmissions Reduction Program (HRRP) by the Affordable Care Act in 2010, hospitals with a high rate of 30-day readmissions are financially penalized by Centers of Medicare and Medicaid Services (CMS) reimbursement (“Readmissions Reduction Program”). The HRRP aims to reduce the number of patient readmissions due to certain conditions including myocardial infarction, heart failure, pneumonia, chronic obstructive pulmonary disorder, total hip arthroplasty, and total knee arthroplasty. Although traumatic injury is not currently a condition scrutinized by the HRRP, it is predicted to soon be included (Zuckerman et al., 2016).

Existing research has identified factors such as race, socioeconomic status, and insurance type to be associated with hospital outcomes and unplanned readmissions in trauma patients (Moore et al., 2014; Morris et al., 2014; Ladha et al., 2011). Further studies conducted at BUMC have identified similar variables that are predictive of patients who are high utilizers of hospital resources, also known as “superutilizers” (Petrey et al., 2014). Others have found geographic and demographic-related predictors for incidence of traumatic injury, such as individual income, proportion of a population living below a given poverty level, education level, employment status, and household income (Daly et al., 2002; Galobardes et al., 2006). Research at Cincinnati Children’s Hospital Medical Center studied attributable demographic data by Census Tract and its relationship to readmission rates in children diagnosed with asthma. Readmission rates were
found to be higher in census tracts with higher poverty rate, lower education levels, and lower home values (Beck et al., 2012). Canadian researcher, Cui Yang PhD, used geolocation to analyze the 25 neighborhoods that make up the Winnipeg area to identify if patients from certain clusters have a higher or lower chance of being readmitted. Their results, showing some neighborhoods with significantly higher all-cause readmission rates, implied that readmissions are not randomly distributed geographically and patient neighborhood is associated with increased hospital utilization (Cui et al., 2015). Geographic predictors for 30-day patient readmissions have also been identified using patient address and demographic attributable data from seven Dallas-Fort Worth metropolitan hospitals. Factors identified were race, age, and having Medicare insurance. While these factors were significant, lack of sufficient data could not determine strong significance in hospital distance and median household income (Silverstein et al., 2008). Despite extensive research in readmissions and geography, few studies have analyzed readmissions of trauma patients in association with geographic location.

SPECIFIC AIMS

This practicum study hypothesized that geographic location is predictive of trauma patient readmission by determining whether various geographic factors, including patient county, patient ZIP code, and patient distance from hospital, are determinants of hospital readmission rates. A specific aim of this study is to query and analyze patient data including age, race, diagnosis codes, comorbidities, address, insurance, and readmission history. This data is then assessed to determine if there is any statistical significance between the collected data and the readmission history of the patient, specifically, whether there are geographic factors that can be used as indicators of readmission rates. Significant variables will then be evaluated in order to
gain an understanding of their clinical relevance as risk factors to readmission and what actions can be taken to reduce readmissions in the population that presents these risk factors.

SIGNIFICANCE

Following the implementation of the Hospital Readmission Reduction Program (HRRP), research aiming to predict and reduce readmissions has become an important topic of interest. Currently, 47% of hospitals in the United States are being penalized from <1% to 3% of Medicare revenue for excess patient readmissions, with minority-serving hospitals nearly twice as likely to be penalized (Shih et al., 2015). HRRP’s goal is to curb readmissions from select conditions including pneumonia, myocardial infarction, and heart failure (Readmissions Reduction Program, 2016). As this list of conditions continues to increase, it’s predicted that it is only a short time before trauma admissions are under this same scrutiny.

Geographic analysis of readmission rates and demographic characterization in North Texas may result in the implementation of outreach programs directed to areas identified to have low follow-up compliance and high readmission rates (Overton et al., 2014). Reduction in trauma readmissions will reduce healthcare costs for both the patient and hospital while improving the quality of patient recovery.

MATERIALS AND METHODS

Data Source and Description

The data used for this retrospective cohort study were gathered from the Dallas-Forth Worth Hospital Council (DFWHC). These data include patient admission data from 88 member hospitals in the North Texas area giving access to admissions to Baylor University Medical Center (BUMC) trauma center and subsequent patient encounters at other DFWHC hospitals (Source “Building the Next Generation,” 2013). The DFWHC Initiative is a comprehensive data
registry which captures demographic, diagnosis, and readmission data from 95% of hospitals in North Texas (Source “Readmission in North Texas”). This data sharing warehouse combines patient information from all member institutions to facilitate readmission and health disparity research. This practicum study will analyze DFWHC data recorded between January 2003 and July 2014. The DFWHC includes all patient encounter information excluding outpatient laboratory visits and hospital-based outpatient clinic visits. Data excluded from our analysis includes patients under the age of 18 years, admissions to Skilled Nursing Facilities (SNFs), admissions to Inpatient Rehabilitation Facilities (IRFs), admissions to Long Term Acute Care hospitals (LTACs), planned readmissions, and transfers within one admission.

It is important to note that much of the data analysis describes “encounters.” As a result, data analysis will not identify characteristics that can predict the readmission of a patient, but will identify characteristics of a patient encounter. An “index encounter” describes the initial admission to BUMC due to any traumatic injury. As a patient is readmitted to any hospital within the DFWHC, they are creating a sequence of serial encounters. Consequently, a patient encounter can describe an admission or readmission, but a singular patient will have multiple encounters. Additionally, a patient’s index encounter will necessitate a blunt or penetrating trauma diagnosis, however subsequent encounters range from any admitting diagnosis, not limited to trauma.

Variables

Patient-level predictor variables analyzed from the DFWHC data set included patient demographics, patient address, International Classification of Diseases (ICD-9), cause of injury (E-Codes), insurance type, length of hospital stay, and Elixhauser Comorbidity Index score. The Elixhauser Comorbidity Index is a tool based on diagnosis codes used to predict patient hospital
resource utilization and mortality. The score identifies underlying illnesses in patients and are calculated at the time of admission. (Elixhauser et al., 2006). Encounters which were admissions to LTACs, to SNFs, to IRFs, planned readmissions, or transfers within the same admission were excluded from the data. Also made available by the DFWHC was the Regional Enterprise Master Patient Index (REMPI) number assigned to each patient as a unique identifier that also functions as a probabilistic electronic tool. REMPI can match and group patient encounters, regardless of hospital system affiliation or payer, and the entire continuum of data for more than a decade of inpatient and outpatient encounters (Petrey, 2015). The REMPI sequence captures the sequence of serial encounters, or the “visit count,” for a particular patient at any given encounter as well as over their entire inpatient and outpatient encounter history, excluding hospital-based clinic visits, as outlined above. Encounters included in this count reaches back to 1999, the year when the DFWHC began collecting data, and includes outpatient visits for radiology, emergency department services, ambulatory surgical care, cardiology, observation, and gastrointestinal encounters.

**Statistical Analysis**

Statistical analysis was done using both Chi-square Automatic Interaction Detection (CHAID) and Binary Logistic Regression (BLR). CHAID is a statistical technique that builds a hierarchical probabilistic decision tree to examine how multiple independent predictor variables interact with each other to predict and explain variation in the dependent target outcome variable of readmission after trauma (Ture et al., 2009). Comorbidities, insurance type, injury type, patient county, patient ZIP code, and the variable identifying whether the patient lived within 20 miles of the hospital of admission were added to CHAID. This method was used to explore and identify variables that were significantly predictive of readmissions, based upon their
interactions. Variables that showed significant interactions with the proportion of Readmit Ever Yes to Readmit Ever No, at 95% confidence, were selected on that basis to be tested in the Binary Logistic Regression. Multivariate analysis of the variables identified by CHAID, using BLR regression, provided calculated odds ratios with 95% confidence intervals resulting in a comprehensive model of significant (P<0.05) variables which were identified as independently predictive of the outcome (dependent) variable READMIT_EVER. Results reported include the standard error (S.E.), significance value (p), odds ratio (OR), and confidence intervals (C.I.).

Odds ratio tells the odds of an outcome given a certain exposure. For example, if an exposure has an odds ratio of 2, it would indicate that its presence would result in the outcome being 2 times as likely to occur. Area under the receiver operating characteristic curve (AUC-ROC) for both CHAID and binary logistic regression were calculated to test model discrimination with cross validation.

SPSS v20 was used for the analysis of this data while Microsoft MapPoint 2013 was used to create geographic visualizations of the variables.

RESULTS

The DFWHC data set included 24,495 patients who had an index admission to BUMC trauma center between 2003 and 2014 with a combined 68,667 encounters. Exclusions from this analysis consisted of 3,264 patients who either expired during their index admission, were identified as < 18 years of age, were admitted to a SNF, LTAC, or IRF, or had a planned admission. Following exclusions, information from 21,231 patients with 28,979 hospital encounters within DFWHC remained. Of these 21,231 patients, 16,744 (78.8%) did not return as a readmission, resulting in 16,744 unique index encounters. 4,487 (21.1%) patients were
identified as having readmitted with a combined 12,235 encounters. Figure 1 shows a flowchart of the breakdown of patients included in this practicum study.

