Project Proposal

Aijing Gao, Shiyi Qin, Baiyan Ren, Yi Wang, and Haojie Yu

sqin42@gatech.edu

1 PROBLEM

Among the various contributors to the mortality rate, obesity-related diseases appear on top of the list, including circulatory diseases, cancers, and Type-2 diabetes [1-2]. Currently, the US health system focuses a lot of its resources on treating obesity-related diseases, but there is a lack of preventative measures. Given the abundant data availability from Fast Healthcare Interoperability Resources (FHIR), we see the opportunity to improve the monitoring and prevention of obesity, which may help health providers act early and reduce obesity rates. We also summarized a complete list of the topics we are interested in below. We will work as a team of five on this mentoring project under the supervision of Raj Vansia.

Priority	Project Topic	Description
1*	**Obesity Management Tool**	**Web app. for population health obesity monitoring using FHIR**
2	Connected Patient Experience	Web app. for better patient connection with providers as well as easy accessibility and understanding of data
3	COVID-19 Contact Tracing	App. for COVID-19 contact tracing by broadcasting communication to associated contacts
4	Wound Care Tracking App	Web app. for tracking the healing process of foot ulcers by computer vision
5	Early diagnosis of higher-order ASD	Model that aids early diagnosis of ASD based on the existing patient data, their behavioral patterns, and diagnostic patterns
6	Mental Health Management	Web app. to track and manage mental health for patients who do not have the ability to go to a facility
7	High Blood Pressure Tracker App	Web app. to track blood pressure as well as activities to assist in lowering blood pressure
8	Pillbox	Web app. to remind patients to take medicines
9	Interoperability in HIT	Create two mock systems and leverage an interoperability engine such as FHIR to expose mock data to each respective system.
10	Health Insurance Plans against Medicare	Benchmark a "cost-effectiveness" statistic model to quantitatively measure US health insurance plans measured against Medicare

2 AREA OF FOCUS

The focus area of our project is one of the significant health problems – obesity.

3 BACKGROUND AND SIGNIFICANCE

Rising obesity in the US is a serious and costly public health crisis. According to CDC, more than 1/3 of adults were obese in 2017-2018. Over the last decade, US obesity prevalence increased from 30.5% to 42.4%. Severe obesity has also risen from 4.7% to 9.2%. Medical cost for obese people was $1,429 higher than medical costs for healthy weight [3]. Obesity significantly increases the risk of coronary heart disease, type 2 diabetes and certain types of cancer, which are the leading causes of preventable and premature death. Recent studies [4-5] show that supplementing population health management with primary care is associated with improved outcomes for patients with obesity.

4 PROPOSED SOLUTION OR IDEA

We will develop a web application that serves as a tool for clinicians to monitor the obesity levels for their patient population, which are further stratified by key demographics and socioeconomic characteristics for identifying health disparities. The solution/project consists of three parts:

4.1 Data wrangling

We will acquire the FHIR bulk data through SMART/HL7 FHIR Bulk Data Access API [6] and 1upHealth APIs [7]. Several metrics are available to assess obesity: (1) Adult BMI Assessment (ABA) (2) Weight Assessment and Counseling for Nutrition and Physical Activity for Children/Adolescents (WCC) (3) Combining BMI with waist circumference (WC) (4) body fat percentage.

4.2 Statistical analysis and machine learning

Using BMI as an example, we will use the distribution of BMI, obesity rates, median/mean of BMI, and percentile of BMI to assess the level of obesity in specific regions. Those metrics will be further stratified by key demographics and geographic characteristics. We will visualize the historical trends on these statistics and apply SARIMAX to forecast future trends of obesity levels [8].

4.3 Building the web application and deployment

We will deliver the statistical analysis to the interactive web application. It will be a portal for clinicians to monitor the obesity levels for their patient population. Python or Java will support the backend service while we plan to adopt Angular or React for the front-end. HTML and JavaScript could implement some components of the web application. We will deploy the web application through Heroku or GitHub Pages. Clinicians will navigate web

pages with different topics covered in the web application. On the page showing obesity level visualization, clinicians can select the county/zip-code served by specific clinics and visualize BMI distribution in the patient population. We will also incorporate the batch prediction output of future obesity trends into the web application.

