SUGAR FREE

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Organization and Scenario Description:

Aetna is one of the oldest healthcare insurance providers in the United States. Aetna is known for covering preventive care, has affordable options and a very large provider network. While this company has some good points, it does not have high ratings due to customer service, billing, and coverage issues. Besides fixing those issues, Aetna will very likely benefit from adding improvements to the points that make the company stronger- specifically preventative care and management of existing issues.

There are numerous numbers of people getting diagnosed with diabetes every year and the main focus of the BI dashboard will be to reduce the number of people diagnosed. There will be a second dashboard which focuses on individual patients, keeping track of nutritional data which is an extremely important part of managing pre-diabetes. In addition to that, the focus will also be having the people to be more connected with preventative benefits that Aetna provides.

We will work with Aetna to provide a BI application which will allow preventative measures to be taken for those who have prediabetes. This condition is when a person's blood sugar level is high, but not enough to classify as type two diabetes. In this phase, the pancreas will produce enough insulin in response to carbohydrates, but the insulin will not effectively remove the sugar from the bloodstream, creating a slow resistance to insulin.

More than 84 million people in the US are not aware that they have prediabetes, and most will not know until they see a physician. If patients do not use preventative measures, they are putting themselves at risk to damaging blood vessels which will further create diabetic related complications in the future.

There are numerous risk factors such as weight, patient demographics, diet, family, age, history, and sleep that can make it more likely for a person to develop diabetes. In many cases, having high blood pressure or cholesterol are risk factors that contribute to pre-diabetes worsening in patients as well. Our BI application will allow patients who are at risk for developing diabetes to be continuously monitored through data collected on their lifestyle. Data such as the patient's blood sugar, eating habits, blood pressure, fitness habits and heart rate are the ones that the BI application monitors.

Using Aetna's data, the BI application can be paired with it and can be used to provide the coverage for outpatient medical self-care programs for a patient with the risk of having diabetes. Outpatient programs can be used to help patients understand their conditions and risk factors by educating them on diabetes and prediabetes. This will make patients aware of important information which the application will be analyzing with the collected data and creates more of an understanding on why this sort of tracking is beneficial and important.

This is also a very affordable option instead of having patients spend a lot of money on things like a nutritionist and having multiple doctor's appointments for continuing care. The focus of this data collection and understanding the output is to track some important risk factors daily. This will create a chance to study the risk factors in diabetes patients to identify the most important indicators of elevated risk for cardiovascular disease and other complications. Patients will also have more power and knowledge over their own healthcare and be able to track when further assistance from a healthcare provider may be needed, depending on their individual numbers from the application.

Nutrition is an extremely important part of managing prediabetes and should be tracked extensively. Tracking nutrition allows patients and their providers to see how different kinds of foods can influence blood sugar levels in each patient.

When this is done in combination with monitoring blood sugar levels sometime after eating, observations can be made on which foods to avoid or eat in smaller amounts. This is because for a lot of people with diabetes, blood sugar levels will not lower easily after having a meal. There are tools available like the Glycemic Index, which basically gives a number to different foods that tell a person whether it is okay to eat that food or not. Any foods that have a higher likelihood of increasing blood sugar will have a higher number on the index scale.

There are several things on the glycemic index that are ranked low, and therefore good to eat when a person is watching their blood sugar. A few of them are steel cut oats, corn, beans, fruits, and non-starchy vegetables, such as greens and eggplants. It is recommended to avoid eating saturated fats since that also increases the risk of other complications with prediabetes, such as cholesterol and heart disease.

Another action a person can try taking to limit their risk for diabetes is practicing portion control. If someone is eating something that is high in fats or carbohydrates, they can limit how much of that food they consume, or pair it with another food that is better for their health. Ideally eating foods that are high in fiber will make it less likely for a person to eat too much and will help the body better manage sugar overall. All of this, in combination with portion control and avoiding inactivity will largely influence one's likelihood of developing diabetes. Therefore, it's so important to have a nutritional dashboard to intuitively help patients track their overall consumption of different types of foods.

For this specific scenario, we will find patients who have Aetna insurance at a hospital or medical facility that fall into risk groups based on health records. Our first dashboard will give an overview of at-risk patients to help us determine those who could find use for our individual nutrition dashboard. These groups of people will be given sensors to track their lifestyle. Preventative recommendations are given by our AI by processing the data collected as a whole. Information from all patients can be used by the AI to find trends and give more accurate and helpful insights to the patients using it to monitor themselves.

The sensors can monitor all of the important risk factors, including food intake, heart rate, blood pressure, blood sugar etc. Most of this data will be collected through wearable devices connected to common health applications such as Apple health or Samsung health. This will allow a large portion of the population to easily access and monitor themselves. It's also better for accessibility because in some cases, these kinds of monitoring devices can be covered by insurance to make it easier for most people to obtain.

To track blood sugar levels, we can use CGMs, or Continuous Glucose Monitoring devices. These devices continuously track blood glucose levels, allowing patients to view the level at any time. The sugar level in the fluid between the cells can be tracked by using the small sensor called CGM which goes under one's skin in the arm.

Having this connected with our application will allow the AI to keep track of the blood glucose trend and give real time notifications on steps if it is too high. Seeing the blood glucose levels along with other data from the wearable devices such as physical activity, food intake, or medication dosages which will allow the AI to take the necessary action based on the situations such as eating habits, exercises and much more. In this way, a patient's lifestyle can be maintained while keeping affordability in mind at the same time.

Process/scenario/workflow/operations Description
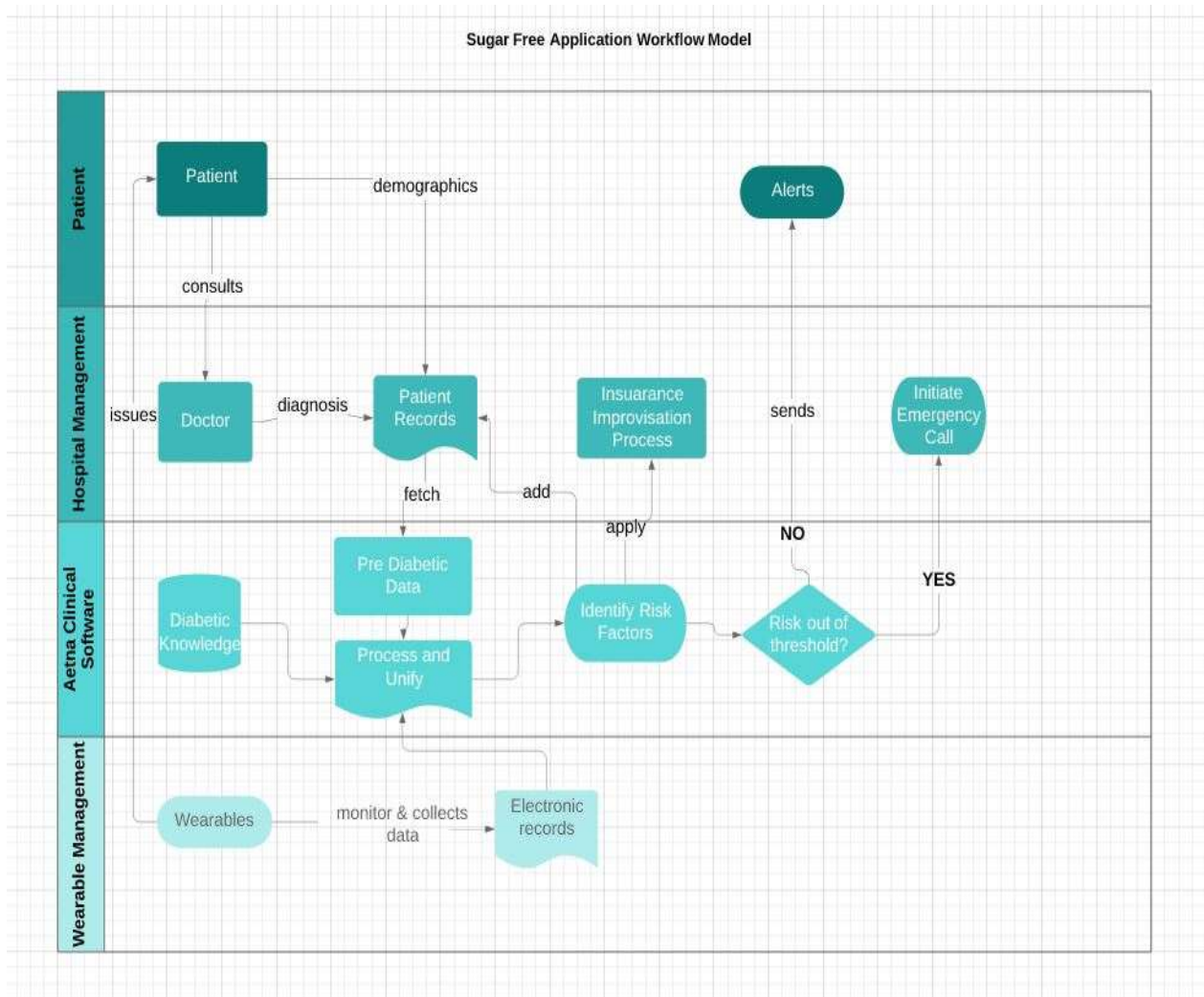
The Proposal

This proposal is to improve "Aetna" health insurance company by providing support to improve their customer service policies. This will be done by aiding a prediabetic patient with a personal digital coach to monitor their daily activities and recognizing which patterns or behaviors put them at an elevated risk ultimately benefitting both patient and the healthcare company Aetna is working with.

On the higher level, the patient consults a doctor in a hospital which has its clinical software equipped with Aetna health insurance as a default service. Like the traditional process, when the doctor finishes the patient diagnoses his demographic data, diagnosis data and lab results will be stored in their clinical database. If the patient is prediabetic, their records can be accessed from the sugar free module.

Once the patient finishes his first check up and has shown results to be pre diabetic they will be given wearables like the Apple Watch, Fitbit, Garmin, or Oura Ring. They will also be allowed to use a device they already possess, which can be synced with the sugar-free application to monitor their daily activities.

Impact

With the help of the Sugar free proactive tool in Aetna's clinical software, the medical data repository which has the complete diabetic knowledge. The data is collected from the wearable devices which record the patient's daily wellbeing like distance walked, blood pressure, heart rate, calories intake, steps walked and hours of sleep with the help of apple health, Samsung health, fitbit and the patient demographics like age, height, weight, other health problems, allergies, hereditary data and surgeries if any.