**Figure 1.** Inclusion flowchart *Excluded encounters: patient death during admission, rehabilitation facility, LTAC, SNF, planned return admissions, and hospital transfers during the same admission.

Analysis using the two statistical methods mentioned above produced a predictive model consisting of 52 variables. This model, robust because of its analysis of 10 years of data, confirmed previous analysis identifying severe sepsis with an odds ratio (OR) of 8.88, being admitted with a comorbidity of tumor (OR = 3.00), and urgent admit type (OR = 2.87) as predictors of readmission following traumatic injury (Petrey et al., 2014). All of the clinical and non-geographic variables identified as predictive of readmission can be seen in Table 1. Included in these variables is having a REMPI sequence of 15 or greater(OR = 4.10) , meaning a patient
who has a history of high hospital utilization is likely to continue high utilization and be readmitted. Medicare and Medicaid insurance along with several comorbidities including diabetes, renal failure, and congestive heart failure were also found as independent predictors. In addition to identifying predictors of readmissions, analysis also identified variables which were found to be protective of readmissions. Encounters in which the patient identified as being uninsured (OR = 0.75), and those in which the patient was admitted with a fall diagnosis E-Code (OR = 0.47) were found to be less likely to have subsequent readmissions. Admit year was also found to be significant with an odds ratio of 0.95, implying those admitted at years closer to the end of data collection were 0.95 times as likely to be readmitted.

Three geographic levels (patient County, patient ZIP code, and patient distance from admitting hospital) were added to the multivariate analysis to identify which, if any, can be related to readmission rates. Analysis of these geographic variables resulted in the 21 geographic factors seen in Tables 2 and 3 that were significant and independently predictive of readmissions. Counties that were found to be predictive include Hunt County (OR = 1.70), Rockwall County (OR = 1.58), and Tarrant County (OR = 1.56) all predicting that a patient is more than 1.5 times as likely to be readmitted if they listed one of those counties as their place of residence upon admission. There were 11 ZIP Codes which were retained in the regression model. The most significant factors identified were Dallas County ZIP codes 75247 (OR = 6.13) and 75251 (OR = 5.59), and Fannin County ZIP code 75438 (OR = 4.50). Similar to analysis of non-geographic factors, the regression model retained ZIP codes which were found to be associated with decreased readmission rates among trauma patients. The 5 ZIP codes that were identified to be protective are all located in Dallas County such as ZIP codes 75001 (OR = 0.15), 75284 (OR = 0.46), and 75201 (OR = 0.54). A visualization of the distribution of significant ZIP codes in the
Dallas/Fort Worth area can be seen in Figure 2. One ZIP code, ZIP 75284, could not be found and therefore is not mapped.

<table>
<thead>
<tr>
<th>Clinical Variables</th>
<th>S.E</th>
<th>p</th>
<th>Odds Ratio (95% C.I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe septicemia with extreme risk of mortality</td>
<td>0.407</td>
<td>&lt;0.001</td>
<td>8.88 (4-19.71)</td>
</tr>
<tr>
<td>REMPI sequence &gt; 14</td>
<td>0.049</td>
<td>&lt;0.001</td>
<td>4.1 (3.72-4.52)</td>
</tr>
<tr>
<td>Tumor</td>
<td>0.136</td>
<td>&lt;0.001</td>
<td>3 (2.3-3.92)</td>
</tr>
<tr>
<td>Urgent admit type</td>
<td>0.047</td>
<td>&lt;0.001</td>
<td>2.87 (2.62-3.15)</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>0.34</td>
<td>0.013</td>
<td>2.33 (1.2-4.54)</td>
</tr>
<tr>
<td>Diabetes complicated</td>
<td>0.19</td>
<td>&lt;0.001</td>
<td>2.05 (1.41-2.97)</td>
</tr>
<tr>
<td>Liver disease</td>
<td>0.089</td>
<td>&lt;0.001</td>
<td>2.04 (1.71-2.43)</td>
</tr>
<tr>
<td>Renal failure</td>
<td>0.077</td>
<td>&lt;0.001</td>
<td>2 (1.72-3.23)</td>
</tr>
<tr>
<td>Medicare insurance</td>
<td>0.053</td>
<td>&lt;0.001</td>
<td>1.89 (1.7-2.09)</td>
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<tr>
<td>Congestive heart failure</td>
<td>0.064</td>
<td>&lt;0.001</td>
<td>1.74 (1.53-1.97)</td>
</tr>
<tr>
<td>Medicaid insurance</td>
<td>0.059</td>
<td>&lt;0.001</td>
<td>1.66 (1.48-1.86)</td>
</tr>
<tr>
<td>Paralysis</td>
<td>0.075</td>
<td>&lt;0.001</td>
<td>1.65 (1.42-1.91)</td>
</tr>
<tr>
<td>Pulmonary circulation disorders</td>
<td>0.141</td>
<td>0.001</td>
<td>1.62 (1.23-2.13)</td>
</tr>
<tr>
<td>Other neurological disorders</td>
<td>0.049</td>
<td>&lt;0.001</td>
<td>1.57 (1.43-1.73)</td>
</tr>
<tr>
<td>Rheumatic diseases</td>
<td>0.122</td>
<td>0.001</td>
<td>1.51 (1.19-1.92)</td>
</tr>
<tr>
<td>Psychoses</td>
<td>0.061</td>
<td>&lt;0.001</td>
<td>1.51 (1.34-1.7)</td>
</tr>
<tr>
<td>Deficiency anemia</td>
<td>0.05</td>
<td>&lt;0.001</td>
<td>1.5 (1.36-1.65)</td>
</tr>
<tr>
<td>Non-other race</td>
<td>0.041</td>
<td>&lt;0.001</td>
<td>1.49 (1.38-1.62)</td>
</tr>
<tr>
<td>Depression</td>
<td>0.053</td>
<td>&lt;0.001</td>
<td>1.47 (1.32-1.63)</td>
</tr>
<tr>
<td>Peripheral vascular disorders</td>
<td>0.085</td>
<td>&lt;0.001</td>
<td>1.4 (1.18-1.65)</td>
</tr>
<tr>
<td>Diabetes uncomplicated</td>
<td>0.044</td>
<td>&lt;0.001</td>
<td>1.38 (1.27-1.51)</td>
</tr>
<tr>
<td>Chronic pulmonary disease</td>
<td>0.047</td>
<td>&lt;0.001</td>
<td>1.37 (1.25-1.51)</td>
</tr>
<tr>
<td>Valvular disease</td>
<td>0.101</td>
<td>0.003</td>
<td>1.35 (1.11-1.65)</td>
</tr>
<tr>
<td>Hypertension uncomplicated</td>
<td>0.033</td>
<td>&lt;0.001</td>
<td>1.32 (1.23-1.4)</td>
</tr>
<tr>
<td>Other federal insurance</td>
<td>0.117</td>
<td>0.032</td>
<td>1.29 (1.02-1.62)</td>
</tr>
<tr>
<td>Weight loss</td>
<td>0.071</td>
<td>0.017</td>
<td>1.18 (1.03-1.36)</td>
</tr>
<tr>
<td>Age ≥ 65</td>
<td>0.052</td>
<td>0.002</td>
<td>1.17 (1.06-1.3)</td>
</tr>
<tr>
<td>Fluid and electrolyte disorders</td>
<td>0.035</td>
<td>&lt;0.001</td>
<td>1.16 (1.08-1.24)</td>
</tr>
<tr>
<td>Year of admission</td>
<td>0.005</td>
<td>&lt;0.001</td>
<td>0.95 (0.94-0.96)</td>
</tr>
<tr>
<td>Uninsured</td>
<td>0.036</td>
<td>&lt;0.001</td>
<td>0.75 (0.7-0.81)</td>
</tr>
<tr>
<td>Fall E-code</td>
<td>0.038</td>
<td>&lt;0.001</td>
<td>0.47 (0.44-0.51)</td>
</tr>
</tbody>
</table>

Table 1. S.E. = Standard error; p = p < 0.05 significance level; C.I. = Confidence interval; REMPI = Regional Enterprise Master Patient Index; E-code = diagnosis code
Figure 2. 11 ZIP code predictors of readmission plotted according to highest odds ratio (red) to lowest (blue)
The third geographic variable studied and found to be significantly associated with an increase risk of readmission was if the patient lives within 20 miles of the hospital to which they were admitted. Essentially, this means based on the hospital the patient is currently admitting to (not necessarily the hospital of their index encounter), for that encounter, those patients who lived within 20 miles of the hospital were more likely to readmit than those who lived more than 20 miles of the hospital. Specifically, those who lived within 20 miles were found to be 1.83 times as likely to be readmitted.

