Data Visualization: Final Project
Visual Health and Socioeconomic Factors in the United States
Tableau Dashboard

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Abstract

This paper summarizes the implementation and design of an interactive dashboard that examines the relationship between visual health and socioeconomic factors in the United States. The dashboard aims to provide users with insights into blindness and low vision (BLV) rates, focusing on geographic distribution, and factors such as obesity, diabetes, and poverty. By leveraging data from various sources and utilizing Python libraries for data processing and Tableau for visualization, the dashboard provides an informative exploration of visual health in the nation.

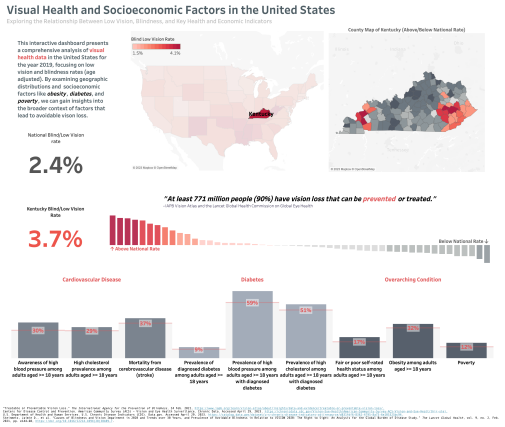

Figure 1. Visual Health Dashboard

1. Introduction

Visual health is an essential aspect of overall well-being for individuals and communities. In the United States, the prevalence of low vision and blindness remains a significant public health concern [1]. Previous research has suggested that various socioeconomic indicators, such as obesity [6], diabetes [4] [7], poverty [8], may be related to the incidence of visual impairment and blindness. Research shows that with a growing elderly population projected, detection and treatment of avoidable vision loss is needed [5, 9].

Building on these findings, this interactive dashboard combines visual health data with these socioeconomic indicators to offer a comprehensive view of the relationship between low vision, blindness, and key health and economic factors.

The Centers for Disease Control (CDC) has developed a dashboard [2] that focuses on visual acuity indicators for different age groups, genders, and races. It provides a simple and accessible way to visualize data on prevalence, confidence intervals, and counts. The data is presented in map, chart, and table views with options to download. The dashboard uses VEHSS Composite Estimates, which combine data from multiple sources to create comprehensive estimates of vision impairment prevalence. However, the CDC dashboard does not incorporate factors that are correlated with vision impairment, such as obesity, diabetes, and poverty.

The Vision Atlas dashboard, titled ”Causes of Vision Loss,” [10] focuses on providing estimates of the number of people affected by vision loss categorized by age, gender, and severity of the condition. It displays data in the form of charts, which are divided into moderate to severe vision loss and blindness. While the charts provide valuable insights into the distribution of vision loss by age and gender, the dashboard does not offer any information about the geographic distribution of these conditions.

2. Demonstration

The visual health dashboard is meant to bring together many health indicators, offering a centralized view of various aspects of visual health and disease outcomes. Its purpose is to provide a user-friendly and easily accessible platform for exploring a wide range of information related to visual health, promoting greater awareness and understand-

ing of the topic. The dashboard is designed to be intuitive, enabling individuals to seamlessly navigate through the different components.

Dashboard Components

- **Dashboard Summary** Information on the goal of the dashboard
- **National Map** States rate of blind/low vision
- **State County Map** Choropleth map of standardized rate above or below the national blind/low vision rate
- **State Rate Big Number** Dynamically colored rate of blind/low vision for the selected state
- **State Rant Rank Chart** Per state, ordered standardized rate above or below the national blind/low vision rate
- **Socio-Economic Comparisons** Bar charts with state rates per indicator with the national rate overlaid

Dashboard Interactivity

1. If a user hovers over a state, a tool tip will appear with BLV metrics and the state will be highlighted on the state rank chart.
2. If a user clicks on the national map state or on the state rank chart, a filter connection exists to all other components of the dashboard. The big number for state rate will change colors to match the color for it's value on the state rank chart. Further, upon click of the state, the county map will reposition to render the standardized BLV rates and the title updates accordingly. At the bottom of the dashboard the disease and socio-economic indicator charts will update to represent the state level statistics overlaid with the national statistic.
3. If a user hovers over the county map polygons, a tool tip will appear with the county name, BLV rate and standardized BLV rate.

3. Implementation Details

Scoping Prior to creating the dashboard, a proposal was submitted, detailing the project's background, data sources, and a mockup of the anticipated dashboard. The initial plan was to incorporate a temporal aspect, but it was later discovered that the available data only covered a limited number of years (2014-2019), rendering this addition irrelevant. As a result, the project was re-evaluated, and the dashboard was redesigned to better suit the available data. Additionally, the use of hexagon shapes for the states proved to be difficult, as was implementing a correlation plot in Tableau.

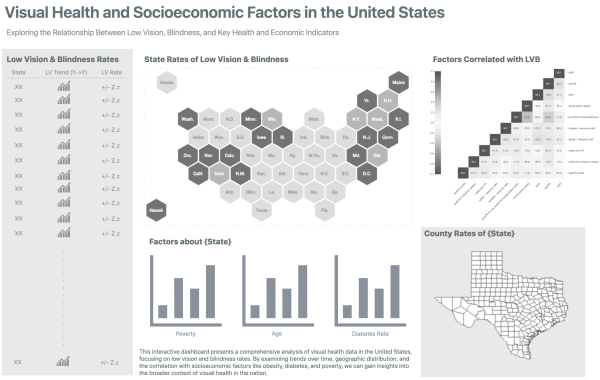

Figure 2. Original Mock up of Visual Health Dashboard

Data Sources The data used in the dashboard is from the year 2019 and comes from a de-identified summary table of vision and eye health indicators from the American Community Survey (ACS) [3]. The ACS is an annual nationwide survey conducted by the U.S. Census Bureau that collects demographic, social, economic, and housing data from the U.S. population. The VEHSS ACS dataset includes one question related to Visual Function and is stratified by age group, race/ethnicity, gender, and state.