Sugar free tool is equipped with Artificial Intelligence / Machine learning which aggregates, resamples, unifies, formats and inputs the collected data to be trained. This further processes the conditions better than the traditional techniques identifying the ultimate risk factors in preventing its worst effects.

Implications and Use

The application will be sending daily stat reports as well as immediate alerts if any improper intake has been detected which is above the risk threshold. It will also be logged in the hospital's clinical software in the patient's records.

When a high risk is observed, an emergency call is raised to the hospital and also the assigned doctor so that they take an immediate action on this course. This increases the ability for healthcare professionals to better understand the day-to-day patterns and needs of the people they care for to provide better feedback, guidance and support for staying healthy. Having an accurate data feed for activity allows the tool to extrapolate risks and recommend actions to help people respond early and keep them consistently engaged in their own health.

This tool's importance lies in the usage of sensors in the wearables to measure daily rhythms in physiological measures. An integration of sensor data from wearables, self-report demographics about cognition, behaviors, and emotions can provide new insights into the interaction of mental and physiological data when gathered which is then integrated into one unified format which is unlike the traditional approach.

Process

This workflow keeps training the model used in the tool to run the data back to back so as to learn the knowledge and predict the risk factors accurately. This is done by linking multiple repeated measurements to physiological data collected with wearables, revealing meaningful information for that specific individual and not generalizing the results because it is not necessarily true for everyone. Hence, separate analysis are conducted for each individual to elucidate individual patterns.

Once these statistical analyses were performed on the combined data sets for every individual, it requires a validation in terms of effectiveness and accuracy. This is done manually by comparing it with the manual analysis of a domain expert, in terms of results, time spent using automated procedures to compare it to the knowledge acquired on diabetes for verification. Next, data was copied into another pre-programmed Excel-template, and descriptive statistics were computed using Excel for any adjustments to be done manually for statistical analyses.

The layered architecture of Sugar-free allows these changes to remain isolated to the service layer, leaving the rest of the program/code unaffected. The results of the manual analysis were equivalent to the output as retrieved from database. Note that for this analysis, imputation was done beforehand, hence improving automation.

End Results

The results comprise a fully working, open-source implementation of the proposed platform and the implementation establishes the feasibility of the best architecture. Everything considered, this workflow might take an experienced researcher to do this process manually for about a day or two to process the data of a single participant. But using this process which is prone to minute error can process automatically to give faster results.

Now that we have the results, the end result would be presenting it on a meaningful and understandable way to the doctor, customer and the metrics required for Aetna to improve on. We believe the best way to do this is through Microstrategy. Creating dashboards with numerous data indicators, demographics and also geography is easy for all the three stakeholders (Aetna management, hospital management and the patient).

Breakdowns and Filtering

Having number of filters in these reports is easy with Microstrategy, Example: the diabetes time period, diabetes medical usage trends, health status and disability if any, limitations in the mobility, daily living stats, visually impaired stats, Hospitalization records like heart failure chances, diabetes related complications, mortality rate in genders, low extremity diseases or list of diseases more prone to and finally the main risk factors for calculations like blood pressure, smoking habits and if pregnant.

Making a habit of checking this information every morning can tell you a lot about how your day is going to be like. Should you hit the gym, or hit the sack? Should you go out again, or go to bed early? A spike might indicate you're about to get sick and trying to take it easy could prevent a full-on cold. It can be a very accurate measure of what state your body is in and the trend is more important than the absolute number. If much lower than usual, then take it easy. Maybe go for a walk rather than a hard run. If high, then go out and conquer the world.

Usability and Appeal

This wearable is very basic and simple as its framework is focused on reducing the energy consumption. As a result, its non-rechargeable battery has a duration of 6 months approximately and alerting the patient on behavioral data is also a great feature to have as these are things we do that affect our body, ex sleep quality. A healthy lifestyle and as well as healthy nutrition habits play a key role in treating T2DM as well as limiting its complications and having a positive mental attitude, showed substantial correlation of the Health Behavior Inventory and the Satisfaction with Life Scale.

To finish it off, the best customer service would involve having effective alerting systems. The commercial success of wearable technology has been rapidly growing market and generally these devices allow the wearer to monitor a range of medical factors discretely, and even detect a fall, monitor heart rate, keep a step count and go beyond those abilities to provide a link to support services in the event of a problem.

Utility and Emergency

To provide these functions inherently, Sugar free goes an extra mile in connecting the patient to the doctor and his respective emergency contacts in case of high-risk observations with the help of wearable devices. The devices which detect movements and can also set to automatically call 911 and get assistance when predicted threshold levels are crossed at any second. In case of non-ideal situations depending on the geographic locations, having the alternative of using the alert button which will contact predefined caregivers, or a medical support line is a plus.

The CDC estimates that medical expenses for people with diabetes are 2.3 times higher than people without diabetes hence with these factors, Aetna will definitely hit the charts as a good health insurance which lies on the key management and treatment of this chronic disease. These analyses can give Aetna improvement policies which give greater access to cheaper, preventative health care plans, including Medicare and Medicaid, which have made it easier to get consistent treatment and support for managing Type 2 diabetes conditions and preventing the disease altogether.

Process map/architecture
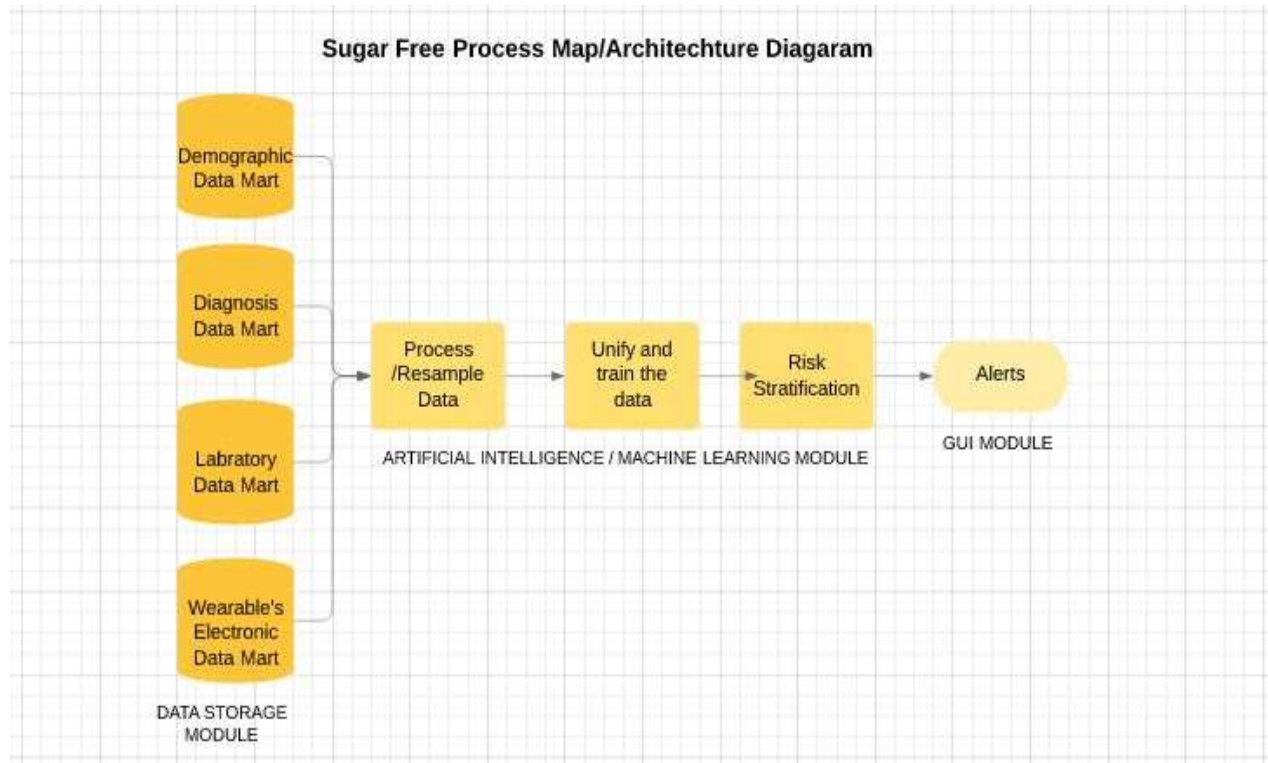
The data storage module consists of four main data repositories which stores the collected data.

Demographic Datamart:

Patient demographics forms the core of the data for any healthcare institution which allows the identification of the patient and his categorization into categories for the purpose of statistical analysis.

The basic being the name, date of birth, gender, country, address, phone number, ethnicity, blood group, emergency contacts, allergies, major diagnosis, medical history and current medications. This information can be gathered from the hospital management right when the patient visits their facility for the first time through forms or by having them fill out questionnaires on the PDA's.

Diagnosis Datamart :

This is the information collected from the patient for hospital management purpose to initiate their record into the system. The data is used in a remarkably wide range of applications including various government agencies, provider associations and individual health care providers, consumer organizations and individual patients, health care insurers and other health care purchasers as they are also answerable to many other organizations like tax agencies to claim what services they charge us for. Furthermore, the reason for their visit, complains and the prescribed medications etc.

Laboratory Datamart :

This data repository contains data of an equal volume, variety, and longevity organized, optimized for pulling together all clinical observations on a patient when he undergoes any medical examination in the

hospital. All types of tests and results information is stored here which is saved as HER which are in turn tracked by the docs. These results need to be broken down to the important factors required for the analysis.

Wearable Electronic Datamart :

Wearables allow different ways in which data from sensors can be collected by other systems. This sensor revolution promises the same operational benefits for clinics as hospitals enjoy and also has the potential to harness the largest untapped healthcare workforce in the country — patients and their families. This stores data like distance walked, heartrate, blood pressure, calorie intake, steps taken, calories exhausted, salt / sweet intake, sleep cycle etc. It is then transferred to a computer or to a smartphone as an intermediate step towards its eventual fetched to this tool permanently without the need of any intermediate system.

Artificial Intelligence / Machine Learning Module:

The best thing of the tool is to offer this single point of access to the brain of the system where it processes data and unifies the main flow of gathered information to summarize steps, distance, or calorie expenditure over a certain time-span is by calculating their respective sums. This approach is incorporated in order to down-sample the measurements, sum of the values/category to derive a value that best represents the interval between subsequent measurements that can be configured to a fixed number of hours.