### TABLE 2. ZIP Codes

<table>
<thead>
<tr>
<th>ZIP Code</th>
<th>S.E.</th>
<th>p</th>
<th>Odds Ratio (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZIP 75247</td>
<td>0.453</td>
<td>&lt;0.001</td>
<td>6.13 (2.52-14.87)</td>
</tr>
<tr>
<td>ZIP 75251</td>
<td>0.659</td>
<td>0.009</td>
<td>5.59 (1.54-20.31)</td>
</tr>
<tr>
<td>ZIP 75438</td>
<td>0.754</td>
<td>0.046</td>
<td>4.5 (1.03-19.73)</td>
</tr>
<tr>
<td>ZIP 76040</td>
<td>0.367</td>
<td>0.01</td>
<td>2.56 (1.25-5.26)</td>
</tr>
<tr>
<td>ZIP 75233</td>
<td>0.292</td>
<td>0.026</td>
<td>1.92 (1.08-3.41)</td>
</tr>
<tr>
<td>ZIP 75235</td>
<td>0.253</td>
<td>0.011</td>
<td>1.9 (1.16-3.12)</td>
</tr>
<tr>
<td>ZIP 75220</td>
<td>0.204</td>
<td>0.022</td>
<td>0.63 (0.42-0.93)</td>
</tr>
<tr>
<td>ZIP 75240</td>
<td>0.238</td>
<td>0.026</td>
<td>0.59 (0.37-0.94)</td>
</tr>
<tr>
<td>ZIP 75201</td>
<td>0.123</td>
<td>&lt;0.001</td>
<td>0.54 (0.42-0.68)</td>
</tr>
<tr>
<td>ZIP 75284</td>
<td>0.321</td>
<td>0.017</td>
<td>0.46 (0.25-0.87)</td>
</tr>
<tr>
<td>ZIP 75001</td>
<td>0.683</td>
<td>0.005</td>
<td>0.15 (0.04-0.55)</td>
</tr>
</tbody>
</table>

### TABLE 3. Counties and hospital distance

<table>
<thead>
<tr>
<th>County</th>
<th>S.E.</th>
<th>p</th>
<th>Odds Ratio (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient to hospital distance &lt; 20 miles</td>
<td>0.04</td>
<td>&lt;0.001</td>
<td>1.83 (1.69-1.98)</td>
</tr>
<tr>
<td>Hunt County</td>
<td>0.111</td>
<td>&lt;0.001</td>
<td>1.7 (1.37-2.11)</td>
</tr>
<tr>
<td>Rockwall County</td>
<td>0.102</td>
<td>&lt;0.001</td>
<td>1.58 (1.29-1.93)</td>
</tr>
<tr>
<td>Tarrant County</td>
<td>0.086</td>
<td>&lt;0.001</td>
<td>1.56 (1.32-1.84)</td>
</tr>
<tr>
<td>Grayson County</td>
<td>0.148</td>
<td>0.006</td>
<td>1.51 (1.13-2.01)</td>
</tr>
<tr>
<td>Collin County</td>
<td>0.07</td>
<td>&lt;0.001</td>
<td>1.42 (1.23-1.63)</td>
</tr>
<tr>
<td>Denton County</td>
<td>0.095</td>
<td>0.001</td>
<td>1.37 (1.14-1.65)</td>
</tr>
<tr>
<td>Ellis County</td>
<td>0.072</td>
<td>&lt;0.001</td>
<td>1.29 (1.12-1.49)</td>
</tr>
<tr>
<td>Kaufman County</td>
<td>0.076</td>
<td>0.012</td>
<td>1.21 (1.04-1.41)</td>
</tr>
</tbody>
</table>
All geographic and non-geographic variables were part of the final trimmed regression model and independently contributed to an area under the ROC curve of 0.782, indicating a good model. Cross validation of the model was performed by CHAID which gave a nearly identical area under the ROC curve of 0.786.

DISCUSSION

Implementation of the HRRP in 2012 and consequent hospital penalization for excess patient readmissions have caused a significant shift in research to identifying patient characteristics that could predict readmissions. It is calculated that nearly 50% of hospitals are currently being penalized up to 3% for unplanned readmissions with minority-serving hospitals receiving the bulk of HRRP penalization. (Shih et al., 2015). While readmissions following traumatic injury are not currently under watch by HRRP such as pneumonia, myocardial infarction, and heart failure, it is predicted to soon be included (Readmission Reduction Program 2016).

With the results obtained from this practicum study combined with preceding trauma studies, patients with a high likelihood of readmission can be characterized and efforts can be directed to improve both their treatment and post-discharge recovery. For example, when patients are admitted with traumatic injuries, their chance of readmission can be predicted using variables such as comorbidities, geolocation, and diagnosis. Those patients predicted to be readmitted would ideally receive more involved treatment to reduce the chance of a complicated recovery by encouraging post-discharge rehabilitation and follow-up. Geographic analysis of readmission rates in North Texas may result in the implementation of outreach programs directed to areas identified to have low follow-up compliance and high readmission rates (Overton et al., 2014).
Reduction in trauma readmissions will reduce healthcare costs for both the patient and hospital while improving the quality of patient recovery.

This practicum study identified and confirmed predictors of readmissions previously found using one year of DFWHC data (Petrey et al., 2014). The strongest predictor was found to be severe sepsis (OR = 8.88; p < 0.001), which predicted that readmission was nearly 9 times as likely in patients with septicemia. For this analysis severe sepsis is defined as severe sepsis with severe level of illness and extreme risk of mortality.

Two non-geographic variables which remained in the final predictive model were the year of patient admission and non-other race. It was calculated that those admitted in later years, toward the end of data collection in 2014, were 0.95 times as likely to be readmitted. Year of patient admission was added as a variable to the analysis to control for the variation of data across the 11 year set. Because BLR created a model of independently predictive factors, all other variables were controlled for the year of admission mitigating yearly variation in the data set.

Non-other race applies to encounters in which the patient did not check “Other” when asked to identify their race. Essentially, this variable includes all races, except “Other”. Although analysis calculates an odds ratio of 1.49 for non-other race, this variable shows little clinical relevance and should be considered for exclusion in further models in order to construct a functional set of predictive variables used by healthcare providers to assess a patient’s risk of readmission.

The final trimmed regression model retained significant factors from all three geographic levels (county, ZIP code, distance from hospital) analyzed. While a previous study determined with limitations that living farther than 50 miles away from the hospital of admission is
associated with a lower rate of readmission, this practicum study found significantly decreased readmissions farther than 20 miles away (Silverstein et al., 2008). There is importance in noting, however, that as distance from the DFWHC system increases, readmission data is more likely to be missing due to patients being admitted to outside hospitals closer to the patient residence.

Several North Texas counties were also reported as predictors of trauma readmissions. Hunt County predicted a 1.70 increase in likelihood of being readmitted, while counties such as Ellis and Kaufman predict odds ratios of 1.21 and 1.29, respectively. Although, most of the counties identified seem to be those surrounding Dallas county where BUMC is located, it does not appear that the extent of significance of each county is dependent on immediate proximity or size of the county. Meaning, those closer to Dallas country don’t generally seem to have higher odds of readmission than those further away. Although there are a number of variables yet to be explored, the northeast trend of predictability could be a result of the population density in those areas. An explanation would be that perhaps higher populated areas are more likely to see higher healthcare utilization and since Dallas is the largest healthcare provider in the area one could hypothesize this is where patients are admitted.

The statistical analysis of patient ZIP codes also gave significant results. Twelve ZIP codes were identified as being associated with higher readmission with nearly half identified as protective against readmissions rather than predictive of them. While ZIP code 75247 in Dallas county was found to predict that resident are 6 times as likely to be readmitted following a trauma admission, those from Dallas ZIP code 75001, are 0.15 times as likely to be readmitted. A majority of the ZIP codes found are located in Dallas however, there were predictors identified from both Fannin County and Tarrant County, as well.
As an initial exploration into the factors that lend significance to these ZIP codes, City-Data.com, a demographic data sharing website, was used to obtain information about each ZIP code from 2013. When observing population density of ZIP codes, there didn’t seem to be any observable relationship between population and readmissions. ZIP code 75284, a ZIP code indicative of a lower likelihood of readmission, was not found in City-Data and therefore no additional information is available for its characterization in this practicum study. While three predictive ZIP codes (75247, 75438, 75146) seemed to have the smallest populations out of the total 12 identified ZIP codes (75247=84 pop/sq mi., 75149=559 pop/sq mi., 75438=20 pop/sq mi.), the fourth most predictive ZIP code (76040) was the third highest populated ZIP with a population of 6,703 pop/sq mi. The protective ZIP codes showed the same trend with populations ranging from 3,446 pop/sq mi to 7,171 pop/sq mi. While no conclusions can be drawn from these values, further research should put efforts into more thoroughly characterizing these ZIP codes with demographic data.

