

The Electronic Health Record as a Research Lab: Leveraging EHR Data to Improve Military Health Outcomes

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The author has no conflicts of interest.

All data collection and analysis done under
Approved IRB protocol #174953-13 (PI: J. Caban)

Objectives

1. Provide an overview of the Military Health System (MHS)
2. Outline the MHS Electronic Health Record
 - System Architecture
 - Clinical & Research Applications
3. Use Cases
 - Healthcare Utilization and mTBI
 - Health Outcomes Research
 - Clinical Dashboards

Military Health System (MHS)

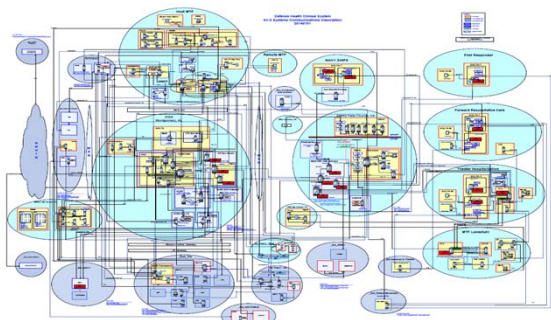
- The MHS provides health care services to active duty military, activated reservists, military dependents, and military retirees

Theater Hospitals	Medical Centers	Ambulatory Care Clinics
6	57	364
Naval Ships	Dental Clinics	Veterinary Facilities
117	281	255
Hospital Ships	Submarines	
2	17	

1,099 Locations in 16 countries
153,000 employees
9.5M beneficiaries

Source: 2016 HIMSS Presentation, Col Richard Terry

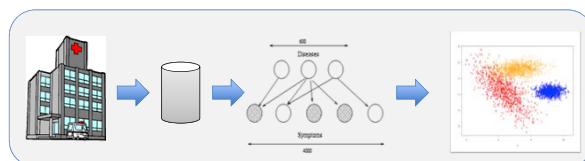
MHS Electronic Health Record



Currently the MHS clinical systems consist of >50 integrated individual applications

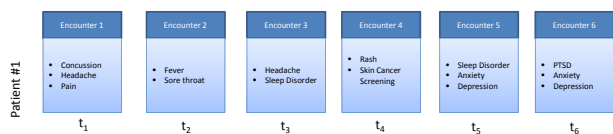
Big Data & Clinical warehouse

- During the last 5-10 years a significant amount of work done in data warehousing for hospitals
- Successes and failures
 - Lazer et al., "The Parable of Google Flu: Traps in Big Data Analysis", Science 2014
 - Murdoch et al., "The inevitable application of big data to health care", JAMA 2013
 - Feldman et al., "Big Data in Healthcare Hype or Hope", JAMIA 2012
- "Inevitable" applications:
 - Research studies
 - Clinical care

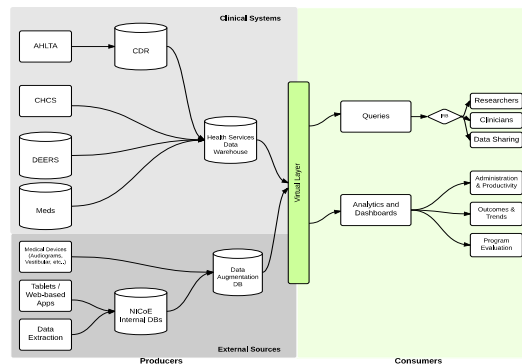


Health Services Data Warehouse

- 17 million individual records
- 4.8 billion clinical encounters
 - Direct Care ~ provided by MHS
 - Purchased Care ~ provided by civilian network
 - Pharmacy / Enrollment Eligibility / Third-party Insurance information



Health Services Data Warehouse



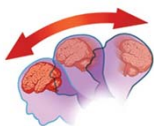
USE CASES

Use Cases

1. Healthcare Utilization
2. Clinical Outcomes
3. Data Visualization
4. Dashboards
5. Clinical Pathways
6. Provider Productivity
7. Advanced Analytics for Population Health
8. Forecasting
9. Etc...

What is mTBI?

- **Traumatic brain injury:** damage to the brain caused by an external force
 - Rapid acceleration / deceleration
 - Impact, Blast, Penetrating injury
 - “Signature Injury” of Iraq / Afghanistan
 - >300,000 service members from 2000-2015



	Structural Imaging	Loss of consciousness	Alteration of consciousness	Post-traumatic amnesia
Mild	Normal	0-30 mins	<24 hours	0-1 day
Moderate	Normal or Abnormal	>30mins <24 hrs	>24 hours; severity based on other criteria	>1 to <7 days
Severe	Normal or Abnormal	>24 hrs		>7 days

³ VA / DoD Clinical Practice Guideline for the Management of Concussion-Mild Traumatic Brain Injury