To put all the statistical gathered data into different graphical representations to understand the trends, peaks and downfalls of one categorical data is not possible as the gathered data is of different formats. To make sure that the format of the exported data is not affected, the tool unifies the output format of the variables across the categories which also maintains the abstraction. Researchers can use this single datafile without being bothered by the details first gathered or all required transformations and use the data as-is. It also imputes the missing values by taking the mean of the range of values for each aggregated variable and cannot be reversed which completes the unifying process.

Lastly, these values when is put up on the charts provides an overview of the data sources per platform to identify the risk factors, threshold levels, do's and don'ts with which the decision of whether to raise a flag against the factor or no could be analyzed by the researchers and is to be documented back to the Hotel management.

Risk factors are then informed to the patients on daily basis and if at all high risk occurs, it implements the trigger available in the Emergency call initiation task.

Apart from leveraging this data analysis to provide insights into the diagnosed diabetes population, the other motive of this proposal being to help Aetna with implementing improvisation processes in order to meet 100% customer satisfaction will be fully met eventually improving their policies that would benefit both patient and company. Afterall the patients interacting with Aetna will have an upper hand in understanding that they are able to be equipped with better feedback, guidance and support for staying healthy.

Comparative Outcomes Assessment

More than 100 million Americans have prediabetes or diabetes and of that an estimated thirty four percent of all adults in the US have prediabetes. Being given a diagnosis like prediabetes is a wakeup call for those in at risk health groups. Usually people with prediabetes are already at an elevated risk of stroke or heart disease, the patient does not yet have the serious problems that comes with diabetes. The silver lining is prediabetes is curable.

The CDC states: "Think of prediabetes as a fork in the road: Ignore it, and your risk for type 2 diabetes goes up. Lose a modest amount of weight and get regular physical activity, and your risk goes down". Unless people with prediabetes change their lifestyle, most will have Type 2 diabetes within the next 10 years. Physicians usually recommend a list of healthy lifestyle changes the patient can do to get out ahead of the disease and prevent sliding into type 2 diabetes.

The usual recommendations given are as follows from the Mayo Clinic:

> "Choose foods low in fat and calories and high in fiber. Focus on fruits, vegetables and whole grains. Eat a variety of foods to help you achieve your goals without compromising taste or nutrition. Aim for at least 150 minutes of moderate or 75 minutes of aerobic activity most days of the week. If you're overweight, losing just 5% to 7% of your body weight — about 14 pounds if you weigh 200 pounds — can reduce the risk of type 2 diabetes. To keep your weight in a healthy range, focus on permanent changes to your eating and exercise habits. Smoking may up your risk of developing type 2 diabetes. If you're at high risk of diabetes, your doctor might recommend. Medications to control cholesterol and high blood pressure might also be prescribed."

Changing all of this might seem an insurmountable task for the average American. Health and human services estimate that less than 5% of adults participate in 30 minutes of physical activity every day and 78 million U.S. adults are obese. However changing lifestyle is required to stave off the worst effects of diabetes.

Consequences

The consequences are debilitating, affecting every major organ in the human body. Having diabetes also puts you at risk for moderate to severe nerve damage, infection, and kidney failure. Diabetes is also the leading cause of amputations in the United States of America. Also, it may double the chance of depression in patients. We know the effects of diabetes and being able to prevent it should be the top priority for those prediabetic patients.

Without BI solutions, the process of aiding prediabetic patients would be periodic check ins with a physician to monitor weight and to give advice on food and exercise. Monthly check ins are recommended but there is no clear process of recovery for this condition. Much of the advice given is similar to normal health truisms i.e. lose weight, go outside, etc and patients could be reticent to listen based on that.

Recommendations

A nutritionist or lifestyle coach could be recommended. Nutritionist can give recipes and suggest shopping lists to aid in good lifestyle choices. However, Nutritionists are expensive, with women's health magazine estimating the costs at around "$150 to 225 or more" for an appointment.

With all of this said, the patient is put under heavy scrutiny to begin their new lifestyle. But the amount of monitoring and check in varies by doctor. This means the patient is mostly left alone after the initial diagnosis to begin their much-needed new lifestyle change. The diabetes council says that 2 out of 5 of these patients will quit in the first 7 days with only one of those 5 continuing it after a month. These statistics paint the bleak picture of support these individuals have while embarking on this prevention process

Heeding Warning signs

For those who ignore this disease, consequences appear relatively quickly. For prediabetics that do not change their lifestyle or receive treatment, twenty five percent will develop full blown diabetes in three years. The risk jumps with thirty seven percent of individuals with prediabetes developing the full disease by four years. The deck is stacked against these patients who need to make an overall improvement before disaster strikes.

What can change this current trajectory? Information, Awareness, and Advice. Our project addresses these shortcomings of the manual or traditional process by empowering the user with information about their own health. At every part of the workful, our process improves the experience of the patient to provide them a personal health monitor and coach. Intervention is key, "Several studies have shown efficacy of lifestyle interventions with regards to diabetes prevention with a relative risk reduction of 40%-70% in adults with prediabetes" writes Dr. Nidhi Basnal in the World Journal of Diabetes.

Process and Change

The whole process of this app would be more of lifestyle change intervention in the palm of the patient's hands. Easy information, up to date information, and accurate coaching tailored to the patient's needs could give exactly what is needed for a change.

Dr. Phillip Tuso writing in the Permanente Journal shows the real impact of these interventions:

> "Lifestyle intervention may decrease the percentage of prediabetic patients in whom diabetes develops to 20%. Long-term data also suggest that lifestyle intervention may decrease the risk of prediabetes progressing to diabetes for as long as 10 years."

The lifestyle aid would provide continuous support and coaching as the patient maintains their path towards better health. Unlike the "manual" version this assistance through the app would happen during the patient's day to day with notifications. Adding a layer of personalization through the data analyzed would provide real weight to the advice given. Since the information is tailored from the sensors monitoring you every health choice matters and is recorded. Patients can go back and review health history to know exactly where they are in relation to their health goals. The patient also cannot lie about life improvements like they could with only periodic visits to a physician. Having all of the records on exercise and food intake would show that as well.

Follow through

Suggestions like an easy exercise to get the patient moving on a day where they have been very sedentary would help much more than a periodic check in with a physician a month later. Showing a low-calorie alternative to a sugary dessert or a recipe for nice green salad with chicken moves the patient's mind towards a more positive action. The goal is to make lasting changes to a person's life.

Providing information as a coaching method would help with the stress of transitioning one's bad habits and suggestions that could spark a new improved step to a better healthier life. Continuous support and notifications help prevent falling off the bandwagon. In the event the patient start falling behind in terms of health action can be taken to realign with goals and push through. This on the fly support does not happen to these patients unless a considerable amount of money is spent to give all the coaching needed for day to day support.

Methodology

Hospital Data:

Hyperglycemia is a very critical condition to manage in patients coming into hospitals. Therefore, an analysis of a large hospital system has been created. This is done with the hope that this situation will become an example for the kind of change we need to see in healthcare facilities. In combination with our nutritional dashboard, this initial study should allow us to determine the rate of diabetes in various healthcare facilities To see an improvement in patient safety as well as a reduction in people who are becoming diabetic, we need to see the trends and patterns among people who are being admitted to hospitals. Specifically, we are going to focus the HbA1c level among patients who have diabetes. The goal is to observe whether having HbA1c directly reduces rates of re-admission to hospitals.

Our data is being collected through the Health Facts database, which allows us to utilize the Cerner Electronic Health Record system. The database has information from institutions who provide various types of data, including encounter data, provider specialty, basic demographics such as age, race, and sex, and types of diagnoses as shown through the ICD-9 codes. Pharmacy, lab data, hospital mortality rates and specific hospital characteristics are also included (table1). The data that is being used ranges over a total of ten years with information across over several mid-ranged hospitals. This information as a collective will point us toward the most common risk factors to diabetes and in turn provide points that these patients need to focus on when using the nutritional dashboard. For example, if a patient is pregnant, we would understand the risk factors associated with the diabetes pedigree function. If a patient has a high BMI, we will know that this is something that needs to be lowered in order to stay out of the range for pre-diabetes. For our Nutrition data, we will have patients use our Sugar Free app for two weeks and analyze the data to see if it has a positive effect on their lifestyle.

Visualization of Data:

We are using MicroStrategy to create our graphs for the diabetes dashboard. We will view and compare several different factors, first of which includes diabetes pedigree function based on pregnancy. This graph will tell us the rate at which diabetes is transferred to the child during pregnancy. Another graph will be based on the rate of different diseases such as circulatory/respiratory that occur in the diabetic patients. We will also view how Body Mass Index (BMI) has an impact on the condition. Finally, we also want to view the rates at which patients are re-admitted based on both age and gender. The goal of all the above is to relate the rate of re-admission to different factors that have an impact on re-admission rates. The admission data is divided between re-admission, and otherwise, which means re-admission occurred 30 days after the initial admit, or it did not occur at all.

Implementation of Nutritional AI:

At the end, we will use the hospital data to determine those who could find use out of the Nutrition dashboard, and implement the gathered information with the AI that can help keep track of specific risk factors with the goal of reducing the rates. To view a change, we will look at individuals who have been tracking their nutrition on the dashboard through the AI. We can take the data collected over the course of about 15 days to see how different nutrition levels have changed for the better or gotten worse over time. We are hoping to see an improvement or steady trend in nutrition over time.

A few of the categories being tracked include protein levels, cholesterol, sugars, calories, fats, water intake, body weight, and amount of exercise. We will look at exercise in terms of both time and total number of steps, divided into morning, afternoon, and evening. This will also help gauge most active or inactive parts of the day for the patients. Knowing and understanding how water intake and amount of exercise relate to each other will aid the AI in reminding a patient to drink enough water with their exercise schedule in order to maximize the effects on other nutrient levels. Also keeping track of key nutrients like fiber and protein gives the AI information on what kinds of nutrients to recommend, based on foods and the levels they have on the Glycemic index.

TABLE I: List of features and their descriptions in the initial dataset (the dataset is also available at the website of Data Mining and Biomedical Informatics Lab at VCU (http://www.cioslab.vcu.edu/)).