Furthermore, similar relationships could be drawn when median household income were observed for each ZIP code. Among the seven predictive ZIP codes, five (75247, 75438, 76040, 75233, 75235) had average median household incomes below that of the Texas average of $55,200. However, the 4 identified ZIP codes which predict decreased readmissions showed similar trends with half (75220, 75240) having an average median household income below the state average. Again, no conclusions could be drawn regarding demographic values explored and additional research is necessary to determine geographic related variables that affect trauma readmission rates.
SUMMARY AND CONCLUSIONS

Readmissions are an important topic of discussion due to their high cost and increased risk of patient mortality. While factors such as insurance type, socioeconomic status, and comorbidities are associated with higher readmission rates, additional variables can be explored. With the extensive 11-year data provided by the DFWHC, this practicum study identifies both geographic and non-geographic factors that may further assist healthcare professionals to identify patients at higher risk for readmission following a traumatic injury. Variables identified in previous research were confirmed and retained in a predictive model with new county, zip code, and distance variables. Counties and ZIP codes found significant in the model can be used to characterize a patient and formulate a predictive profile giving information on the readmission likelihood of that patient.

LIMITATIONS

This practicum study does not come without limitations. One such limitation to keep in mind is that these results cannot be generalized to a population outside of North Texas. The cohort used in this study was composed of patients who had an index trauma admission to Baylor University Medical Center and only subsequent readmission data made available by the DFWHC was analyzed. This results in the possibility of creating statistical models that do not represent populations outside of North Texas, as well as analyzing incomplete readmission data unavailable due to outside hospital utilization. Furthermore, this data was compiled from both trauma and non-trauma centers making it difficult to determine if an encounter was planned or unplanned and if it was related to the index trauma. Similarly, diagnosis codes assigned to an encounter cannot always be identified as being related to the initial admission. Use of an administrative data set such as this also runs the risk of attributing an incorrect address to a
patient. Addresses documented in the DFWHC data are those of the guarantor or person being billed for hospital admission, not necessarily where the patient lives, making it likely that some patient locations are incorrectly reported.

FUTURE RESEARCH

Further studies should aim towards using data which can be generalized to a national level. Future interest should also move toward characterizing significant geolocations to determine if there are geographic attributable demographics that are predictors of higher readmission rates among the trauma patient population. For example, it would be valuable to examine in more depth the characteristics of predictive and protective ZIP codes. This would allow us to generate a more generalizable variable linked to geography that can be applied to other areas and communities.
BIBLIOGRAPHY


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INTERNSHIP SITE

During my internship at Baylor University Medical Center, I worked under Dr. Laura Petrey, a critical care and trauma surgeon. Most of my work was done in the trauma and critical care research office, however throughout my research internship I found myself working alongside medical professionals in other parts of the hospital as well. As part of my practicum, I formulated a research project, wrote a study proposal, and defended my project in front of a committee and my peers to earn a Master’s in Clinical Research Management.

JOURNAL SUMMARY

In addition to working on my practicum project my daily responsibilities included attending weekly multidisciplinary rounds on the ICU floor on Tuesdays and Thursdays, daily screening of potential patients for study enrollment, and attending weekly trauma conferences on Tuesdays in which a trauma/critical care physician or doctor would give a lecture on patient treatment and diagnoses. Every Thursday I would travel to 8080 N Central Expy to meet with statistician, Richard Gilder, to discuss my project and other ongoing research of Dr. Petrey’s. Every Friday I would take the Baylor Healthcare System therapy dogs to the trauma and ICU floors to interact with the patients and staff members. Throughout my internship, I regularly attended Trauma and Critical Care Grand Rounds, lectures given on good clinical practice, and monthly Baylor Research Institute faculty meetings. I worked approximately 40 hours a week.
Tuesday May 31st, 2016
9am - 11am
Mackenzie and I went on rounds.
This was an interesting experience because I've never witnessed a team of medical professionals collaborate to assess a patients status. I can tell that I will learn a lot from these runs as I have already heard many concepts learned at UNTHSC.

12pm
lunch

1pm-5pm I read the current papers of studies Dr. Petrey is currently working on and got familiar with some of the work I will be participating in while here.

Wednesday June 1st, 2016
10am
Attended a staff meeting with Evan Rainey to discuss upcoming projects and events. We further discussed possible proposals I can do and what would be required.

12pm
Lunch

12pm-5pm
Spent the rest of the afternoon researching geocoding and trauma readmission for proposal. More or less came up with an interesting topic to start working on.

Thursday, June 2nd
9:30-11am
Went on multidisciplinary rounds with Mackenzie on7Roberts.

12- went to lunch

1pm-4pm
discussed and looked into possible proposals.
Read example thesis and proposals sent by Evan to get an idea of what mine should include and look like.

Monday, June 6th
9am-11am
worked on setting up badge, parking, and building access.
12am – lunch

1pm–4pm
Worked on assigned BLNs and did some research on other studies related to my possible proposal.

**Tuesday, June 7**
9am – 11am
Went on multidisciplinary rounds with Mackenzie.
11 am
Reviewed example proposals and thesis to get an idea for how I should go about doing my project.

12noon
Had lunch

1pm–3:30pm
Looked up relevant articles pertaining to my proposal and read past readmission studies conducted by Dr. Petrey.

3:30pm
Had an Advisory Committee meeting to discuss my internship experience, responsibilities, and potential proposal idea.

**Wednesday, June 8**
9:30am– 11am
Went on multidisciplinary rounds with Jordin, another intern here.

11am-Discussed how to go about researching and writing literature reviews for my project with Mackenzie.

12 noon – Completed online BLN courses.

1pm-Went to lunch and scheduled a meeting with John from Baylor Libraries to gain information on how to navigate and conduct searches on Pubmed

1pm–4pm
Researched and worked on literature reviews.

**Thursday, June 9th 2016**
9am – 11am
Had a meeting with Richard Gilder a statistician to discuss methods for conducting study.
We discussed the possibility of using geographic data to possibly predict the chances of a patient being readmitted.
He advised that using zip codes for the data could be troublesome because zip codes do not stay constant and change depending on postal service efficiency. As a result he suggested that county maps might be better to use because they are more or less constant. He said that a possible limitation to using our data is that sometimes the county of the patient is not reported but the county of the payer. We briefly formulated a null hypothesis that would be to the effect of “geolocation does not predict readmission”

He explained Binary Logistic Regression that uses dichotomous data with different factors to make a prediction.

He also said that he would dummy code the data he has now which I have no idea what this means and will be looking this up.

--at some point in the narrative if necessary we will mention the amount of out of state values that we found in the data.—

Richard also explained and showed examples of the CHAID program he uses that I will research more extensively.

Things I need to research mentioned in the meeting:
NCTOG
CHAID
Face sheet
BLR
DFWHC
Pivot Table

2pm-3pm
attended lecture given by Dr. Funk (sp) regarding treatment of organ donors.

**Friday June 10th, 2016**

9:30am – 11am
Went to the trauma floors with the service dog Lily.
Got to play with Lily as well as talk to patients and make their stay here easier.

11am -12pm
Did literature reviews and attempted to look at the data sent by Richard. Didn’t really understand anything.

12pm –
had lunch
1pm
- worked on literature reviews. Navigated through patient charts with Mackenzie to get a feel of the system.

2pm
Met with John in libraries to get some help on PubMed navigation and research. Learned how to use MeSH.

3pm-5pm
Continued doing research on proposal topic. Looked into the format and requirements of the proposal itself.

**Monday, June 13, 2016**

10am-12
Started to get familiar with the different spatial analysis websites and programs that could potentially help with my project. Researched different sites and found out what kind of data would be needed to be input.

12 noon
Went to lunch in Sammons

1pm-2:30pm
Touched bases about my project with Mackenzie. We came to the realization that Richard would be doing the analysis of the data and that I would not have to do it on the spatial analysis software. Thank being said we would still need some data to input into some software to be able to map Richard’s findings.

**Tuesday, June 14, 2016**

9:30-11:30
Attended multidisciplinary rounds on 7 Roberts lead by Dr. Petrey.

12 noon
Attended weekly Trauma Conference in the Sparkman Library. The discussion was about treating, expectations, and monitoring acidosis in a patient. The speaker (forgot his name) detailed important physiological factors that contribute to and result from acidosis. He discussed lactic acidosis.

1pm-4:30pm
Discussed expectations and costumes for the ATLS exercise on Friday. Researched and read up on the different levels of trauma activation. Mackenzie suggested I get comfortable with some of the terminology used during rounds so I spent the rest of the day looking up trauma protocols and priorities.
Also spent some time researching the insurance and reimbursement trouble with readmissions.

Wednesday June 15th, 2016

9am-10am
With Mackenzie, walked through a patients chart who could be an eligible candidate for the nurse driven chest tube study. Still don’t have access to the studies so I couldn’t navigate myself through the charts but I learned a lot from Mackenzie showing me. She went over the IRB approval and informed consent processes with me.

