**D210 Representation and Reporting**

**Task 1: Dashboard and Storytelling**

Petra I Bier

Western Governors University

D210 Representation and Reporting

May 2, 2024

Dr. Festus Elleh, PhD

**D210 Representation and Reporting**

**Task 1: Dashboard and Storytelling**

**Part I: Dashboard**

A :

Creating a [Tableau dashboard](https://public.tableau.com/views/WGUD210RepresentationandReporting_17165942201570/Re-Admits?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link) started with searching for relevant data to enhance the WGU medical data set. There are various publicly available data sources, and the external data set was downloaded from the UC Irvine Machine Learning Repository [(Strack et al., 2020)](https://archive.ics.uci.edu/dataset/296/diabetes+130-us+hospitals+for+years+1999-2008). The data from both sources was uploaded into a Jupyter Notebook and cleaned using Python. The UCI data set was pared down to relevant data for the executives' question, which concerned examining patient readmission rates and possible causes.

The most pertinent variable in both data sets was whether a patient had been readmitted within 30 days of their last hospital admission. Three visualizations from the WGU medical data and two from the UCI data set were created. As the dashboard was compiled, the filters from each visualization could be used on multiple visualizations. The full explanation of the filters and interactivity of the dashboard will be addressed in section A3. The completed Tableau dashboard can be viewed at:

<https://public.tableau.com/views/WGUD210RepresentationandReporting_17165942201570/Re-Admits?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link>

This first data representation is a map that breaks out the following data by average values for each state: number of Patients, Days in Hospital, Average Daily Charge, and Total Charge for visits. This visualization could be filtered by whether the patient has been readmitted or not, whether the patient has diabetes or not, and by each state.

A map of the united states with a blue state

Description automatically generated A screenshot of a map

Description automatically generated

The second visualization shows the relationship between the average number of hospital days and MD visits, broken down by readmission status. The density of the plot lines references the average daily cost to each group of patients. This visualization can also be directly filtered by whether a patient has diabetes. This visualization can be used as a key performance indicator (KPI) to track patients' number of MD visits.

A graph with a line and a line

Description automatically generated

The third visualization from the WGU data set was the association between the admission category and the number of patents admitted under each. It also shows the number of admissions, the percentage of admissions in that category, the average daily cost to the patient, and the number of admissions in the admit category. Like the other two visualizations, this data could be filtered by the readmission status and the presence of diabetes. This visualization can be used as a KPI, tracking the number of patients admitted under each category.

A screenshot of a graph

Description automatically generated

The UCI data set had several significant differences that must be considered. All the patients in the UCI data have diabetes, as the original data set involved a study on diabetic patients. Within the UCI data, the maximum number of days a patient stayed in the hospital is 14, compared to 72 in the WGU data. Finally, the UCI data set was considerably larger, coming in at over 91,100 rows, compared to 10,000 in the WGU data set.

The first representation of the data from the external data set was a look at the number of hospital days grouped by age. These plot lines were broken down by readmission status, and data could be filtered based on this criterion. It also lets us see the average number of lab procedures performed on each subgroup. This visualization can be used as a KPI to track the number of hospital days for each age group.

A graph with numbers and a line

Description automatically generated

The second visualization of the UCI data was a heat map of the number of patients readmitted status, broken down by age. This part of the dashboard can also be filtered based on the patients' readmission status and responds to all the readmission filters on the dashboard. This visualization can be used as a KPI, tracking the number of readmitted patients for each age group.

A screenshot of a computer

Description automatically generated

A1: Data

The Jupyter notebook containing the UCI and WGU data code for cleaning is attached. The code used to clean these data sets was taken from previous PA projects and modified for the task presented. Both final cleaned data sets have been attached. The external data set from the UC Irvine Machine Learning Repository was available for public use [(Strack et al., 2020)](https://archive.ics.uci.edu/dataset/296/diabetes+130-us+hospitals+for+years+1999-2008).