5 COMPLEXITY OR EFFORT

As pointed out in the problem statement, obesity-related diseases have been a major contributing factor to the life expectancy rate below average OECD countries. The web application aims to provide tools for people to monitor weight and provide resources for them to increase physical activity, promote dietary quality, and prevent obesity. We use CDC Nutrition, Physical Activity and Obesity – Legislation [9] as guidelines. State legislation and regulations on nutrition, physical activity, and obesity serve as policy resources to follow when developing the application.

Due to the web application hosting a collection of personal weight, health, and clinic data, we plan to implement user role features and apply data access permission levels. All the customer data is protected against unauthorized access. The application aims to improve the lives of those with obesity and is intended for individual use. Therefore, the application does not provide aggregate statics about customers to any companies or third-party vendors. In addition, protecting the privacy of the young is especially important. We comply with the 1998 Children's Online Privacy Protection Act (COPPA) [10].

6 TENTATIVE TEAM MEMBERS & ROLES

Name	Background	Roles
Aijing Gao	Healthcare data analytics, machine learning (ML)	Point of contact, Web development
Shiyi Qin	Chemistry, ML	EDA, ML, data visualization
Baiyan Ren	Biological research experience, data science, ML	EDA, ML, data visualization
Yi Wang	Web application development	Backend service, testing, data collection
Haojie Yu	Software Engineer	Web development and backend service

7 RISK PLAN

If a team member cannot contribute to the project for unforeseen reasons, we will initiate a meeting for task redistribution. Based on the expertise of the remaining team members, we may reassess and revise the project's scope. For each skill set that we will utilize in this project, our current team constitution has guaranteed at least one backup member who has relevant experience.

8 REFERENCES

1. Expert Panel on the Identification, Treatment of Overweight, Obesity in Adults (US), National Heart, Lung, Blood Institute, National Institute of Diabetes, and Kidney Diseases (US). (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report* (No. 98). National Institutes of Health, National Heart, Lung, and Blood Institute.

2. Indicators, O. E. C. D. (2019). Health at a glance 2019: OECD indicators.

3. CDC. (2021, November 12). Obesity is a Common, Serious, and Costly Disease. Centers for Disease Control and Prevention. https://www.cdc.gov/obesity/data/adult.html

4. Baer HJ, De La Cruz BA, Rozenblum R, Nolido NV, Orav EJ, Metzler K, Block JP, Halperin F, McManus KD, Aronne LJ, Minero G, Bates DW. Integrating an online weight management program with population health management in primary care: Design, methods, and baseline data from the PROPS randomized controlled trial (Partnerships for Reducing Overweight and Obesity with Patient-centered Strategies). Contemp Clin Trials. 2020 Aug;95:106026

5. Baer HJ, Rozenblum R, De La Cruz BA, et al. Effect of an Online Weight Management Program Integrated With Population Health Management on Weight Change: A Randomized Clinical Trial. JAMA. 2020;324(17):1737–1746.

6. Mandl, K.D., Gottlieb, D., Mandel, J.C. et al. Push Button Population Health: The SMART/HL7 FHIR Bulk Data Access Application Programming Interface. npj Digit. Med. 3, 151 (2020). https://doi.org/10.1038/s41746-020-00358-4

7. 1upHealth Docs. Introduction. (n.d.). retrieved February 6, 2022, from https://1up.health/docs/

8. Sarimax: Introduction. Statsmodels. (n.d.). Retrieved February 6, 2022, from https://www.statsmodels.org/dev/examples/notebooks/generated/statespace_sarimax_stata.html

9. CDC Nutrition, Physical Activity, and Obesity—Legislation | Chronic Disease and Health Promotion Data & Indicators. (n.d.). Retrieved February 6, 2022, from https://chronicdata.cdc.gov/Nutrition-Physical-Activity-and-Obesity/CDC-Nutrition-Physical-Activity-and-Obesity-Legisl/nxst-x9p4

10. Children's Privacy. (n.d.). Federal Trade Commission. Retrieved February 6, 2022, from https://www.ftc.gov/tips-advice/business-center/privacy-and-security/children%27s-privacy