10am-12pm
Did more lit review on readmissions, geographic mapping, and trauma.

12noon
Went to lunch.

1pm-2:30
Continued Literature review and wrote journal.

Thursday, June 16th

9:30-11:30
Went to multidisciplinary rounds
Learned:
Medicare 3 midnight rule
Flomax
TPN

12 noon
Had lunch

12pm – 1:30pm
Researched information and questions to ask Richard at our meeting

2-4pm
Had meeting with Richard at the Data Mining Lab.
Talked about the analysis being done on my project. Learned about the different coding systems used to determine severity, comorbidities, and age of patient.

Friday, June 17th 2016

9:30am – 11:30am
took the therapy dogs to Truett and the Roberts.

12noon – Had lunch
1pm – 5:30pm
Listened to an ATLS lecture concerning burn wounds and patients.
Prepared and participated as a fake patient for the ATLS practice and assessment.
I was a 49 year old gunshot wound victim and the residents, NPs, fellows etc. were to simulate a
treatment.
The surgeon that accompanied me was Dr. Taylor.

Monday June 20, 2016
9am – 12
Did some research, learned about writing for research, brainstormed and looked into questions
that I can direct to Richard at our weekly meeting.

12
Had lunch

12-4pm
Continued to do research on GIS sites and concerns for Richard.

4pm-5pm
Attended the monthly Trauma, Critical Care, & Acute Care Surgery Research meeting. Meeting
where everyone in the office talks about their projects.

Tuesday June 21st, 2016

9:30-12
Went to multidisciplinary rounds
Learned:
Chemoprophylaxis
Leukocytosis
NG tube
Metopralol
Lasix
NPO

12pm
Went to lunch (weekly Trauma conference was cancelled)

1pm
Sat in to listen to phone call between Mackenzie, Jake and Evan with Dr. Zsohar at the Worth
Street Clinic regarding another ongoing study.

2pm
Attended lecture given by Bridgett Browder - BRI learning in the digital world. This lecture was about how as all things, clinical research is starting to include more technology and what challenges, rewards, and responses come with it.

3pm-5pm
looked up proposal writing help online.
Got in touch with Dana Walker in Baylor marketing to see if her department has any experience with GIS software.

**Wednesday June 22nd, 2016**

9am-12
looked through the data files and other similar studies to brainstorm questions for Richard for our weekly Thursday meeting.

12pm
Had lunch
Looked over medical school application.

12pm-2pm
Found a lecture series about GIS usage and started to look into how to use the software

2pm
Talked to Mackenzie, a high school volunteer. She wanted to do interviews wit people in the office and asked if she could interview me.

3pm – 4pm
Did more research on GIS software and how its been used in the past for other studies.

**Thursday June 23rd, 2016**

9:30-11am
Went to multidisciplinary rounds with Mackenzie.
Learned:
Lovanox
Ativan
CRRT
Serotonin Syndrome
CPAP vs BiPAP
TBAR

11:30am – 12:30
Had lunch in the conference room for Dr. Foreman’s birthday.
12:30-1:30
Wrote journal, checked emails, brainstormed more ideas for Richard for meeting at 2.

2pm -4pm
Had weekly meeting with Richard. He put in the County data and got data output that showed significant results. Mackenzie and I had concerns about the outcome because the counties that showed the most readmissions were the ones nearest to the Baylor Healthcare system. We discussed the possibility of using Zip Codes with Richard and we think that’s the direction we’re going to start moving in from now on.

Friday, June 24th 2016

9:30-11:30
Took therapy dog (dolly) to the trauma floors.

11:30-12
Started an online step by step lesson on how to use QGis to put in census data. Getting familiar with the type of data necessary.

12-1pm
Had lunch with office peeps

1pm-2pm
Continued with the QGis lesson.
Looked at the data and studies that were sent from Alan Cook.

Monday June 27, 2016

9:30AM-11:30AM
Did therapy dogs on 6 Truett and 7 Roberts

12noon
Had lunch

1pm – 5pm
Began work on proposal. Wont have a meeting with Richard this week or next so I need to touch base with him via email.

Tuesday, June 28th

9:30 – 12noon
Attended Multidisciplinary rounds. Learned:
Sundowning in Alzheimer patients
Seroquel
Sliding scale insulin therapy
Propafol

12:30 noon
Went to lunch

1pm- 4pm
Began work for Richard on converting the ZIP codes from the DFWHC to census tracts

**Wednesday, June 29**
9am-12noon
continued to input ZIPs and census tracts into a spreadsheet for the analysis of the data. This took a while because there were hundreds of zipcodes and multiple census tracts for each. We will next have to trim out insignificant tracts to make a one-to-one reference.

**Thursday, June 30**
9:30am-12pm
Went to multidisciplinary rounds.
Learned about:
Precidex
GCS-gasgow coma scale
Levofed – adronergic agonist
Q dosing terminology

12noon
Went to lunch

1pm -4pm
Worked on data for Richard.
Looked up information about chest tube protocols and pneumo/hemothoraxes to prepare for chest tube study opening.

**Wednesday, July 6**
10am-11am
Had weekly trauma research staff meetings. Everyone talked about the status of ongoing studies.

**Thursday, July 7**
9:30am-12
Went to multidisciplinary rounds.
Learned:
Latate levels-.5-1
INR – international normalized ratio – provides information on a bloods ability to clot
12-1pm
had lunch

1pm–4pm
Did some more lit review for proposal background
Went over chest tube patients with Mackenzie and went over study protocol again.

**Friday, July 8**
9:30-11:30
Took Lily (therapy dog) to 6 Truett and 7 Roberts.

12noon
Attended memorial for the incident that happened in Dallas the night before.

1pm–4pm
Sifted through Richards shared data files to determine what should be added to proposal.

**Monday, July 11**
9-11am
worked on proposal, followed up with Richard on last email.

11am-12noon
Sorted and accounted for documents in the already existing patient data of the Nurse Driven Chest Tube study. Went through the protocol and researcher data sheet with Mackenzie

12noon
Had lunch

12noon – 2pm
Finished chest tube document spread sheet to see which patients’ files were missing documents

2pm – 4:30pm
Worked on proposal. Got a very detailed reply from Richard so adding more information to the methods section.

**Tuesday July 12**
9am – 11 am
Did not go to rounds and instead stayed to work on proposal

12pm – 1pm
Went to trauma conference about Shock given by Dr. Estroff
for shock----more hemoglobin
Not all O2 delivered is consumed –das when you got shock
We consume fixed amount of O2 (this is all the time)

Anaerobic threshold max out extrac ratio -> --decrease in CO(cardiac output) or hemoglobin
enough that consumption plummets

Shock....02 consumption is now dependent on available 02

Lactate goes up in shock...

HEMODYNAMIC MONITORING
Swan Ganz – people down know how to use swan and it was overused and dangerous and there
are better more efficient ways to look for shock and before you do a test make sure you know
how to read/interpret it – as per Dr. Foreman

3 types of shock
Hypovo/hemorrhagic
Cardiogenic
Distributive CO increased, decreased SVR

SHOCK MANAGEMENT
Lactic acid clearance (problem with sepsis)
Dobutamine-strong b1, weak b2
Dopamine- only for normal kidney function
Has different levels low(natureisis), med (like dobutamine), high dose (a)

Epinephrine- side effect hyperglycemia a receptor ok insulin

Phenyl ephedrine- a only

1pm-5pm
Did online GIS tutorial to learn how to input and analyze census data

Wednesday July 13th, 2016

9am – 12am
Worked on proposal background. Still waiting to get more information from Richard on how far
to explain what we have been doing. Need more information about types of analysis and
DFWHC from him.

Started binder of work we have done so far to help organize data. This should help with
organizing the study in order to write my proposal and paper.
12noon
Went to lunch

1pm-5pm
Looked at patient charts and filled out practice research documents.
Worked more on proposal

**Thursday July 14th 2016**

9:30-12pm
Went to multidisciplinary rounds
Learned:
Regulin
What procalcitonin tests are for
Zofran
What wound vabs do
Versed-sedative
IPPB – intermittent positive pressure breathing
Bacterial bands test – neutrophils, tests for infections
Robaxin – muscle relaxant

12pm – 2pm
Went to lunch and did research on GIS use and DFWHC

2pm
Went to Grand Rounds given by Dr. Estroff about Prophylaxis of VTE and time fram at which lovanox should be given.

Didn’t pick up a lot of information because I didn’t understand 80% of the acronyms.

**Friday July 15**

9:30 – 12am
Took Jake and Qiunn to the trauma/ICU floors. (Therapy dogs)

12:30-2pm
had lunch with research crew.