* PBier\_D210.ipynb
* wgu\_data\_210.csv
* uci\_data\_210.csv

A2: Installation/ Access to Dashboard

The entire dashboard for this project was created using Tableau Public, the free online version of Tableau. The dashboard can be directly accessed through the following link; installation is unnecessary.

<https://public.tableau.com/views/WGUD210RepresentationandReporting_17165942201570/Re-Admits?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link>

If the above link does not work, it may be accessed by:

* Go to the Tableau public website by clicking on the link or pasting the address into the search bar: <https://public.tableau.com/app/discover>
* Click the search icon in the upper right corner –
  + Search “WGU D210 Representation and Reporting Petra Bier”
* Click on the dashboard corresponding with the name Petra Bier

A3: Dashboard Navigation

The dashboard can be navigated in several ways, allowing for personalized views of information that a person may be trying to discover. The first step will be discussing the filtering within each visualization. The second is the filter bar, which will be explained following each KPI explanation.

Data set from WGU:

State Data:

* Hovering over any state will give information on the number of patients, days in the hospital, average daily charge, and the total charge for the visit. A map of the united states with a number of patients in the center

  Description automatically generated
* Directly clicking on a state will filter the other KPIs, giving information solely for that state.

**A map with a blue outline

Description automatically generated**

* A filter bar in the top right corner of the state box allows the user to filter by state name rather than using the state. Multiple states can be chosen to show corresponding filtered data in the other KPIs. After selecting the desired state(s), click Apply at the bottom of the drop-down box.

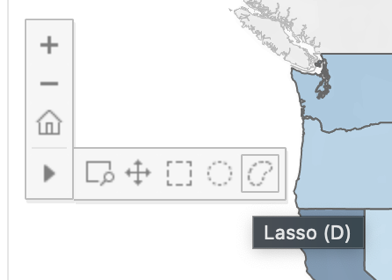
**A screenshot of a computer survey

Description automatically generated A screenshot of a computer

Description automatically generated**



* Multiple states can also be chosen using the Lasso tool, which can be found on the left side of the state box in the toolbox.

** A map of the state of washington

Description automatically generated**



* The toolbox can also be used to move the view of the United States around and for zooming in or out.

**A screenshot of a computer

Description automatically generated A map of the state of alaska

Description automatically generated**



* The filters can be reset anytime by clicking the un-filter icon above the filter itself, hitting the “Esc” key on the upper L-hand corner of the keyboard, or using the reset view button in the bottom right corner of the dashboard.

A grey square with red x in it

Description automatically generated A screenshot of a computer

Description automatically generated

Admission Level:

* Hovering over each admission level shows the number of admissions, the percentage of admissions in that category overall, and the average daily cost to the patient.

A screenshot of a graph

Description automatically generated

* Clicking on an individual category acts as a filter for the other KPIs, and the changes can be visualized directly or by hovering over a point of interest to see the new results.

A screenshot of a computer screen

Description automatically generated

Number of MD Visits:

* Data can be seen by hovering the mouse over the plot line. The information displayed at each point on the lines includes the average number of MD visits, if the patient was readmitted, the average number of days in the hospital, and the average daily cost to the patient.

A graph showing a number of visits

Description automatically generated

* Clicking directly on a plot line will make the readmission status a filter for the rest of the dashboard, allowing the user to filter by the number of MD visits and the readmission status.
* The bottom of the KPI has a filter based on the number of days spent in the hospital. The slider can be moved to increase or decrease the range of days a person would like to focus. As with the other filters, it will filter across the entire dashboard and can be reset with the un-filter button.

A graph of a number of days

Description automatically generated`



Data set from UCI

Lab Procedures :

* Like the MD visits line graph, information can be found by hovering over the line. The information shown includes the patients’ age group, readmission status, the average number of labs per day for the age group, and the average number of days of admission.

A graph with numbers and a line

Description automatically generated

* Clicking on a plot line will filter the readmission status for the rest of the dashboard.