Feature name	Type	Description and values	% missing
Encounter ID	Numeric	Unique identifier of an encounter	0%
Patient number	Numeric	Unique identifier of a patient	0%
Race	Nominal	Values: Caucasian, Asian, African American, Hispanic, and other	2%
Gender	Nominal	Values: male, female, and unknown/invalid	0%
Age	Nominal	Grouped in 10-year intervals: [0, 10), [10, 20), …, [90, 100)	0%
Weight	Numeric	Weight in pounds.	97%
Admission type	Nominal	Integer identifier corresponding to 9 distinct values, for example, emergency, urgent, elective, newborn, and not available	0%
Discharge disposition	Nominal	Integer identifier corresponding to 29 distinct values, for example, discharged to home, expired, and not available	0%
Admission source	Nominal	Integer identifier corresponding to 21 distinct values, for example, physician referral, emergency room, and transfer from a hospital	0%
Time in hospital	Numeric	Integer number of days between admission and discharge	0%
Payer code	Nominal	Integer identifier corresponding to 23 distinct values, for example, Blue Cross\Blue Shield, Medicare, and self-pay	52%
Medical specialty	Nominal	Integer identifier of a specialty of the admitting physician, corresponding to 84 distinct values, for example, cardiology, internal medicine, family\general practice, and surgeon	53%
Number of lab procedures	Numeric	Number of lab tests performed during the encounter	0%
Number of procedures	Numeric	Number of procedures (other than lab tests) performed during the encounter	0%
Number of medications	Numeric	Number of distinct generic names administered during the encounter	0%
Number of outpatient visits	Numeric	Number of outpatient visits of the patient in the year preceding the encounter	0%
Number of emergency visits	Numeric	Number of emergency visits of the patient in the year preceding the encounter	0%
Number of inpatient visits	Numeric	Number of inpatient visits of the patient in the year preceding the encounter	0%
Diagnosis 1	Nominal	The primary diagnosis (coded as first three digits of ICD9); 848 distinct values	0%
Diagnosis 2	Nominal	Secondary diagnosis (coded as first three digits of ICD9); 923 distinct values	0%
Diagnosis 3	Nominal	Additional secondary diagnosis (coded as first three digits of ICD9); 954 distinct values	1%
Number of diagnoses	Numeric	Number of diagnoses entered to the system	0%
Glucose serum test result	Nominal	Indicates the range of the result or if the test was not taken. Values: ">200," ">300," "normal," and "none" if not measured	0%
A1c test result	Nominal	Indicates the range of the result or if the test was not taken. Values: ">8" if the result was greater than 8%, ">7" if the result was greater than 7% but less than 8%, "normal" if the result was less than 7%, and "none" if not measured.	0%
Change of medications	Nominal	Indicates if there was a change in diabetic medications (either dosage or generic name). Values: "change" and "no change"	0%
Diabetes medications	Nominal	Indicates if there was any diabetic medication prescribed. Values: "yes" and "no"	0%
24 features for medications	Nominal	For the generic names: metformin, repaglinide, nateglinide, chlorpropamide, glimepiride, acetohexamide, glipizide, glyburide, tolbutamide, pioglitazone, rosiglitazone, acarbose, miglitol, troglitazone, tolazamide, examide, sitagliptin, insulin, glyburide-metformin, glipizide-metformin, glimepiride-pioglitazone, metformin-rosiglitazone, and metformin-pioglitazone, the feature indicates whether the drug was prescribed or there was a change in the dosage. Values: "up" if the dosage was increased during the encounter, "down" if the dosage was decreased, "steady" if the dosage did not change, and "no" if the drug was not prescribed	0%
Readmitted	Nominal	Days to inpatient readmission. Values: "<30" if the patient was readmitted in less than 30 days, ">30" if the patient was readmitted in more than 30 days, and "No" for no record of readmission.	0%

Roadmap for Aetna App

Limitations → Metrics → Dashboard → Impacts

Limitations:

The application we are developing has some useful features like displaying glucose values, trends and alerts on the patient's mobile devices mostly smart phones and smart watches. The system is also designed in a way that it can alert the medical organization that Aetna Health Insurance is working with for that individual. Along with the basic features, for EMR purposes in the hospital, it can track patterns and trends in concentrations of glucose levels.

If we are implementing these features in the wearables, there are still some limitations present in this application proposal. Although integration of Business Intelligence in the project has many advantages, it is a key factor in containing the project's potential.

Some of the common limitations in execution of this application are:

The implementation of data processing is very complex as there are too many variable data that needs to be considered before making an accurate conclusion. Since the Business Intelligence tool used for Aetna solely depends on sensory data from wearable tech, there can be a lot of stray data found which needs to be eliminated to produce necessary information.

The sensory data would have to be filtered, and there is also room for inaccuracy in its measurements. The sensory data collection also may not be consistent because of the chances that these wearable devices run out of charge and therefore are not able to collect any data. Another major restrain in the Business Intelligence tool is piling of historical data. A filter algorithm has to be developed so that redundant data is eliminated properly.

We only want to be able to view data that is necessary and tells us the important details about the patient. Customer data collected from wearables should be regulated based on state and federal laws in order to maintain proper security compliance.

According to United States Code, Federal Food, Drug and Cosmetic Act (FD&C) has to be followed while creating application for wearables. Besides the legal importance of making sure our app complies with HIPPAA, patients are also less likely to use our application with their sensors if they feel like their health information is at risk. Although companies have minimal liability exposure, HIPPA has to be covered as data has been harvested and it can impact the customers directly as it collects, processes and produce results from various sensors used for other data collection purposes.

Metrics:

There are specific metrics that need to be followed while creating the project of this scale for one of the largest healthcare companies. These metrics could prove useful as it can add the additional factor which will make the application stand out from the other health monitoring apps on smart watches or smartphones. If our application is advanced and well made, it will increase the likelihood that a patient will keep using

it. There are also high expectations when working with companies like Aetna, who want to outrun their other competitors.

With access to patient data turned on all time on their devices, we can monitor the "last active" session of the patient so that we can notify them the time of their last exercise and remind them to keep on track with the schedule. The app can also notify them to try and exercise for a longer time in comparison to past times in order to help them become healthier instead of staying stagnant.

We can have Sugar Free set goals for the patient when it comes to number of steps or even the amount of water, they are drinking in order to create a sense of motivation and achievement when reaching these goals. The app will give the patient the capability to enter the number of cups of water they are drinking every day. There can also be a section where the patient can enter in how they are feeling. We can have a mood or feeling section where the patient selects if at the end of the day, they feel good or if there are other issues like feeling bloated or dizzy or otherwise unwell.

The Sugar Free AI can take this information into account, and help the patient figure out what adjustments to their schedule will help them feel better. Whether it is not drinking enough water, eating too many calories and sugary foods, or not getting enough exercise, the AI will be able to point these things out for the patient to consider. With recording the insulin content secreted from the pancreas, we can calculate body glucose levels and chart a "nutrition needed" or "nutrition exceeded" table as a suggestion to the patient's next meal.

With devices like apple watch series 5, we can calculate Electrocardiogram of wearer, determining the stress level of the patient informing hospitals when it reaches beyond threshold. Along with these metrics, there must be a "Level of Compliance" where we must track if patient is adapting and committing to the changes and by how much. This can also be seen through patient trends over time. If the risk rate goes lower, it is likely the patient has been following recommendations from the Sugar Free AI.

Dashboard:

For the application to properly function, there must be a final polished user interface in which we can relate all the processed data, link them and combine them to produce results. Data visualization plays a main part in creating a dashboard for the application. With data visualization playing its part, we can detect patterns, anomalies, and any relation with inter-department health data. While tabled data is also important, In order to produce conclusions, we need to convert tabular data into graphical form. By creating pie charts, histograms, heat maps or scatter plots, we may be able to find correlations between healthcare data. Line graphs will be able to tell us if we have any numbers that changed over time, and if there is any trends between the data we're looking at.

We can use pie charts to see ratios and what they are to what they should be. All of the different types of visualizations will allow us to understand the things that are affecting people who have diabetes. With our Sugar Free AI, it also helps individual patients look at and easily understand what their trends are through the graphs they will see on their own devices.

It's important that on our application we use visualizations that are easy to look at and anyone in the general population will easily be able to understand. We do not want to create a dashboard for patients that they will have to struggle to decipher. Using visualizations along with tabular data in the app will also help create a better and cleaer understanding of what information is being portrayed to the patient.

With Artificial Intelligence integrated with BI, tools like SAS, R studio, MicroStrategy can help complete the warehousing of health data and create a visually appealing interface for hospitals to understand their patient data and patients to understand their own health.

Impacts:

The most important impact of this application on healthcare companies is streamlining its operations and correcting its financial workflows. The goal here is to reduce the number of re-admissions due to complications with pre-diabetes. Healthcare facilities can look at the data for their own patients, and if they are able to pinpoint the patients that need extra care and could benefit from Sugar Free, they should be able to reduce the number of readmissions solely through better education on how to be healthy and care for oneself. Since all the information will be available through the Sugar Free application, patients will easily be able to show their health information to any provider they may visit- this is especially useful if a patient is going to an emergency room or urgent care that isn't their usual doctor's office. This application should have a very positive impact on patient care, including all kinds of healthcare facilities.

Allocation of Manpower:

| Team Member	Tasks	Contribution %	Week
Vaishak Radha Krishnan	Gathered data and created dashboards	12.5%	12
Yogesh Selvaraj Narayanan	Gathered data and created dashboards	12.5%	12
Geethika Banda	Edited dashboards, wrote analysis and results, organized	25%	11-12
Samuel Broady	Edited dashboards, wrote analysis and results, created dashboard video	25%	11-12
Sabreena Yaseen	Produce test results and review final changes from feedback, wrote methods, analysis and results	25%	11-12

Analysis, Results, Discussion

The goal with having our dashboards like this, is to intuitively figure out who is most at risk, and to efficiently help these patients understand the path they are going on. This will be done by helping them manage risk factors.

After the AI has collected data from an individual person every day, it will be able to determine which factors have a bigger impact on each patient, creating a customized focus for every patient, in a way. It will also notify a patient if it determines that incoming data needs to be checked out by a healthcare professional, so if a patient seems like their condition is worsening, they will be told to seek professional help. With this method, a patient will not need to go to a doctor all the time, and instead will have to go when their trends point in a negative direction. All of this will help the population by creating an affordable path to reducing cases of diabetes.

