Questions and tasks:

The questions which needs answering for this assignment is:

1. How the symptoms progressed in each patient? Which occurs the most?
2. What is the frequency of occurrence of symptoms and is there a correlation between symptoms?

The solution to these questions is what we need to find in this assignment.

Initial design by: Grasso, Koepper, Liu, Mercure, and Wu

Tasks/Mapping/Encoding choices:

Change tasks:

1. Show the order of occurrence of symptoms relative to each other and overall relative to recorded brain trauma.
2. Show time difference of the occurrence relative to other encounters in the series.
3. Show recurrences of symptoms.
4. Show encounters which co-occur in multiple patients with similar attributes such as age, gender etc.

Data Abstraction:

1. Each patient record is represented as a row in a table which sequentially records different symptoms occurrence as they occurred in time. This abstraction allows for representation of progression of disease with relative to each while abstracting away the uneven distribution in time of actual encounter.
2. Each symptom is an attribute of the patient which occurred at some point in time recorded relatively via its position in the list of encounters.

Mapping Tasks:

1. Map symptoms encountered by a patient as an ordered list, ordered according to time.
2. Map symptoms occurring on the same day as a nested list.
3. Align list of symptoms of each patients, so that the day of injury in each list is at same place for each patient.

Encoding Tasks:

1. Each patient record is represented as a row in a matrix, sorted based on a choice of attributes available with the patients. That is, patients are recorded on Y-axis of the matrix.
2. Relative time between different symptom is recorded as order of occurrence of the symptom represented along the x axis of matrix.
3. Each symptom is encoded using different hues, mapped to a particular cell in the matrix.
4. Within a patient record, symptoms' actual time difference is recorded as luminance value of the hue. Darker shades represent older encounter records than brighter shades.
5. Each symptom occurring on the same day is stacked vertically within a cell as a sub-cell. This way it is easier to distinguish between symptoms occurring on the same day as they generate a contrast with horizontal ordering of the symptoms' cell.

Validation:

Domain validation:

Domain attributes in EHR dataset does not need a specialized abstraction process as each the dataset is already quite generic. Each symptom, which is an attribute to a patient's record is a categorical item directly used in the visualization. Each patient is a row in a matrix having a condensed representation of symptom occurrence over time.

Data/Task validation:

Data Structure used for this representation is that of a table with a nested structure. The columns in this table represents relative time instead of symptoms as attributes. Each cell then records a list of symptoms which occurred on that particular day. This data structure is directly derived from the original dataset which represents each day as separate row, which one or more symptoms recorded on that day. Since this is a direct derivation, symptom occurrence and temporal data structure is also preserved in the new data set, which is crucial for change task to represent actual picture.

Critical evaluation:

Does the design address change task; how would you modify the task to make it a change task if not?

Current design successfully describe the order of occurrence of encounter's in the patient's history by ordering each encounter in increasing order of time. However it fails to properly encode exact timeline because luminance is only a good encoding to show a relative order and cannot answer questions where exact values are required. We can improve on answering the exact timeline of a patient by providing an option to highlight only selected time range but that is all we can do with this design. Any more information can only be presented if we choose to go into a detail view or choose a different design technique.

Recurrence of different symptoms for a patient is also visible which is answered by same colors repeating themselves within a row.

Co-occurrence of a symptom between different patients is visible when a particular symptom is highlighted, when hovered over the symptoms legend.

how many items can the design show on a 24-inch monitor?

On a 24 inch monitor, This design can easily represents around 300 cells horizontally, and around 100 patients vertically. Above these limits, it's usually hard to differentiate between different encodings. (My own account, Not tested in public)

Does it use overview+detail technique?

No, this Visualization is designed to present just an overview of the dataset. Details are not presented.

Does it show "temporal" changes?

It successfully manages to display the temporal changes by encoding it linearly on horizontal scale and to some extent using luminance of the hue.

Whether or not it introduces clutter by comparing with all other designs? Is the design visually pleasing?

It does not introduce clutter in comparison to other design strategies, this representation is very clean and visually pleasing.

Critical Evaluation of other designs:

Our Group's proposal: Vashistha, Nallamothu, Chaudhari and Athley

This design does address all the change task which are addressed by above solutions using animation. It can address much larger number encounters on a 24 inch screen and even larger temporal range, since the time dimension is encoded as animation and not as length.
However it suffers from clutter when the number of patients increases and does not account for multiple encounters on same day.

Group: Boyer, Justice, Storey, and Sturcke

Boyer et al. group's design choice properly addresses the time range of any symptom for a patient. It can provide much more detailed view of occurrence, co-occurrence and onset and end-time of any symptom, however it cannot address large number of patients as each symptom is represented as single line taking up space.

Group: Campbell, Latt, Chen, and Xie
The design this group used very effective at trend visualization. They used flow lines where the width of the flow represents the quantity of that particular encounter type over all the patient's history, however for this design to properly represent the situation, it need temporal values to be properly aligned in time, which is not the case with available dataset.

Group: Yorick and Abhishek
Their design also exactly follows, Campbell et al. group’s design but only the encoding they used is of cloud lines