Readmissions by age:

* This heat map shows the number of readmissions based on age groups. Hovering over a cell reveals information on the age group, readmission status, the number of readmissions for that grouping, and the percentage of the readmission group.

A screenshot of a computer

Description automatically generated

* Clicking on any cell will act as a filter for readmission status for the rest of the dashboard.

Filter bar:

* Two quick filters on the far-right side of the dashboard allow the user to view only the selected data. Instructions are available above the filters.
* Click the desired information and then click "Apply."

A screenshot of a white screen

Description automatically generated A screenshot of a medical survey

Description automatically generated

* Remove filters by clicking the un-filter button above each filter or the reset view button in the bottom right corner of the dashboard.

**Part II Storytelling**

B: Panopto video link:

<https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=ef30a4fd-5f69-4016-8bef-b17f003b96a9>

Tableau presentation link: This is a supplement to follow along with the video, it is not the full presentation. A PDF is also attached to the PA as a supplement for individuals to follow along with.

<https://public.tableau.com/shared/43XKJK8Q8?:display_count=n&:origin=viz_share_link>

The presentation used an image (CIF, n.d.) and a reference to best practices in diabetic care (Dhatariya et al., 2020), which have been cited here to give appropriate credit to the original authors.

**Part III Reflection**

C :

C1: Dashboard

The request given in the data dictionary was to see how much of a problem readmission is within the WGU hospitals. The data from WGU was explored, and it was discovered that the readmission rate of all hospital stays was approximately 37%, with these admissions having the most extended hospital stays.

The dashboard looks at several possible contributing factors to the high readmission rate, such as admit level, diabetes, the number of MD visits during the stay, age group, and number of labs performed. These views allow a person to investigate further using the filters to determine possible correlations between factors.

This dashboard also allows a view of the cost to patients and the cost burden that a patient may have after leaving the hospital. While unrelated to readmission causes, it aligns with the Institute for Healthcare Improvement's (IHI) Triple Aim, which focuses on improving population health and patient experience and reducing per-capita costs (Stiefel & Nolan, 2012). The concept is to know where the WGU hospital system is and to retain a view of the different factors to align with the overall patient care goals.

C2: Data Set

The outside data set from UCI also examined hospital stay length, and the readmission rates of known diabetics were used to help identify if there were similar trends within the data sets. This data was a good fit with the WGU data, which has data on many comorbidities, including diabetes, allowing for filtering the WGU data to align more readily with the outside data.

This data set also contained data on length of stay that could be compared to readmissions. The number of labs performed on patients could also be analyzed to see if there were any patterns within the diabetic population. One disadvantage of this data set is that the maximum number of days is 14 compared to 72 for the WGU hospitals.

C3: Representations for Decision-Making

A visualization illustrating the association between the admission category and the number of patents admitted was created. It shows the number of admissions, the percentage of admissions in that category, the average daily cost to the patient, and the number of admissions in the admit category. The readmission status and the presence of diabetes can filter this data. This chart can be used as a KPI to track the number of patients admitted under each category. The KPI allows Executives to determine where the focus of improvement projects should take place while also allowing them to see if any changes have occurred with implementation.

A screenshot of a data

Description automatically generated

The second visualization, which can be used as a key performance indicator (KPI) to track patients' MD visits, shows the relationship between the average number of hospital days and MD visits, broken down by readmission status. The density of the plot lines references the average daily cost to each group of patients. Since this visualization can filtered by whether a patient has diabetes, it also allows for tracking the admitted patients' disease burden.

A graph with a line and a line

Description automatically generated with medium confidence

A visualization of the external UCI data was a heat map of the number of patients readmitted status, broken down by age. This visualization can be used as a KPI, tracking the number of readmitted patients for each age group.

A screenshot of a graph

Description automatically generated

Another representation from the external data set looks at the number of hospital days grouped by age. This visualization can be used as a KPI to track the number of hospital days for each age group. The plot lines show readmission status, and the data can be filtered based on this criterion. The graph also shows the average number of lab procedures performed on each subgroup, allowing for tracking the number of labs performed for each age group.