Our Dashboards

Because of all of this, we are creating a dashboard that will pick out patients from a large pool of people in clinics or hospitals. It is created in order to have a broad overview on which patients, and how many, are at risk of getting diabetes or are pre-diabetic. Data visualization plays a main part in creating a dashboard for the application. With data visualization playing its part, we can detect patterns, anomalies, and any relation with inter-department health data.

Healthcare facilities can use the first dashboard on their patient information. The dashboard will filter through patient profiles and lab results, with the intention of picking out those at risk based on the information in their health record. It may look at fasting blood glucose, demographics, lifestyle information, or anything else that can be found in a heath record which could point to one being at risk for diabetes.
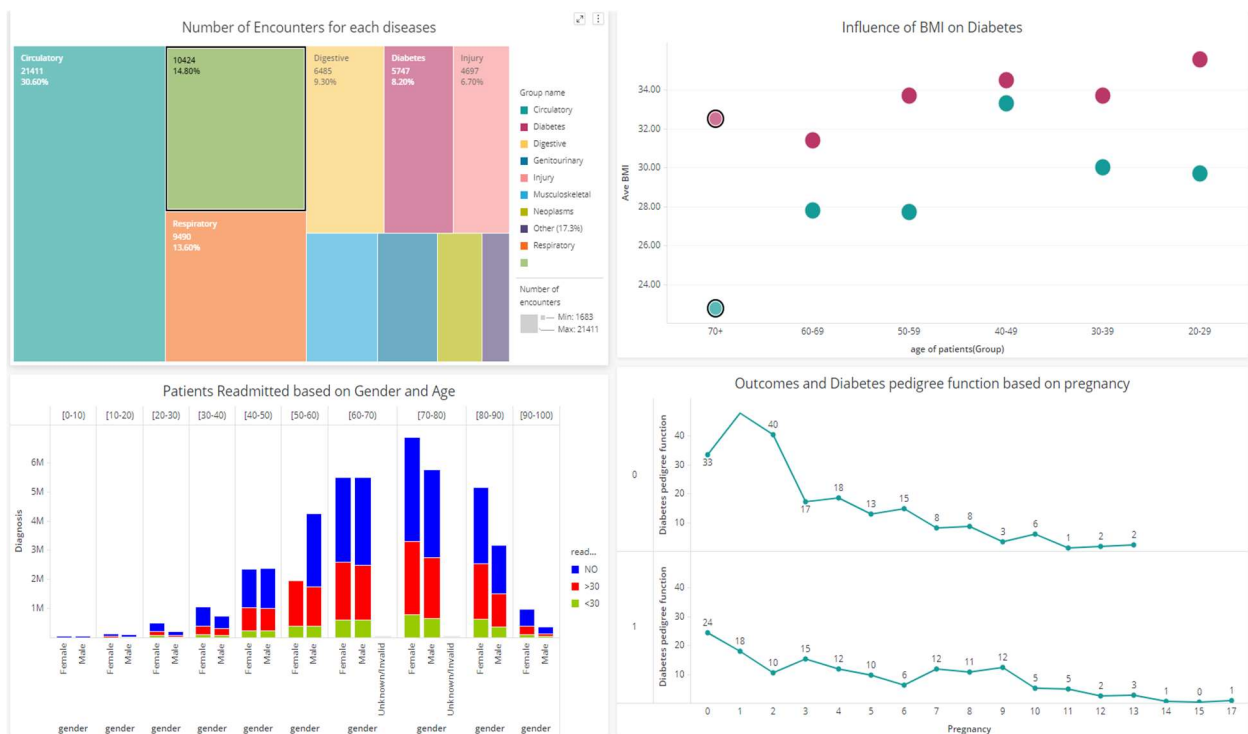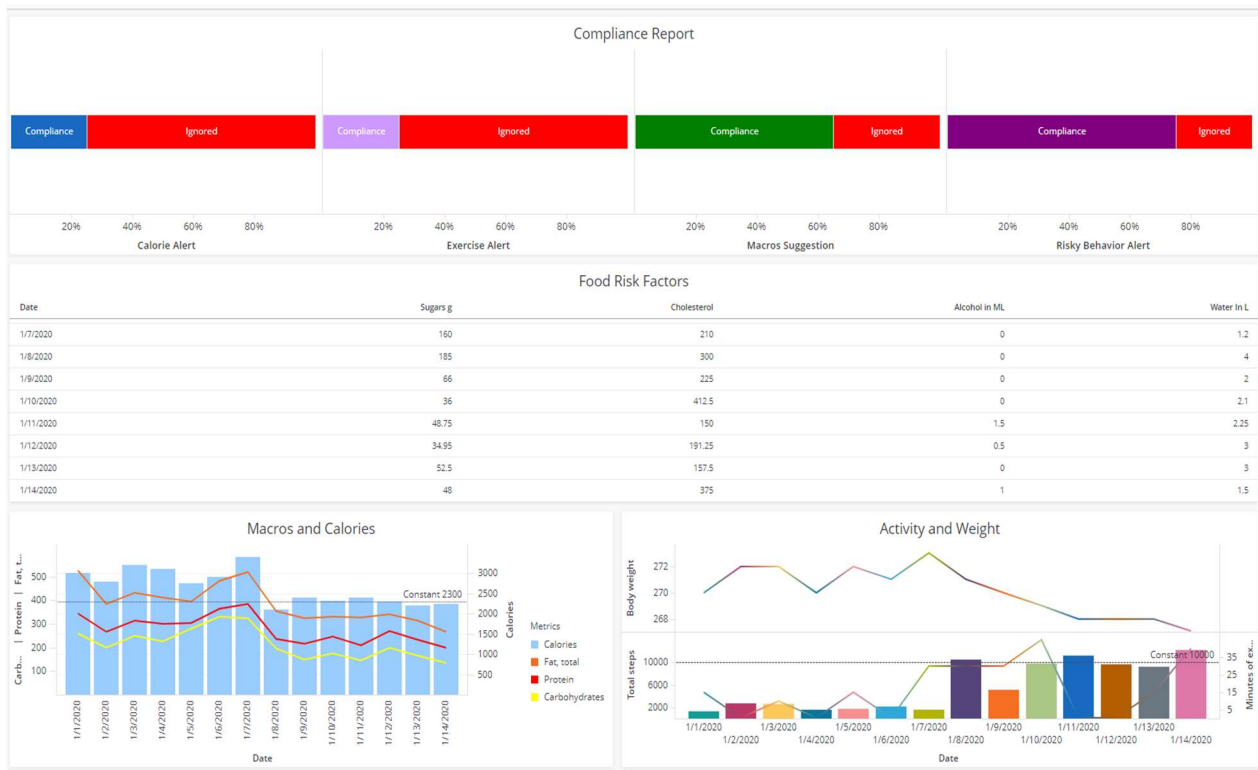
Having this kind of information is very important, as it gives providers information to determine how much of their patient population is at risk and need to be followed up with. This will help reduce the overall number of new cases of patients with diabetes and also assist with population health at each location.
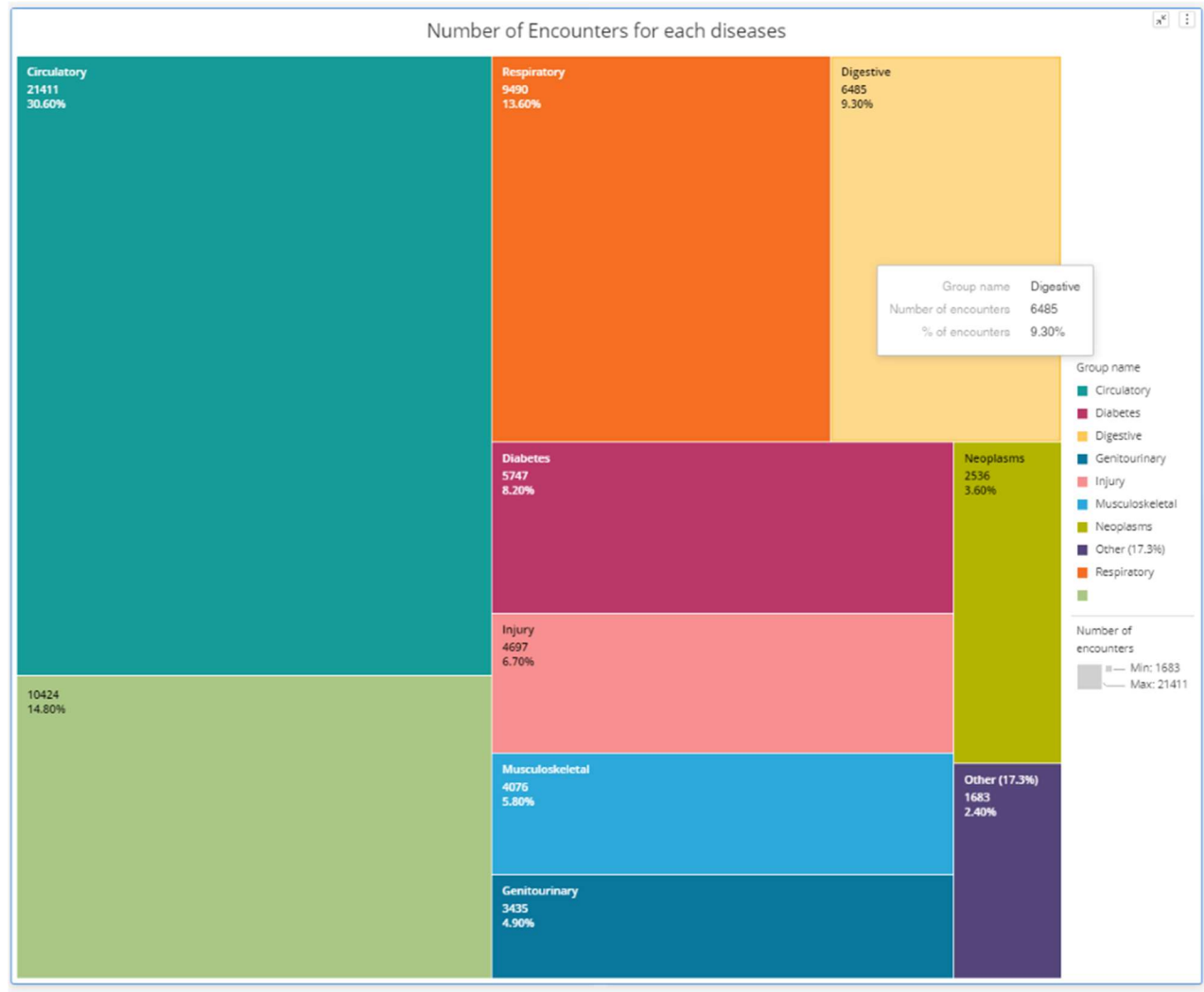
It is recommended to avoid eating saturated fats since that also increases the risk of other complications with prediabetes, such as cholesterol and heart disease.