2pm-4pm
looked at ArcGIS program from the UT system but had some trouble downloading.
Started write up on Richards new data we found in our weekly meeting yesterday
Monday July 25th, 2016
8:30-9:30
Emailed Richard to get more information on the methods of the study to add to proposal
Worked on getting a final draft of the proposal

9:30am-11:30am
Took the therapy dogs to 6 Truett and the ICU.

12noon
Went to lunch

1pm-4pm
Added edits that Richard had to the methods section of the proposal.
Gave copy of final draft of proposal to Evan and Mackenzie for edits.

Tuesday July 26, 2016
9:30am-11:30am
Attended multidisciplinary rounds in the ICU

12-1pm
Went to trauma conference
Got necessary proposal signatures from Dr. Petrey

1:00pm-5pm
Continued with Evan’s edits and gave a copy of proposal to Mackenzie to read and edit
Corrected proposal with Mackenzie’s and Dr. Gwirtz’s edits.
Got final copy of proposal ready for submission.

Wednesday July 27th, 2016
9am-11am
Put binders and covers on trauma support books

12noon
Drove to Ft. Worth to submit study proposal

Thursday July 28th, 2016
9am-11:30am
Went to multidisciplinary rounds in the ICU

12noon
Picked up lunch from Truett and prepared for the meeting with Richard at 2pm
Looked at what we have done so far and thought of concerns.

2pm-4pm
Had meeting with Richard at 8080. Dr. Petrey and Jake both called in. All together we decided to go in the direction of characterizing zip codes by some data sharing census website. We also determined however I'm unsure of the method used, that Census Tract was not a predictor of readmissions. Concerned whether these websites will contribute reliable data.

Friday July 29\textsuperscript{th}, 2016

9:30-11:30
Took the therapy dogs to 6 Truett and the ICU.

12noon
Had lunch with the officemates at freshii

1pm-4pm
Summarized and compiled data from the meeting with Richard yesterday. Looked into what directions we would take the study next.

Monday August 1\textsuperscript{st}, 2016

9am-12
Had a quick check in with Mackenzie to talk about my time here and what things I would like to change or do differently. When Chest tube study starts I will start coming in at 8

Read up on Traumatic brain injuries and repeat heads CT study that Mackenzie is also coordinating

12
Went to lunch

1pm-4pm
Did more research on TBIs and CT scans

Tuesday, August 2\textsuperscript{nd}, 2016

9:30-11:30
Attended multidisciplinary rounds in the ICU.

12-1pm
Attended weekly trauma conference

1pm-4pm
Since chest tube is starting soon, me and Mackenzie went over how to approach the start up. We will most likely begin with enrolling and going through a whole subject so we can iron out any problems that come up and we can improve the protocol before enrollment of other patients

Wednesday August 3\textsuperscript{rd}, 2016
9am-10am
Practiced screening for chest tube patients because the Nurse driven study will open soon

10am-11am
Went to weekly trauma research staff meeting.
12 noon
Went to get lunch, came back and researched GIS software, and readmission reduction program

1pm-4pm
Read up on Geographic Analysis studies in other areas for other types of admissions and how those were carried out.
Researched transition services used in other areas that follow up with patients after hospital discharge to improve recovery and reduce readmissions

Thursday August 4th, 2016

9:30-11:30
Went to multidisciplinary rounds in ICU held by Dr. Petrey.

12 noon
Went to get lunch, came back and did more research ion geographic analysis study.
Read up on some of the statistical methods used by Richard.

2pm-4pm
Went to weekly meeting at 8080 with Richard, Macknezie, and Jake.
Brought up concerns for significance of 10 year data with possibly unrelated readmissions and how it would affect the validity of the study.
Need to check method: Richard did analysis and found that a majority of the readmissions in all of the patients in the database are within one year of discharge from the index trauma admission. This would suggest that within the average time people are admitted they are admitted for a reason related to the index event

Friday August 5th, 2016

9:30am-12
Did therapy dogs on 6 Truett and ICU. Jake and Quinn

12-1pm
Trauma family lunch in the conference room featuring Jake, Quinn, and tiny cookie sandwiches.

1pm-4pm
Researched census websites and how past researches have used the information in their studies. Researched for background information. 
Chest Tube study is starting next week so went over protocol and inclusion/exclusion criteria.

**Tuesday August 9th, 2016**

9am-11:30am  
Attended multidisciplinary rounds

12-1pm  
Attended trauma conference given by Dr. Foreman about gastro tubes and drains.

1pm-3:30  
Screened patients for the chest tube study  
Did background research for Geo mapping and trauma readmissions  
Found information in the charts for MTBI patient for study

3:30pm-5pm  
Met with Dr. ? from radiology to talk about MTBI and RHCT study.

**Wednesday, August 10th 2016**

9am – 10am  
Screened 7 Roberts for chest tube patients.

10am –  
Worked on the researcher and nurse checklist for enrolling and treating patients.  
Spent time until lunch reviewing and editing the nurse care checklist

12-1pm  
Lunch and screened patients

1-4pm  
Finished research and nurse check lists.  
Made a PowerPoint for the meeting with the residents tomorrow regarding the start of the CT study

**Thursday August 11, 2016**  
*meeting with Richard canceled today*

8am-9:30  
Screened ICU and ED patients for possible chest tubes

9:30-11:30
Went on multidisciplinary rounds

12pm
Went to lunch

2pm
Attended Grand rounds given by Dallas Police Department. Learned about street drugs.

3pm-5pm
Worked on CT checklists, flyers, and screened patients

5pm
Went to meeting with residents to notify them of the start of the Nurse Driven Chest Tube study

**Friday August 12, 2016**

8am-9:30
Screened ED and ICU patients for possible chest tube study subjects.

9:30-11:30am
Took therapy dogs to 6Truett and ICU floors

12noon
Went to lunch

1pm-4pm
Edited Nurse checklist and got final copy to Mackenzie
Attempted to reformat the Chest Tube data sheet
Did more research on the geo-analysis study.

**Monday August 15th, 2016**

8am-10am
Screened ED and ICU patients for possible Chest tube Study subjects.

10am
Went to speak with Diane Trower in the ICU about the start of the CT study. Also checked with Dian about the wristband study which there is no information available and will not start.
12noon
Had lunch

2pm
Went to 6Truett to notify the staff that the chest tube study is started and what they can expect from us.

**Wednesday August 17th, 2016**

6am-7:30am
Met with the 6 Truett nurses to inform them of the start of the Chest Tube study.

7:30-11am
Screened ED and ICU patients for Chest tube study

12
Went to lunch

1-3pm
Read and made edits on Anil’s (Last years CRM intern) readmission paper.
Started filling out mock data sheet to use as an example for the Truettt nurses.

**Thursday August 18th, 2016**

8am-9:30am
Screened ED and ICU patients for possible chest tube study subjects

9:30-11:30
Attended multidisciplinary rounds in the ICU

12-2pm
Went to lunch
Summarized previous analysis from Richard for the meeting today
Attempted to fill out mock data sheet as an example for the nurses of 6 Truett but came across some questions that need to be directed to Dr. Petrey

2pm-4pm
Attended weekly trauma research readmissions meeting at 8080 with Richard

**Monday August 29th, 2016**
8am-9:30am
Screened patients in ICU, surgery, and ED for possible chest tube study participants.

9:30-11:30am
Took therapy dogs to the ICU units to see the patients and staff.

11:30-12
went to lunch

12-4pm
Did literature research for geographic study while continuing to screen patients.

3pm–4pm
attended resident meeting to inform them of the chest tube study protocol and expectations.

**Tuesday August 30th, 2016**

8am-9:30am
Screened patients in the ED, ICU, and surgery floors. No patients with chest tube found.

9:30am – 11:30am
Attended multidisciplinary rounds in the ICU. Tried to pay attention to patients who could potentially get a chest tube. It is better to catch patients before they get chest tubes because they cant participate if they have been intubated for longer than 24 hours.

12 – 1pm
Attended trauma conference in Sparkman auditorium.

1pm – 4pm
Screened patients throughout the afternoon.
Began result interpretation and report of geographic study.
Edited a comprehensive checklist Mackenzie wrote up for the nurses with patients in the chest tube study.

**Wednesday August 31, 2016**

8am – 9am
attended grand rounds given by Dr. Steimer about ECMO

9am – 10am
screened ICU and ED patients for patient who might have or get a chest tube.
10am – 11:30 am
worked on MTBI date. Retrospectively looked at patient charts to see the progression of their minor head trauma and the improvement or worsening of their GCS score.

12-1:30pm
Today was Dr. Mark Powers first day, the new trauma research director. To welcome him we walked to Stackhouse burgers for lunch.

1:30-4pm
Continued collecting data for MTBI study. Also started collecting whether the patient received TEG upon their arrival in the ED or not. TEG is a test to see the clotting activity of your blood. Looked into Geo data to determine if there were any questions or clarifications needed at the meeting with Richard tomorrow.

**Thursday September 1st, 2016**

8am – 9:30 am
Screened ED and ICU patients before rounds to see if any could be part of the chest tube study.