A graph with numbers and lines

Description automatically generated

C4: Interactive Controls

The dashboard has several interactive controls, allowing users to filter data and drill down on specific questions. These include a simple quick filter, a slider bar, and the ability to filter by state.

The quick filters are located on the right side of the dashboard and allow the user to choose the information they want to focus on. These filters can be used individually, in tandem with each other, or with the other dashboard controls.

A screenshot of a medical survey

Description automatically generated

The slide bar is located underneath the MD visits KPI and allows users to filter by the number of days a patient was admitted to the hospital. Like the quick filters, it can be used alongside the other filters and interactive controls on the dashboard.

A graph of a number of days

Description automatically generated



The state map also acts as a filter, either by clicking on the state directly or using the drop-down box located at the top of the state map. The user can pick either a single state or multiple states using the lasso tool or the drop-down filter box.

**A map with a blue outline

Description automatically generated** A screenshot of a computer survey

Description automatically generated A screenshot of a computer

Description automatically generated

**A map of the united states

Description automatically generated** **A map of the state of washington

Description automatically generated**



C5: Colorblind Accessibility

While building the dashboard, a color palette was chosen to allow individuals with color blindness to see and interact with it. Individuals with color blindness easily interpret blue and shades of blue, and orange avoids problems for those who cannot see reds (Schaffer, 2024). Blue was chosen as the primary color, and orange was chosen to highlight the readmissions, as this was the main point to be investigated in the analysis (Knaflic, 2015, p. 117). The specific blue and orange were chosen from the colorblind palate offered within Tableau.

C6: Data Representations

The data presentation had several visualizations to accentuate data insights. A bar chart was made to show the rate of readmissions within the WGU hospital system, which was 37% of all hospital stays. It included the average length of stays for a patient and was meant to highlight the high number of readmissions.

A screenshot of a computer

Description automatically generated

Although equal, the central idea that the MD visits created a disparity in the level of care a patient may receive was shown using a graph comparing the two groups' (readmission vs. non-readmissions) length of stay and the number of MD visits received. This graphic can also be found on the interactive dashboard.

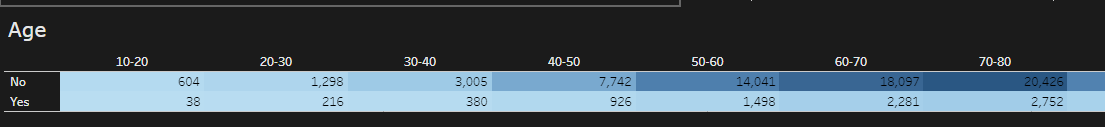
A graph on a black background

Description automatically generated

A visualization illustrating the percentage of diabetics in the patient population was created. This visualization can be used in conjunction with a heat map created using the UCI data set, which breaks down diabetic patient readmissions by age. The heat map is also included on the dashboard.

A graph of blue and black

Description automatically generated



C7: Audience

When sharing the results of an analysis, it can be easy to give all the information to everyone involved. However, the message may become muddied if the results are not aimed at a target audience.

This analysis was created with two executives in mind – the Senior Vice President (SVP) and the Vice President of Research (VP). The SVP has a broad view of all the hospitals within the WGU hospital system and is interested in information that can be broken down by region. With this in mind, the dashboard included viewing information at state levels. It included such information as the number of patients, the number of readmissions, and the ranking of readmissions by state. Information on average daily charges to patients and the total cost of hospital stays was filtered by state, readmission status, and diabetes.

The presentation was also specifically designed for the new VP. This executive is interested in improving patient outcomes, which can be affected by MD visits and the number of lab procedures performed. The VP can further filter information based on patient diabetes status.