The CDC's Division of Population Health has developed a set of 124 indicators that cover a wide range of health outcomes across different demographics [11]. Health indicators include questions on cardiovascular disease, poverty, obesity, among many others.

Data Prep The data from multiple sources were extracted and cleaned using pandas dataframes to extract only the relevant information. The datasets were then merged and combined with a geodataframe containing the polygonal boundaries for states and counties.

Once the shapefiles were exported, they were imported into Tableau where a dashboard was created, featuring a cohesive user interface. This was accomplished through the use of Tableau actions and dynamic calculated fields for table titles. Color schemes were carefully chosen, with a sequential color ramp used for the national map and a divergent color ramp from gray to red used for the standardized rate county map and rank bar chart. Bar plots were used to compare the state rates to the national rates per indicator group.

4. Design Choices

Rational Color This dashboard prioritizes accessibility, featuring color blind friendly design, high contrast, bold fonts, and large text size for low-vision users. Unfavorable data is highlighted in red, while mild conditions are repre-

sented by a calming gray.

Thoughtful Text There are dynamic titles that update based on state filters, allowing users to follow the updates. Additionally, a summary is provided to give context and purpose to the data visualizations, ensuring that users can effectively understand and utilize the information presented. To highlight the significance of the topic, a quote is also included, emphasizing the importance of this issue to public health.

Limited Chart Junk The dashboard is designed with a focus on clarity, minimizing unnecessary visual clutter and enabling users to focus on the most important information. For example, the horizontal chart uses simple, effective color coding to demonstrate above and below, while text with arrows provides clear explanations of the sort and color codes. Additionally, the horizontal bar chart features interactive labels, while the rank bar chart is color-coded for intuitive visual connections. This ensures that users can easily understand and explore the data presented, without distraction or confusion.

Quick Comparisons The bar-in-bar charts allow for a rapid comparison of both disease and socioeconomic indicators, providing an easy way to determine how each state compares to the national average. This allows for quick comprehension of the data and highlights areas where action may be needed. Additionally, the dashboard employs a consistent color scheme across all visualizations, further enhancing comprehension and reducing the time required to understand the data.

5. Conclusion

The dashboard allows users to dive into other health status variables by utilizing interactive visualizations such as bar-in-bar charts, horizontal bar charts with color coding and text explanations, and consistent color choices throughout the dashboard. This makes it easy for users to quickly understand the data and identify areas where action may be needed, leading to further exploration of the data.

One potential improvement to the dashboard could be to incorporate more interactive features, such as hover-over text, clickable filters by year, and pop-up information boxes. This would enhance the user experience and enable users to more easily navigate the data presented.

To make the dashboard more robust, it could be helpful to include additional demographic data such as age, race, and gender, as well as data on healthcare access and utilization. This would allow for a more comprehensive view of the factors impacting health outcomes and would provide a more complete picture. Additionally, incorporating more granular data at the county or city level could help to identify specific areas where intervention may be needed.

References

[1] Siantaret al. Impact of Visual Impairment and Eye diseases on Mortality: the Singapore Malay Eye Study (SiMES). *Scientific Reports*, 5(1):16304, 2015. 1

[2] Centers for Disease Control and Prevention. Vision and eye health surveillance system (vehss). Online dashboard, 2022. 1

[3] Centers for Disease Control and Prevention. American community survey (acs) – vision and eye health surveillance. chronic data. https://chronicdata.cdc.gov/Vision-Eye-Health/American-Community-Survey-ACS-Vision-and-Eye-Healt/thir-stei, accessed 2023. 2

[4] El-Bab et al. Retinopathy and risk factors in diabetic patients from al-madinah al-munawarah in the kingdom of saudi arabia. *Clinical Ophthalmology*, 6:269–276, 2012. 1

[5] Foreman et al. Future burden of vision loss in australia: Projections from the national eye health survey., 2020. 1

[6] Klein et al. Is obesity related to microvascular and macrovascular complications in diabetes? the wisconsin epidemiologic study of diabetic retinopathy. *Archives of Internal Medicine*, 156(9):989–997, 1996. 1

[7] Zhang et al. Prevalence of diabetic retinopathy in the united states, 2005-2008. *JAMA*, 304(6):649–656, 2010. 1

[8] Zhang et al. Socioeconomic disparity in use of eye care services among us adults with age-related eye diseases: National health interview survey, 2002 and 2008. *JAMA Ophthalmology*, 128(5):571–578, 2010. 1

[9] Jaimie D. Steinmetz, Rupert R.A. Bourne, Jost B. Jonas, Hugh R. Taylor, Jill Keeffe, Janet Leasher, Kovin Naidoo, Konrad Pesudovs, Richard A. White, and Tien Y. Wong. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to vision 2020: The right to sight: An analysis for the global burden of disease study. *The Lancet Global Health*, 9(2):e144–e160, 2021. 1

[10] Jaimie et al. Steinmetz. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. *The Lancet Global Health*, 9(2):e144–e160, Feb. 2021. Publisher: Elsevier. 1

[11] U.S. Department of Health and Human Services. U.s. chronic disease indicators (cdi). https://catalog.data.gov/dataset/u-s-chronic-disease-indicators-cdi/resource/d831fdf6-8362-4795-8a75-6e105325bc94, accessed 2023. 2