Another action a person can try taking to limit their risk for diabetes is practicing portion control. If someone is eating something that is high in fats or carbohydrates, they can limit how much of that food they consume, or pair it with another food that is better for their health. Ideally eating foods that are high in fiber will make it less likely for a person to eat too much and will help the body better manage sugar overall.

All of this, in combination with portion control and avoiding inactivity will largely influence one's likelihood of developing diabetes. Therefore, it's so important to have a nutritional dashboard to intuitively help patients track their overall consumption of different types of foods.

Compliance Report

| | Calorie Alert | Exercise Alert | Macros Suggestion | Risky Behavior Alert |

Food Risk Factors

Date	Sugars g	Cholesterol	Alcohol in ML	Water In L
1/7/2020	160	210	0	1.2
1/8/2020	185	300	0	4
1/9/2020	66	225	0	2
1/10/2020	36	412.5	0	2.1
1/11/2020	48.75	150	1.5	2.25
1/12/2020	34.95	191.25	0.5	3
1/13/2020	52.5	157.5	0	3
1/14/2020	48	375	1	1.5

Number of Encounters for Each Disease

Many underlying conditions are precursors or red flags of prediabetes. Although there is no exact 1 to 1 dependence, general correlation to the disease and warning signs can serve as an early indicator toward diagnosis. This display shows conditions in the population surveyed with 8% suffering from diabetes. Immediately we can drill down into that population and learn the general attributes of those in that population. Many of the diseases listed are conditions mostly found in overweight or obese subjects which makes sense when we return to the list of the qualities that traditionally predisposes someone towards prediabetes.

Having a panel that allows management to drill down into the population that all suffer from the same disease gives a view on the common threads that link them. With a disease like diabetes that is preventable you can see attributes like BMI, ages, and other risk factors that contributed to their diagnosis.

In the population many suffer from multiple diseases, counting toward each disease encounter. This also shows of a general health status of our population by not omitting secondary diseases in patients.

Knowing the full breath of conditions gives a fuller picture to physicians looking at those in the at-risk population of any disease not just diabetes.

Populations

In terms of institutional implications having a working knowledge of what diseases tend to overlap in patients gives physicians an increased lens in terms of what to test for or watch for in patients that test positive in one. Many of these patients have at least two underlying conditions before they were considered at risk for prediabetes. This gives patients more time to change habits before getting too far into a risky predicament with their health. The easiest guard against diabetes is preventative care, the earlier it is addressed the better chance the patient has of avoiding being in the prediabetes "zone" and staving off the worst of the symptoms that it can cause.

Treatments

Another managerial aid this provides is the incentive to develop treatment plans that cover multiple conditions simultaneously. Making sure many of the treatments that are for just one of these conditions do not put the patient at risk if they may happen to have a secondary different condition would be a priority to management upon fully recognizing the above chart. If patient is put on a medicine that is supposed to treat their circulatory disease but that same medicine could impact them negatively if they happen to have an undiagnosed respiratory condition treatment plans need to be in place to account for that risk. Further tests may need to go into someone that has prediabetes to screen for these other conditions to make sure no more harm is done.

BMI
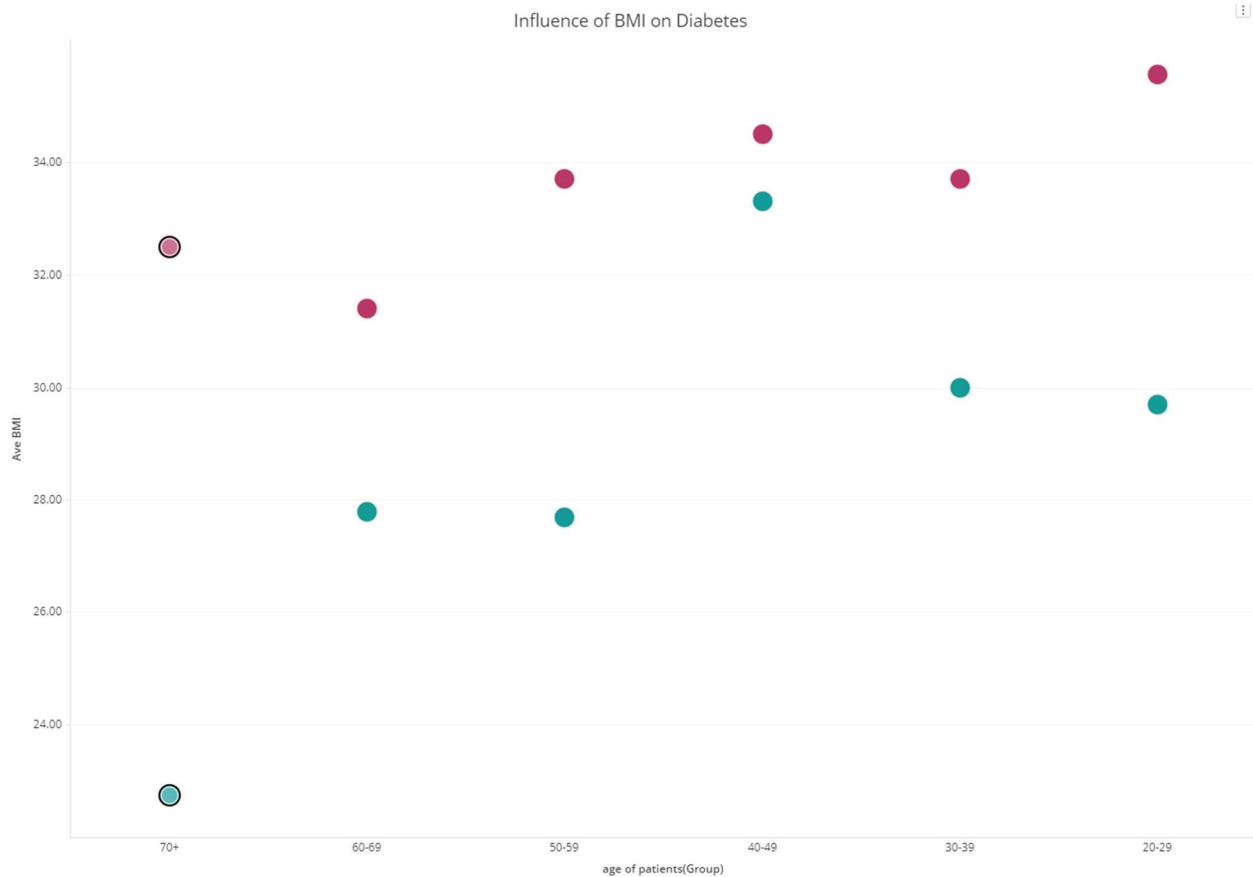
The highest correlated condition that predisposes someone to prediabetes and diabetes is weight. BMI is a function of a person weight and height given to show a metric of weight on the body. The average healthy BMI score is one that falls between 18.5 and 24.9. This shows that a person is within the normal average weight range for a person's height. A BMI score and the corresponding chart is used to sort a person as underweight, normal, overweight, or obese.

For the purposes of showing how at risk a person is to prediabetes, BMI is seen as a good corresponding metric. Many of the issues caused with a high body weight are steppingstones on the way to diabetes. Many organs lose effectiveness when pressured by a large amount of body fat. Kidneys have trouble regulating and filtering minerals from blood. They also have trouble removing waste from the bloodstream when weight is a significant factor.

Liver

The liver is also affected by a high bmi. Hopkin medicine defines the normal functions of the liver as

"Production of bile, which helps carry away waste and break down fats in the small intestine during digestion

Production of certain proteins for blood plasma

Production of cholesterol and special proteins to help carry fats through the body

Conversion of excess glucose into glycogen for storage (glycogen can later be converted back to glucose for energy) and to balance and make glucose as needed

Regulation of blood levels of amino acids, which form the building blocks of proteins"

All of which lose effectiveness and even begin to slow down when pressured by a high bmi body. Function of the entire endocrine system lessens with the strain of a high fat content body.

Pancreas

The most important organ in the endocrine system to prediabetes though is the pancreas. The pancreas is an organ that as defined by diabetes.uk works as part of the endocrine system to produce hormones, chemicals which are delivered via the blood to help regulate our mood, growth, metabolism and reproduction."

One the of the major hormones that the pancreas creates in response to stimuli is insulin. This hormone works to regulate blood sugar in the body. For prediabetes and the sequential diabetes, the body begins building a resistance to the hormone and consequently needs more and more insulin to bring down blood glucose levels. As a result, the pancreas is strained to produce enough insulin to regulate the body's blood sugar levels.

Therefore, using BMI as an initial "barometer" on a patient to push them for enhanced screening was our choice for a metric. Providing patients with a chart that reflect this and even offers an age-based comparison would show their predisposition for the condition. Getting people to care about their risk factors would help show the seriousness of the process.