C8: Universal Access

In addition to designing the dashboard and presentation for people with color blindness, care was also taken to ensure that people with other disabilities could access and understand the information presented. General best practice guidelines were followed based on the Web Content Accessibility Guidelines 2.1 (WCAG 2.1) of Perceivable, Operable, Understandable, and Robust (W3C, 2023).

The alternative text available for web readers was updated for each visualization using an easier-to-understand language than the standard default created by Tableau.

A screenshot of a computer screen

Description automatically generated

Care was taken to have informative titles for each visualization. Instructions were added to the filter bar. The Veranda font was used for all text, as this is easier for people with dyslexia to read (Flohr & Ilyas, 2024).

The primary colors used in the presentation were also checked for cultural meaning, specifically for Native Americans, as this author lives in an area with many people identifying as Native Americans (Census Bureau, 2023). Blue is similar in its meaning of cold for both Native Americans and Western Cultures (Allison, 2023).

C9: Effective Story Telling – 2 elements -

The presentation conveyed an important data discovery made during the analysis. The point was that although average MD visits appeared equal, there needed to be equity since patients with more extended stays and higher admissions rates often had long periods between seeing an MD. This discovery was expressed through several storytelling elements. The presentation was done with the dramatic element being the high readmission rate, also called the "hook" (Dykes, 2019, pg. 143).

Further insights were shown in a linear manner, with the central idea then being revealed. The final part of the presentation gave insight into possible actions that could be taken from the data. Throughout the presentation, visualizations were used to keep the audience engaged and emphasize data findings. Each page of the story was purposefully kept simple, and clutter was minimized to focus on the single point on each page (Tang, 2022).

D: Web Sources

Allen, J., MD (2023, January 4). *Understanding The 2023 Medicare Hospital Readmission Penalty*. Hospital Medical Director. Retrieved February 29, 2024, from <https://hospitalmedicaldirector.com/understanding-the-2023-medicare-hospital-readmission-penalty/>

Allison, R. (2017, June 29). Colors represent different things in different cultures. SAS Learning Post. Retrieved May 15, 2024, from <https://blogs.sas.com/content/sastraining/2017/06/29/colors-in-different-cultures/>

Copenhagen Institute for Future Studies (n.d.). *Equality vs Equity in Healthcare: Both Are Important*. CIFS Health. Retrieved May 15, 2024, from <https://cifs.health/backgrounds/equality-and-equity-in-healthcare/>

Dhatariya K, Corsino L, Umpierrez GE. Management of Diabetes and Hyperglycemia in Hospitalized Patients. [Updated 2020 Dec 30]. In: Feingold KR, Anawalt B, Blackman MR, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK279093/>

Flohr, Y., & Ilyas, H. (2024). The Best Fonts for Dyslexia (Guidelines for Website Owners). Accessibility Checker. Retrieved May 15, 2024, from <https://www.accessibilitychecker.org/blog/best-fonts-for-dyslexia/>

Strack, B., DeShazo, J. P., Gennings, C., Olmo, J. L., Ventura, S., Cios, K. J., & Clore, J. N. (2014, May 2). *Diabetes 130-US Hospitals for Years 1999-2008*. Retrieved May 15, 2024, from <https://archive.ics.uci.edu/dataset/296/diabetes+130-us+hospitals+for+years+1999-2008>

<https://doi.org/10.24432/C5230J>.

Tang, T. (2022, January 31). *Seven Tricks for Better Data Storytelling: Part II*. DataCamp Blog. Retrieved May 15, 2024, from <https://www.datacamp.com/blog/seven-tricks-for-better-data-storytelling-part-ii>

United States Census Bureau (2023, January 7). QuickFacts: San Juan County, New Mexico. United States Census Bureau Quick Facts. Retrieved May 15, 2024, from <https://www.census.gov/quickfacts/fact/table/sanjuancountynewmexico/PST045223>

World Wide Web Consortium (2023, June 23). Introduction to Understanding WCAG. W3C. Retrieved May 15, 2024, from <https://www.w3.org/WAI/WCAG21/Understanding/intro#understanding-the-four-principles-of-accessibility>

