Data Insights and Visualization Application for Costs and Comorbidities Associated with Obesity

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Problem Statement and Objective

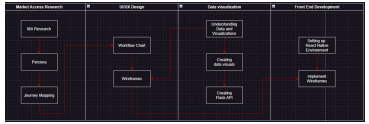
- To optimize healthcare decisions and develop comprehensive care plans to improve health outcomes for obese patients, Novo Nordisk has a need for an application that displays data associated with obesity health outcomes
- The application aims to display quantitative insights into the impact of obesity and SDoH on their patients' population from a health and cost perspective

Application Features

- Our application consists of the following features:
  - **Login page**: Verify the user's identity and grant them access to the system
  - **State-level insights page**: Allow user to select a state and a comorbidity, then display selected insights using visually understandable and appealing data visualizations of the selected state
  - **National insights page**: Allow user to select a state and a comorbidity, and display national-level insights through visually appealing data visualizations of the nation's data

Market Access Research, Persona Creation, and Journey Mapping

- We performed Market Access Research to build an understanding of Novo Nordisk's internal stakeholders that our app will be serving
- Journey mapping involved putting ourselves in the shoes of our stakeholders



Workflow diagram

Stakeholder Persona 1

Journey Mapping

UI/UX Design

- After understanding the precise needs of our stakeholders, we utilized Figma to create wireframes for the iOS app.
- We iteratively refined the wireframes based on feedback from internal stakeholders, and specifically surrounding ease of the query feature

Client-Side: React Native Development

- Used React Native in XCode environment. Expo is used for building cross-platform mobile apps
- Users will be Obesity Regional Account Managers, using the app on an iPad horizontally
- Users can make queries using a dropdown to select a "state" and a "comorbidity"
- When queried, the app displays graphs for SDoH values and cost values. For Texas and Mississippi, the app displays Novo Nordisk's ML prediction results and accuracy as well

Bridging Front End and Back End: API Development

- We used Flask REST API for frontend (React Native) and backend (Python) to communicate
- REST API for scalability and industry standard
- Both API's have a request body of a JSON object that indicates the "state" and "comorbidity".
- The API request will return a HTML element from the Python environment and return a JSONified HTML element to the React Native environment to render and display

```
@app.route('/generate-plot-sdoh', methods=['POST'])
def generate_plot_sdoh_api():
    try:
        # Get the request data from the request body as a dictionary (json)
        data = request.json
        state = data.get('state')

        # Call the generate_plot_sdoh function
        response = generate_plot_sdoh(state)

        return(response)

    except Exception as e:
        return jsonify({'error': str(e)}), 500
```

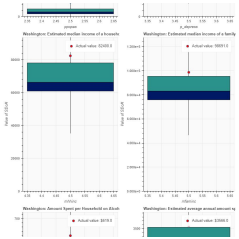
At left: API designed to plot SDoH data and send the result back to the frontend.

```
{
  "state": "Washington",
  "comorbidity": "Hypertension"
}
```

At left: Sample request body sent from frontend to backend

Back End: Python Development for Data Visualization

- Used Python in conjunction with libraries such as Bokeh, Pandas, and Numpy
- Display data based on the user's request of "state" and "comorbidity" or "SDoH"
  - **Example**: State = Washington, Comorbidity = Hypertension



SDoH graphs: Displays the SDoH information with boxplot, with red circle indicating the specific state's SDOH value

PATIENTS	Cost to Commerical Payer	Cost to Health Insurance Exchange
11787	3681721.03	17881.11
Cost to MANAGED MEDICAID	**Cost to FFS MEDICAID**	**Cost to Medicare**
15591.38	7263.04	109013.86

Cost display: Displays the related costs with a bar graph/in a table format based on the given state and comorbidity

Future Work, References, and Acknowledgments

- Implement a select/zoom option for users to have more utility while viewing the graphs
- Creating a user profile screen that display their user information and system updates
  - Allow the user to update personal information
- Have system update/upload new data
- Allow users to export current displayed data to PDF

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