9:30am – 11:30
Attended multidisciplinary rounds in the ICU. Listened to patients who could possibly getting a chest tube or was given one before the chart could be updating and they were missed in screening.

11:30 – 12 pm
Had lunch in Sammons.

12pm – 2pm
Worked on adding more information to the MTBI data set.

2pm-4pm
Went to the weekly statistics meeting at 8080 with Richard to discuss where data analysis has taken us in the geographic study. We also discussed a replication of a past paper published by Dr. Petrey regarding superutilizers

**Friday September 2nd, 2016**

8am – 9:30 am
Screened relevant floors for patients that could be included in the chest tube study.

9:30am – 11:30am
Took the therapy dogs to 6Truett to see the patients and 7 Roberts to see the staff.

12-1pm
Had lunch

1pm -3pm
Screened patients for chest tube while entering MTBI data.

**Tuesday September 6th, 2016**
8am – 9:30am
Screened for chest tube patients

9:30am – 11:30am
Went to Cardiovascular ICU multidisciplinary rounds on 4 Roberts. This floor has the more severely ill patients with cardiovascular diseases and symptoms. Many are transplant patients. Today I listened to doctors discuss a lung transplant patient

12-1pm
Attended trauma and critical care conference

1pm – 4pm
Continued screening for chest tube patients.

**Wednesday September 7th, 2016**
8am – 9:30am
Screened charts for possible patients who could have been admitted overnight and received a chest tube

9:30am –12
Began drafting and data interpretation for thesis. Started working on Map Point to build graphs to be used in my paper and in my defense presentation. I also continued screening and periodically added to the MTBI data set.

12 – 1pm
had lunch in the Truett Cafe

1pm – 3pm
Continued screening for chest tube patients and prepared questions for Richard tomorrow.
3pm – 4pm
attended the Trauma Resuscitation Conference with the residents. At the end we gave a short explanation of the chest tube study and what to expect upon its re-opening

**Thursday September 8th, 2016**
8am – 9:30am
Screened ICU and trauma surgery patients for possible chest tube study participants.

9:30am – 11:30am
Attended multidisciplinary rounds in the ICU to further screen for chest tube patients. Screening must be ongoing throughout the day because there is a 5 ½ hour enrollment window which the patient must be consented in.

12pm-1pm
Went to lunch in Truett.

1pm-3pm
Attended Trauma Grand Rounds on 17 Roberts.
Today’s meeting with Richard was canceled due to grand rounds.

**Friday September 9th, 2016**

8am – 9:30am
Screened ICU and trauma surgery patients for possible chest tube study participants.

9:30am – 11:30am
Took Dolly, the therapy dog to visit patients on 6 Truett and the staff on 7 Roberts.

Had an early day off to use as thesis writing. Started outlining and planning which results were reportable. Also researched in detail the 2 stats methods used for the study.

**Tuesday September 13th, 2016**

8am – 9:30am
Screened ICU and trauma surgery patients for possible chest tube study participants.

9:30am – 11:30am
Attended multidisciplinary rounds in the ICU with Dr. Powers since he is shadowing Mackenzie. Explained how rounds work what various acronyms and abbreviations mean. Described what I specifically listen in for in regards to the chest tube study.

12 – 1pm
Went to weekly trauma/ critical care conference presented by Dr. Pan and Dr. Nguyen.

**Wednesday September 14th, 2016**
Did not go into the office today. Traveled to Ft. Worth to meet with the new Director of the Clinical Research Management program.

**Thursday September 15th, 2016**
8:30am-9:00am.
Screened ICU and trauma surgery patients for possible chest tube study participants.

9:30am – 11:30am
Went to multidisciplinary rounds in the ICU to listen for possible chest tube patients.

11:30am – 12pm
Lunch

12pm – 1pm
Worked on data input for the MTBI study. Became familiar with study to explain to medical student who will be helping with this part of the study.

2pm – 4pm
Had weekly meeting with Richard Gilder to discuss the final analysis for the superutilizer paper since the abstract is due soon. Did not discuss geographic analysis since superutilizer deadline is so close.

**Friday September 16th, 2016**
8:30am-9:00am.
Screened ICU and trauma surgery patients for possible chest tube study participants.

9:30 – 11:30am
Took therapy dogs to 7R and 6T to see patients and staff. Jake and Quinn were here today.
12-12:30pm
Went to lunch
12:30-1:30pm
Talked to Marcus Wong, a med student that is going to help with the data of the repeat CT TBI study. Summarized the study and walked him through the chart review process to acquire relevant data for the study.

1:30pm – 3pm
Continued on chart review and data input for the MTBI repeat CT study

**Monday September 19th, 2016**

8:30am-9:00am.
Screened ICU and trauma surgery patients for chest tubes that can participate in our study.

9am – 12pm
Worked on MTBI repeat CT chart reviews.

12pm went to lunch

1pm -4pm
Continued to screen patients, working on MTBI study, and data analysis interpretation for geographic readmissions.

**Tuesday September 20th, 2016**

8:30am-9:00am.
Screened ICU and trauma surgery patients for chest tubes that can participate in our study.

9:30 am – 11:30am

Attended multidisciplinary rounds on the ICU floor 7R . Listened for possible chest tube patients that could qualify for the study.

12-1pm
Attended the weekly trauma/ critical care conference given by the surgeons. Today’s talk was by Dr. Graybeal about a new intensive neurological exam that is said to be better at determining the mental status of a patient.
1pm-2pm
Attended weekly trauma research staff meeting in Dr. Powers office to discuss current status of several of the studies the research staff is working on.

2pm – 4pm
Did an ad hoc review for a paper that Dr. Powers is reviewing. Learned about the reviewing process and what’s important to address when reviewing a paper. Discussed and compared my critiques with Dr. Power’s.

**Wednesday September 21st, 2016**
8:30am-9:00am.
Screened ICU and trauma surgery patients for chest tubes that can participate in our study.

9am – 11:30am
Attended cardiovascular ICU multidisciplinary rounds with Dr. Powers today. This is different than the ICU round normally attended on 7Roberts because these focus on cardio/ respiratory diagnosis and treatment. This is the floor where they do ECMO which is a life support system responsible for artificially oxygenating blood and delivering it back to the body.

12- lunch

1pm – 4pm
Looked at superutilizer analysis from the paper Mackenzie is currently working on. Since this data includes geographic analysis I can dedicate a section of my paper to analysis of geography in the superutilizer population.

**Thursday September 22nd, 2016**
8:30am-9:30am
Screened ICU and trauma surgery patients for chest tubes that can participate in our study.

9:30am – 11:30am
Went to multidisciplinary rounds on the ICU floor given by Dr. Estroff. Listened for patients who could possibly be getting a chest tube for Dr. Petrey’s study.

12-12:30pm
Had lunch at the Truett café while reading readmission literature for possible directions to explore with the 11 year data.

1pm – 4pm  
Continued to screen trauma patients for chest tubes.  
Analyzed some data for my thesis as well as super-utilizers.  
No meeting with Richard today as he’s out of town.

**Monday September 26**th, 2016  
8:30am-9:30am  
Screened ICU and trauma surgery patients for chest tubes that can participate in our study.

9:30am  
Went to meet therapy dogs in the ICU and they didn’t show up so therapy dogs were cancelled.

9:30am-2:30pm  
Continued to screen patients while working on thesis.

**Tuesday September 27**th, 2016  
8am – 9:30am  
Screened all trauma/ICU floors for chest tube patients for ongoing study.

9:30 am– 11:30am  
Attended multidisciplinary rounds on the ICU floor to listen for possible chest tube patients. Dr. Petrey was the attending physician.

12-1pm  
Had weekly trauma meeting with Dr. Powers to discuss status of ongoing studies in the office. Discussed publications, grants, ideas, and the research retreat on Thursday.

1pm-3pm  
Screened patients for chest tube study, looked at possible variables to explore within readmission data for new studies, and worked on thesis.

3pm–4pm  
Had weekly research meeting with Dr. Petrey to discuss super-utilizer paper due for submission this Saturday as well as the current status on Dr. Petrey’s other studies.
**Wednesday September 28th, 2016**

Today I did not go into the office and instead traveled to Ft. Worth to get signatures and submit my Intent to Defend form. Dr. Berg was out of town at this time and after speaking with Carla I’ll have to come back next week to get his signature and submit the form.

Took the rest of the day as a writing day to work on my thesis.

**Thursday September 29th, 2016**

8am-4pm

Attended all-day research retreat in Waxahachie to learn from and interact with the other research departments and employees at Baylor Scott & White Research Institute. We heard from several speakers in administration and we taught about the importance of coordination of thinking styles to effectively and efficiently progress on a project. Lunch was provided as well as activities to facilitate collaboration and familiarity between different Baylor areas of research and Texas.