I: Sources

Anscombe, F. J. (1973). Graphs in Statistical Analysis. The American Statistician, 27(1), 17–21. <https://doi.org/10.2307/2682899>

Dhatariya K, Corsino L, Umpierrez GE. Management of Diabetes and Hyperglycemia in Hospitalized Patients. [Updated 2020 Dec 30]. In: Feingold KR, Anawalt B, Blackman MR, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK279093/>

Dykes, Brent. *Effective Data Storytelling : How to Drive Change with Data, Narrative and Visuals*, John Wiley & Sons, Incorporated, 2019.*ProQuest Ebook Central*, <https://ebookcentral.proquest.com/lib/westerngovernors-ebooks/detail.action?docID=5993965>.

Knaflic, C. N. (2015). Story Telling with Data (1st ed., p. 117). Wiley.

Stiefel, M., & Nolan, K. (n.d.). A Guide to Measuring the Triple Aim: Population Health, Experience of Care, and Per Capita Cost. IHI Innovation Series White Paper. Retrieved May 15, 2024, from <https://www.ihi.org/resources/white-papers/guide-measuring-triple-aim-population-health-experience-care-per-capita-cost#downloads>

References

Allen, J., MD (2023, January 4). *Understanding The 2023 Medicare Hospital Readmission Penalty*. Hospital Medical Director. Retrieved February 29, 2024, from <https://hospitalmedicaldirector.com/understanding-the-2023-medicare-hospital-readmission-penalty/>

Allison, R. (2017, June 29). Colors represent different things, in different cultures. SAS Learning Post. Retrieved May 15, 2024, from <https://blogs.sas.com/content/sastraining/2017/06/29/colors-in-different-cultures/>

Copenhagen Institute for Future Studies (n.d.). *Equality vs Equity in Healthcare: Both Are Important*. CIFS Health. Retrieved May 15, 2024, from <https://cifs.health/backgrounds/equality-and-equity-in-healthcare/>

Dykes, Brent. *Effective Data Storytelling : How to Drive Change with Data, Narrative and Visuals*, John Wiley & Sons, Incorporated, 2019.*ProQuest Ebook Central*, <https://ebookcentral.proquest.com/lib/westerngovernors-ebooks/detail.action?docID=5993965>.

Flohr, Y., & Ilyas, H. (2024). The Best Fonts for Dyslexia (Guidelines for Website Owners). Accessibility Checker. Retrieved May 15, 2024, from <https://www.accessibilitychecker.org/blog/best-fonts-for-dyslexia/>

Knaflic, C. N. (2015). Story Telling with Data (1st ed., p. 117). Wiley.

Strack, B., DeShazo, J. P., Gennings, C., Olmo, J. L., Ventura, S., Cios, K. J., & Clore, J. N. (2014, May 2). *Diabetes 130-US Hospitals for Years 1999-2008*. Retrieved May 15, 2024, from <https://archive.ics.uci.edu/dataset/296/diabetes+130-us+hospitals+for+years+1999-2008>

[**https://doi.org/10.24432/C5230J**](https://doi.org/10.24432/C5230J)**.**

Tang, T. (2022, January 31). *Seven Tricks for Better Data Storytelling: Part II*. DataCamp Blog. Retrieved May 15, 2024, from <https://www.datacamp.com/blog/seven-tricks-for-better-data-storytelling-part-ii>

United States Census Bureau (2023, January 7). QuickFacts: San Juan County, New Mexico. United States Census Bureau Quick Facts. Retrieved May 15, 2024, from <https://www.census.gov/quickfacts/fact/table/sanjuancountynewmexico/PST045223>

World Wide Web Consortium (2023, June 23). Introduction to Understanding WCAG. W3C. Retrieved May 15, 2024, from <https://www.w3.org/WAI/WCAG21/Understanding/intro#understanding-the-four-principles-of-accessibility>