Body Mass Index (BMI)	Weight Status
Below 18.5	Underweight
18.5 - 24.9	Normal
25.0 - 29.9	Overweight
30.0 plus	Obese

Patients Readmitted based on Gender and Age
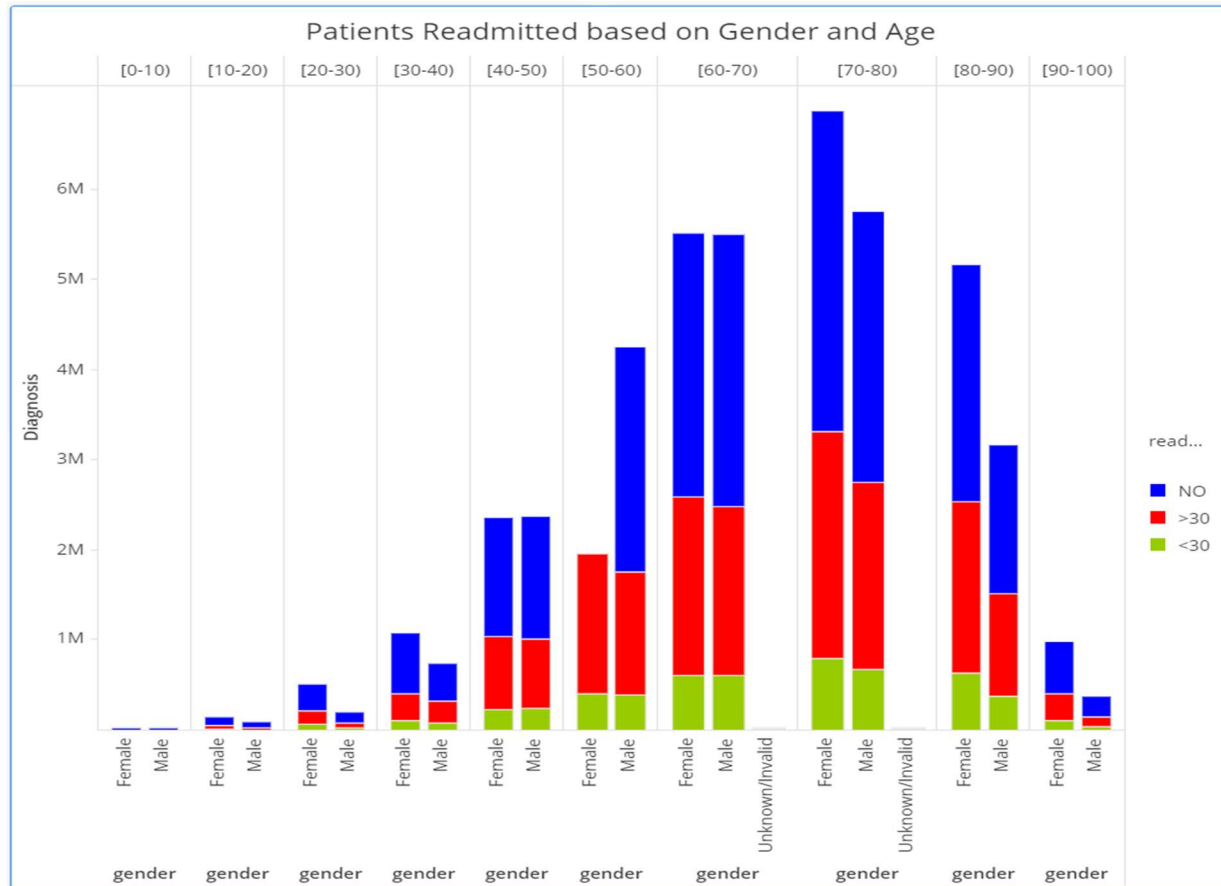
Readmission of patients with diabetes is common and costly. We studied the potentially important clinical data to determine the readmission risk factors among diabetes patients and have identified that hospital readmission within 30 days of discharge (30-d readmission) is an undesirable outcome.

We considered only the first encounter for each patient as the primary admission and determined whether they were "readmitted" within 30 days or "otherwise," which covers both readmission after 30 days and no readmission at all. Only readmission attribute is taken into consideration removing all encounters that resulted in either discharge to a hospice or patient death, to avoid biasing our analysis.

Takeaways

As a result, the above graph provides a more comprehensive understanding of 30-d readmission risk factors among patients with diabetes distributed across age and sex. Considering the days to inpatient readmission, the values are divided in the range of having "<30" if the patient was readmitted in less than 30 days, ">30" if the patient was readmitted in more than 30 days, and "No" for no record of readmission.

We can analyze which age group needs more attention post-discharge to the predictive accuracy achieved by pre-discharge factors. A better understanding of readmission risk may ultimately lead to lowering that risk.

Outcomes and Diabetes pedigree function based on pregnancy
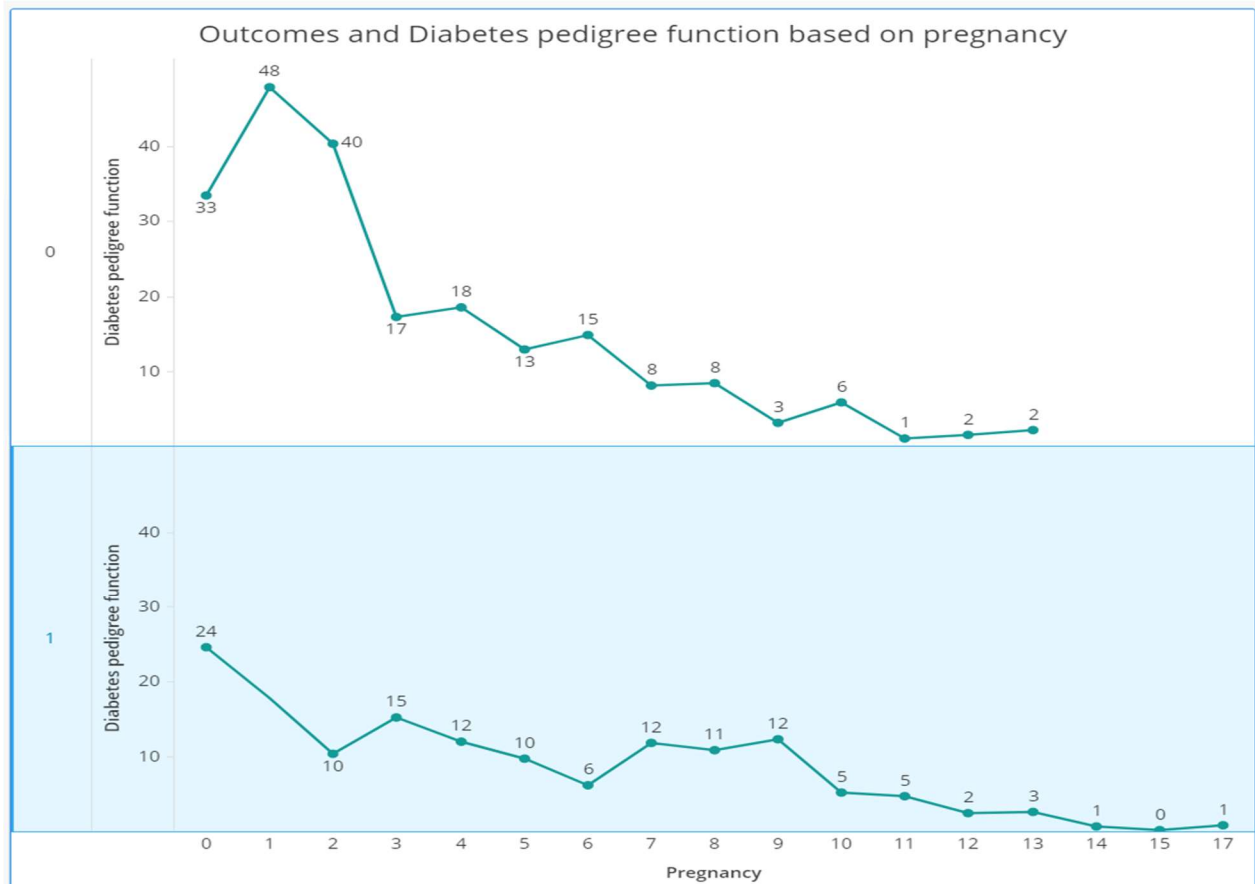

One of the main factors while working towards futuristic predictions in women could be with determining their pregnancy counts for those who tested positive for diabetes and those who tested negative for diabetes. The relationship between the test results for diabetes and the pedigree function could be the way out which scores the likelihood of diabetes based on family history. Hence taking the features like, Number of times pregnant, Glucose, Blood Pressure, Skin Thickness, insulin, BMI, Diabetes Pedigree Function, Age can help us predict whether a person is diabetic or not.

Visualization

This line graph visualization is mapped out w.r.t to diabetes pedigree function to the number of times a non-diabetic (0) and diabetic (1) women in the dataset got pregnant. Overall, it seems that there is some form of an association between number of pregnancies and pedigree function, and the test results for diabetes. Since those who tested positive have a higher median and more high outliers as the number of pregnancy increases, it is clear that the pedigree function does in fact, accurately help estimate the test results for diabetes. It shows that diabetes does follow genetics so those whose ancestors suffered from it have a higher risk of getting the disease themselves as well.

