Proposal

## Basic Info.

### Project Title:

Emergency Medical Complaints

### Team:

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### Repository:

GitHub: <https://github.com/lateoclock/dataviscourse-pr-EmergencyMedicalComplaints>

## Background and Motivation

As biomedical informatics students, we are interested in using data to improve healthcare. Patrice is a Research Analyst at the Utah Department of Health, Bureau of EMS and Preparedness. She regularly works with pre-hospital data, as well as various health data repositories. BEMSP has a goal to return more of the data obtained from local agencies back to those agencies with added value in order to promote participation in data sharing programs. This is especially important for small, rural agencies and facilities that don’t have in-house data analysis resources. This visualization could be a means of showing state program participants that their data is being used. It would be especially successful if the recipients find it fun and easy to use. Patrice will obtain EMS and emergency data from UDOH.

When a person calls in to 911, they are sometimes panicking or rushed. The caller may not be the person in distress, or the person in distress may be unable to respond to questions from dispatchers. Although dispatch follows a protocol to best document the callers complaint, the complaint often does not accurately and completely capture the real problem. For example, a person may call in complaining that they are having breathing problems. The emergency medical team may prepare to treat a person with asthma, or a blocked airway, only to arrive at the scene and find a patient with anxiety having a panic attack. Urgency is defining characteristic of pre-hospital care. EMTs, AEMTs and paramedics need to assess and care for a patient as quickly as possible. Awareness of unexpected but likely possible diagnoses may help a care provider better anticipate needed treatment. Analysing outcome data from the hospital emergency department where the patient was eventually treated can add insight that EMS agencies could use in performance improvement and education efforts.

## Project Objectives

The objective of this project is to produce a data visualization that will provide insight into the triage and treatment of patients that require emergency care. This visualization will answer questions like “when a person calls in to 911 complaining of a headache, what are possible outcome diagnoses based on previous patient calls?” and “among all of the patients diagnosed with a substance abuse disorder, what were the complaints provided to dispatch? What were the ratios of each complaint?” The visualization will also give a layperson a snapshot of how medical issues are documented across the continuum of care. For example, it will show how 44 dispatch complaints result in thousands of diagnoses in the emergency room. The user will learn whether a complaint generally leads to a single, straightforward diagnosis, or if it’s a symptom with complex etiology.

The web based format is a benefit because it is more accessible to volunteer agencies that may not have facilities, hardware, or software. The visualization will give agencies and hospitals a chance to see the data they provide in a new way and allow them to compare what they have noticed in their own organization and what is happening across the state as a whole.

### Data

The data for this project will come from pre-hospital and emergency department data from 2017. More recent data is not yet available. The UDOH BEMSP has recently started to link pre-hospital data with data from emergency departments in hospitals across the state. The data will not contain any PHI. This will somewhat limit possible filtering and sorting options, but including PHI would complicate access tremendously. There will be three fields: dispatch complaint, EMS provider primary impression, and emergency department discharge diagnosis. There is one row per provider impression/diagnosis combination per incident. The dataset contains approximately 40,000 rows, 44 categories for complaints, 419 types of provider impressions, and 3500 diagnosis codes. Combinatorial explosion will be an issue and may be handled with sorting, filtering, consolidating, and data clean-up. We may also choose complaints or diagnoses that are of particular interest and only include those data points.

### Data Processing

Because the data in 2017 was not validated to the extent that is now, it will need to be cleaned up substantially. There are some missing values, typos, and lack of terminology standardization. There is also some messiness introduced with matching the emergency department dataset with the pre-hospital data set, mostly in the form of not matching a patient incident in both sets. This can be mitigated somewhat with careful data queries. The data will need to be formatted so that it can be easily rendered into our diagrams and charts. Our program will need to do some aggregation. The main quantities to be derived from the data are counts and ratios of complaints for given diagnoses. Data processing will be implemented with a combination of SQL queries, some spreadsheet maneuvering, and javascript.

### Visualization Design

The data could be displayed in a tree and corresponding tree map, as a network diagram, a chord diagram, or a heat map. Some possible solutions include:

* The root node of the circular tree could be a 911 call, with the first level of nodes being the dispatch complaint, the second being the provider impression and the third being ED diagnosis. The tree could expand and collapse nodes. The terminal node could be selectable to provide a filter criterion for another visualization.
* A tree map that can show the ratios of dispatch complaints represented for any given diagnosis or impression selected with a search bar.
* A chord diagram could trace the path from dispatch to EMS to discharge. The different complaints could be highlighted on hover.
* A heat map in the form of a human body could be used to display the frequency of illness and injury to a particular part of the body, with dropdown menus that let the user choose the level of care.

Our ideal visualization will be a network/tree diagram and a heatmap represented as a patient’s body. This will depend on the feasibility of obtaining data on body regions.

### Must-Have Features

This visualization must represent the three types of data, complaint, provider impression, and ED diagnosis and the relationship they have with each other. It should have interactive filtering or sorting in order to make the large amount of data manageable.

### Optional Features

Including appealing design, color and illustration in addition to the actual data would be a bonus. For example, putting the tree map into an image of an ambulance as the back of the truck may add interest and rememberability. Highlighting a path on the tree diagram from start to finish would make it easier to distinguish from the rest of the tree. An indicator of a selected value on a tree node, such as larger text, bold color, or change of the color of the node would help users see the selection better. Color saturation and hue could add emphasis or code for additional features.

### Project Schedule

October 18th - Team Announcement. Ada sets up the repository and turns in the completed form.

October 25 - Ada and Patrice have met to brainstorm. Patrice submits proposal.

November 1 - Patrice acquires data and data is clean, formatted, and ready for use. Ada will lead the structural design of the code. Ada and Patrice have completed the display of the basic layout and form of the project. There is a date scheduled to meet with the TA for the review.

November 8 - Patrice and Ada have met with the TA and worked out any bugs. Tasks are divided up between Ada and Patrice. Milestone one is submitted. Begin designing and publishing website.

November 15 - Interactivity is added to the visualization. The project website is up and running with links to the repository. Begin work on the screen cast, including basic script. Edit and finish the process book.

November 22 - The screencast is filmed and added to the readme file in github.

November 27 - Peer review is completed and project is submitted.