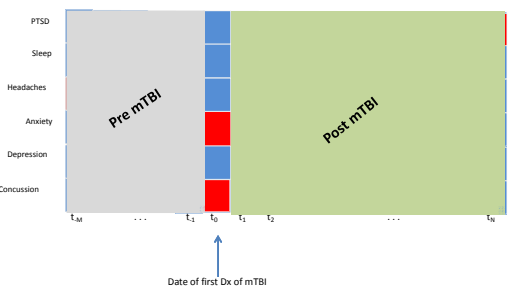
Short- and Long-Term Effects of mTBI

- Post-concussive symptoms:^{4,5,6}
 - Physical symptoms
 - Impaired cognition
 - Behavioral / Emotional distress
- Chronicity of post-concussive symptoms differs by:^{7,8,9}
 - Demographics
 - Peri-injury Events
 - Comorbidities
- Utilization Intensity & Treatment Modalities
 - Veterans with mTBI utilize healthcare at a significantly higher rate ^{10,11}
 - Clinical outcomes differ by utilization type and intensity ¹⁶⁻²³

How can we leverage existing electronic health records to better understand the short and long term effects of mTBI and improve Clinical Outcomes?

Case 1: Healthcare Utilization

- What is the change in short-term HCU following a first mTBI?
- How does utilization differ by Age, Gender, & demographics?

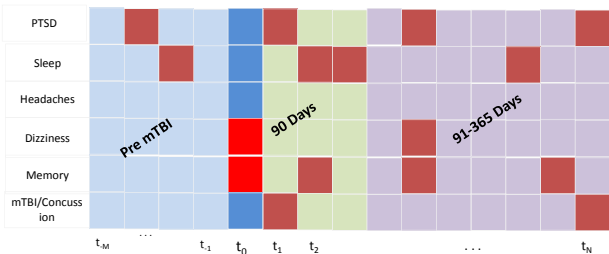


Case 1: Results

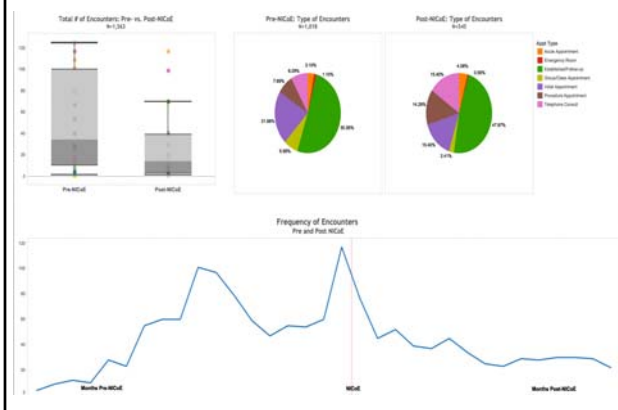
- Utilization increased at least 200% in 65/68 outpatient clinics
 - Pre-injury Visits: 260,940
 - Post-injury Visits: 663,452
- Specialty Clinics
 - Neurology ~ 1800% increase
 - War-related injury
 - SMs ages 17 – 24
 - Substance Abuse ~ 6% decrease

Case 2: Clinical Outcomes

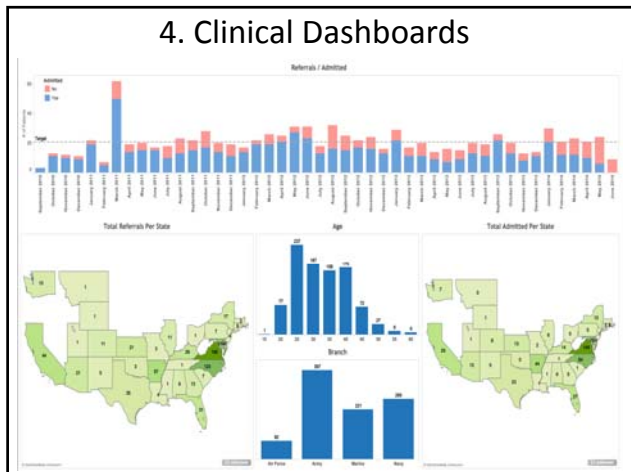
- RQ: What is the relationship between the short-term pattern of health care utilization related to mTBI and long-term effects related to mTBI?
- Does utilization in the 90 days following injury affect long-term clinical utilization?
 - Does show-term utilization affect short-term / long-term symptomatology?



3. Data Visualization



4. Clinical Dashboards



Conclusion

- EHRs provide a rich source of existing longitudinal data for clinical and research applications
- True population health research is becoming achievable due to EHRs and Team Science
- Clinical applications continue to expand exponentially at all levels of patient care

Acknowledgements

- Dr. Jesus J. Caban, PhD
 - Walter Reed National Military Medical Center
 - National Intrepid Center of Excellence
- Tim Wu, MD
 - Walter Reed National Military Medical Center
 - National Intrepid Center of Excellence
- Jonas Center for Nursing and Veterans Healthcare