**Tuesday October 4th, 2016**

8am – 9:30am

Screened all ED/ICU floors for chest tube patients for ongoing study

9:30 am– 11:30am

Attended multidisciplinary rounds on the ICU floor to listen for possible chest tube patients. Dr. Petrey was the surgeon in charge.

12-1pm

Attended trauma/critical care conference in the Sparkman Library.

1pm-2pm

Went to the new weekly research meetings we have with Dr. Powers. This is a chance for everyone to discuss the progress of their research, and share ideas for publications, conferences, and grants.

2pm – 4pm

Worked on thesis for the rest of the day periodically screening patients for the chest tube study.

**Wednesday October 5th, 2016**

8am – 9:30am

Screened all ED/ICU floors for chest tube patients for ongoing study
9:30 – 12
Created tables of results for my thesis. I split all the variables into two tables one geographic and the other non geographic

12
went to lunch

1-4pm
Screened for patients while continuing to work on thesis. Also did some work on the MTBI data.

**Thursday October 6th, 2016**
8am – 9:30 am
screened patients that may have come in overnight with chest tubes

9:30 – 11:30
Attended multidisciplinary rounds in the ICU and screened for patient conditions which may lead to chest tube placement.

11:30 – 12
went to lunch

12pm-2pm
prepared questions for Richard for meeting today. Need to ask about mapping and variable by variable breakdown of frequency of encounters.

2pm-4pm
Had weekly readmission meeting with Richard to discuss the status of my thesis and address any concerns me, Mackenzie, or Richard have.

**Friday October 7th, 2016**
8am – 9:30
Screened ED and ICU patients to see if any got chest tubes overnight or came in with conditions that may require chest tube placement,

9:30 – 11:30
Took the Therapy dogs to 6 Truett to visit some of the patients and to 7 Roberts to visit with the staff.
11:30 – 12
Went to lunch

12-3pm
Worked on the methods section of my thesis. Emailed Richard back and forth to get information on some of the variables found significant and also the statistical tests we use to determine our variables.

**Monday October 10, 2016**
Did not go into the office today. Took a full day of writing to work on my thesis and gather the information necessary

**Tuesday October 11, 2016**
8am – 9:30am
Screened all ED/ICU floors for chest tube patients for Dr. Petrey’s chest tube study.

9:30 am– 11:30am
Attended multidisciplinary rounds on the ICU floor to listen for possible chest tube patients.

12-1pm
Attended trauma/critical care conference in the Sparkman Library.

1pm-2pm
Went to the new weekly research meetings we have with Dr. Powers. Reviewed what everyone was working on. I informed everyone of the timeline for my thesis and defense. Evan told me I could submit an abstract to my paper on November 14th.

2pm – 4pm
Spend the rest of the day to work on my thesis while periodically screening the ED for possible incoming chest tube patients

**Wednesday October 12, 2016**
8:30 – 9:30
Screened patients for chest tubes

9:30am – 12
Went over this with Mackenzie and received edits and criticism. Took the rest of the day to add details and make corrections.

12 – 1pm
Went to lunch
1pm -4pm
looked in to the identified ZIP codes on City-data.com to see if there were any kind of obvious demographic factors contributing to the significance of the ZIP codes.

**Thursday October 13th, 2016**
8:30am-9:00am.
Screened ICU and trauma surgery patients for possible chest tube study participants.

9:30am – 11:30am
Went to multidisciplinary rounds in the CV ICU in 4Roberts. There happened to be some trauma patients here at the time so we thought relevant that someone go to listen.

11:30am – 12
Went to lunch

12:30pm – 3pm
Attended Trauma Grand rounds. A detective from the Dallas Police Department came to talk to us about recognizing different gang members. This was interesting because we learned about the different names of the gangs in Texas and also learned common tattoos you can see in each gang.

3pm-5pm
Continued work on my thesis. Added some edits and expanded in some places.

**Friday October 14th, 2016**
8:00am-9:30am.
Screened patient charts for possible chest tube subjects.

9:30am – 11:30am
Took Lily the therapy dogs to 6 Truett to visit the patients and 7 Roberts to visit the staff.

11:30am -12:30
Went to the Baylor employee appreciation Fall Festival to get food and prizes. After, we came back to the Trauma break room and ate lunch.

12:30 – 3pm
Took the rest of the time to again work on my thesis. Prepared a draft to send to Dr. Gwirtz for edits.
**Monday October 17, 2016**
9:00am – 11:30
Attended multidisciplinary rounds in the CV ICU just to listen in on the treatment and diagnoses of the patients.

11:30am – 12
went to lunch

12pm – 4pm
took wrest of the day to work on thesis final draft and get together final concerns and answers from Dr. Petrey and Richard.

**Tuesday October 18, 2016**
9:30am – 11:30
Attended multidisciplinary rounds on the ICU to screen for possible chest tube patients

12 – 1pm
Attended trauma conference in Sparkman and listened to weekly lecture

1pm – 2pm
Attended weekly trauma research staff meeting held by Dr. Powers to discuss the status of everyone’s projects and studies.

2pm – 4pm
Worked on thesis defense presentation
Looked at edits given by Dr. Gwirtz and made corrections on thesis

**Wednesday October 19, 2016**
9am – 4pm
Took this day to write and complete thesis. Included edits from Dr. Gwirtz, Dr. Petrey, Evan, and Mackenzie.

5pm
Sent a final completed draft of my thesis to committee members.

**Thursday October 20, 2016**
9:30am – 11:30
Attended multidisciplinary rounds on the ICU to screen for possible chest tube patients
12-1pm
lunch while screening patient charts for possible chest tube subjects

1pm – 4pm
Worked on defense presentation. Scheduled defense practices with trauma research staff, Dr. Gwirtz, and Richard.

**Friday October 21, 2016**
9:30am – 11:30am
Took therapy dogs to 6 Truett and & 7 Roberts to visit patients and staff.

12-1pm
went to lunch

1pm – 3pm
Screened patients for chest tube patients
And worked more on defense presentation powerpoint.

**Monday October 24, 2016**
9:30am – 11:30am
Took therapy dogs to visit only the staff on 6 Truett and 7 Roberts.

12pm
Went to lunch

1pm – 4pm
Worked on defense presentation and maps.
Prepared to present in front of office staff tomorrow.

**Tuesday October 25th, 2016**
9:30am – 11:30am
Attended multidisciplinary rounds on the ICU to screen for possible chest tube patients

12 – 1pm
Attended weekly trauma conference and listened to lecture given on trauma/critical care.

1pm – 2:15pm
Attended weekly trauma research staff meeting to discuss all ongoing studies everyone is working on.
2:15pm – 3pm
Added more information and maps to presentation slide show.

3pm – 4:30 pm
Practiced defense presentation to office staff. Although incomplete, presentation was approx. 25 minutes. We went slide by slide and talked about organization what should be added/taken away. We also discussed possible problems with the study that could be addressed before my official defense. I got a lot of great constructive criticism.

**Wednesday October 26th, 2016**
Took this day to travel to Ft. Worth to present slideshow for defense to Dr. Gwirtz, Got more constructive criticism and information on publication.

Attended the defense of another student to get the idea of what it would be like.

**Thursday October 27th, 2016**
9:30am – 11:30am
Attended multidisciplinary rounds on the ICU to screen for possible chest tube patients

12noon
Lunch

12- 1pm
Added information from both practices with the office and Gwirtz.

2pm – 4pm
got over presentation with Richard and discussed all the questions that were brought up during both practices with Gwirtz and the office. We went over the concepts of REMPI, sequence number, the DFWHC, planned vs unplanned and exclusions. We also went over the geographic variables and why they were what they were. I also asked Richard for a map of the identified counties with their scaled odds ratios.

**Friday October 28th, 2016**
9:30am – 11:30am
Took therapy dogs to 6 Truett and & 7 Roberts to visit patients and staff

12- 1pm
Ate lunch while screening patients for chest tube subjects

1pm – 4pm
Wrote and submitted geographic analysis abstract for Southwestern Surgical Congress conference.

**Monday October 31st, 2016**
9am – 10am
Chart screening for chest tube patients

10am – 11am
Worked more on defense presentation

11am – 12pm
Went to lunch

12pm – 4pm
Worked on summarizing study limitations and examples of other places that use outreach programs to improve patient recover.

**Tuesday November 1st, 2016**
9:30am – 11:30am
Attended multidisciplinary rounds on the ICU to screen for possible chest tube patients

12 – 1pm
Attended weekly trauma conference and listened to lecture given on trauma/critical care.

1pm – 2:15pm
Attended weekly trauma research staff meeting to discuss all ongoing studies

2:15pm – 3pm
Added more information and maps to presentation slide show.

3pm – 4:30 pm
Practiced defense presentation to office staff. Presentation was approx. 30 minutes. We went slide by slide and talked about organization what should be added/taken away. Got more really good criticism mostly on the amount of words on each slide.

**Wednesday November 2nd, 2016**
Defense day.