Nutrition Dashboard
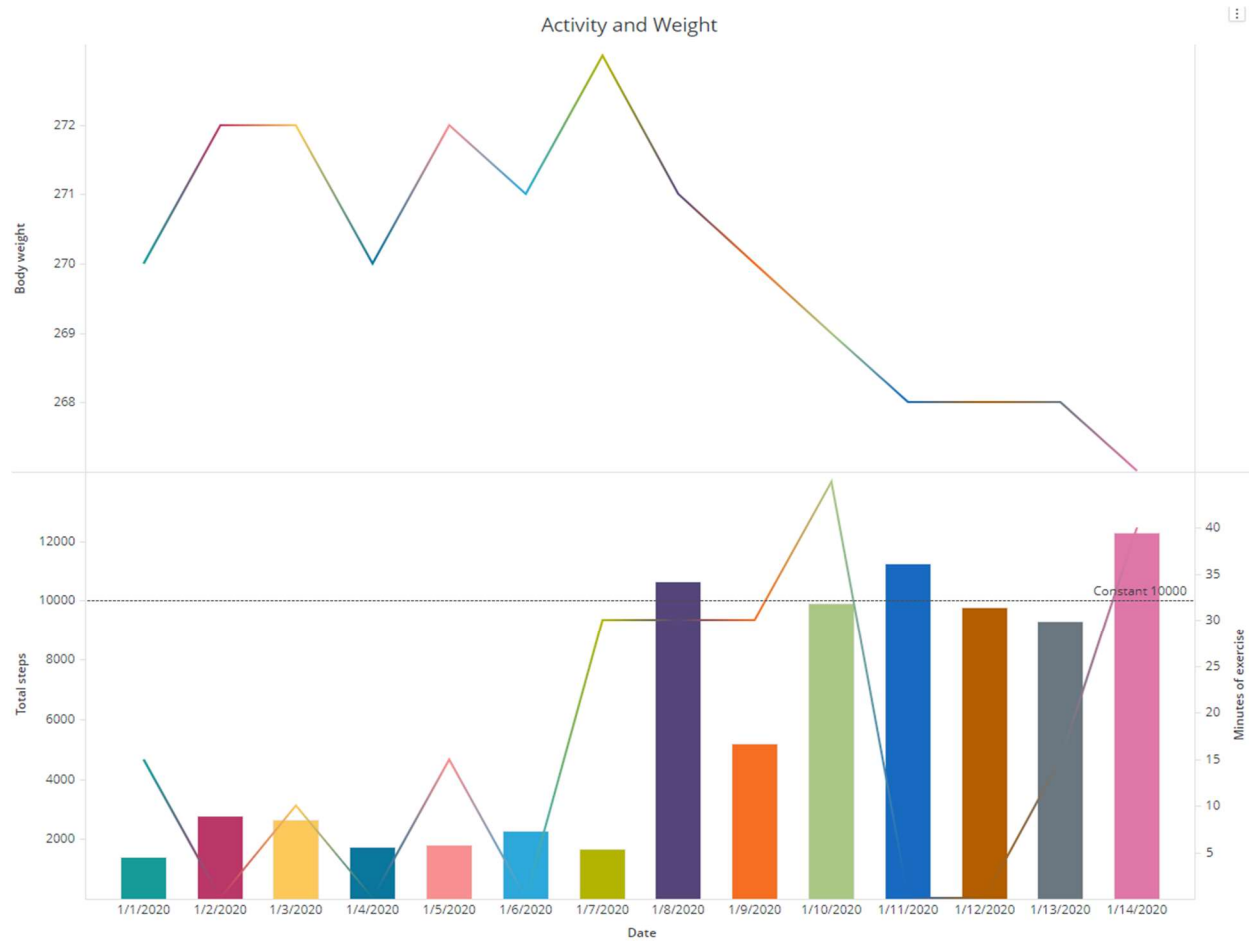
Activity and BMI

We observed earlier that having a high BMI was the largest indicator of Diabetes out of all the risk factors. Because of this, the visualization on our nutrition dashboard is an extremely important one. If the patient is overweight, we would want them to get into the expected BMI range as quickly as possible in order to avoid developing complications that could make them sick. Consistency as well as having a high step count is key.

Weight

It is common to observe a reduction in body weight when a person increases their amount of exercise. This can be observed in earlier days where there was not a large difference in weight and the patient's step count was also under 4000 steps. Once the patient began increasing their step count to 5000 and up consistently, weight started going down as well. This is what our data is telling us for this specific patient, who had their body weight and number of steps monitored for two weeks. The AI for this patient would keep notifying them to remain active in an effort to continue the downward trend in weight until the patient is within a healthy BMI range of 18.5-24.9. Assuming other patients follow the AI's advice, this is the kind of improvement that would ideally be seen across all patients using the app.

Compliance Report

The compliance report is an effective way of observing how often the patient complied or ignored the AI's recommendation for each category. The goal of the alerts are to encourage the subject to be more mindful of his or her own health journey. We do not want to take the decisions out of the patient's hands or force them to comply with a diet or exercise plan but to nurture a thoughtfulness around their choices.

Diets are proven to not work long term and can give patients a poor relationship with food. The aim is to transition the patient from a risky lifestyle to a healthy one that they are happier with themselves.

Calories

Each alert would be push to the patient's phone to keep them in touch with their status. If a patient consumed a large number of calories early in the day the calorie threshold would be hit and suggest a low-calorie meal for the final meal of the day.

If the patient ate two meals in a row with a high fat content, the app would alert and suggest a low-fat final meal. Harm and threat reduction as well as daily advice would help with the continuation of care even after the patient leaves the hospital.

Exercise

A large part of these lifestyle changes are exercise. Including 10,000 steps into your daily activity is recommended as a way to increase circulation and general wellbeing. With wearables like a fit bit, tracking step and syncing the information to a phone would simple. This would keep track and remind the user to follow through to the full 10,000 steps. Getting the body up and moving is highly recommended for weight loss programs.

Sugar

Diabetes and prediabetes makes processing sugars an ordeal on the body. We track sugar and alcohol to warn the user of its effects in large quantities. If there is consistent overindulgence the alerts would record the user ignoring the prompts as on any of the alerts above. Every week the user's physician would get a report of how the patient is adhering to the new lifestyle and would decide if further counseling or intervention is required for the patient's wellbeing.

Macros and Calories
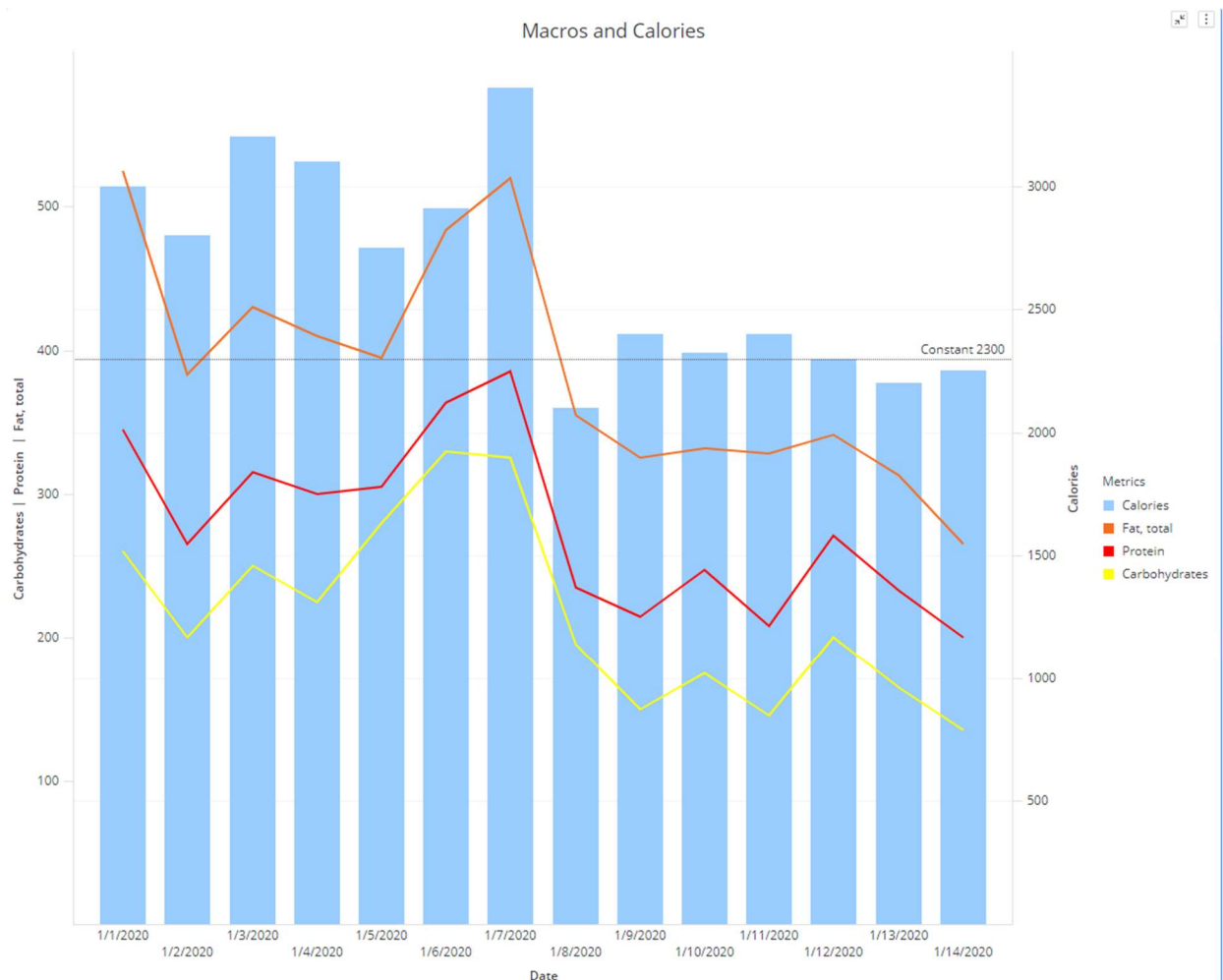
Keeping track of macros and calories is an important part of staying healthy and losing weight as well as managing pre-diabetes. Specifically, in this case, we related the amount of fats, protein, and carbohydrates in comparison to the number of calories the patient was consuming. The goal is to reduce the amount of consumption overall since portion control is a big part of being healthy. Reducing the number of fats will make it easier for the patient to lose weight. It's likely that this patient began taking food recommendations from the AI based on the Glycemic index since those foods are also good for reducing blood sugar in patients who are borderline.

The ideal calorie count for women is around 2000 and for men its around 2500. We can see the trend on the graph going down over time, showing that the patient took the recommendations from the AI and began reducing overall calorie intake. Before, calorie and fat intake were far above the recommended limits. After a few days of using Sugar Free, the patient was able to see a decrease in calorie consumption, also in turn decreasing the number of fats, proteins and carbs. This data, in combination with the increased exercise and number of steps the patient is taking (as seen on the activity and weight graph) would largely contribute to the results that are being observed- the patient on the path to losing weight and becoming healthier.

Risks factors

Food Risk Factors

Date	Sugars g	Cholesterol	Alcohol in ML	Water In L
1/1/2020	150	500	5	2
1/2/2020	130	400	0	2
1/3/2020	120	300	5	1
1/4/2020	125	550	0	1
1/5/2020	110	200	2	3
1/6/2020	150	255	0.6	2.1
1/7/2020	160	210	0	1.2
1/8/2020	185	300	0	4
1/9/2020	66	225	0	2
1/10/2020	36	412.5	0	2.1
1/11/2020	48.75	150	1.5	2.25
1/12/2020	34.95	191.25	0.5	3
1/13/2020	52.5	157.5	0	3
1/14/2020	48	375	1	1.5

We monitor major risk factors as they are a danger to the patient on their own. WebMD cites alcohol as one of the worst items you can consume while prediabetes or diabetic. Stating:

"While moderate amounts of alcohol may cause blood sugar to rise, excess alcohol can actually decrease your blood sugar level -- sometimes causing it to drop into dangerous levels, especially for people with type 1 diabetes.

Beer and sweet wine contain carbohydrates and may raise blood sugar.

Alcohol stimulates your appetite, which can cause you to overeat and may affect your blood sugar control.

Alcoholic drinks often have a lot of calories, making it more difficult to lose excess weight.

Alcohol may also affect your judgment or willpower, causing you to make poor food choices.

Alcohol can interfere with the positive effects of oral diabetes medicines or insulin."

Being such a risk factor we saw fit to record and display all of a patient's alcohol consumption.

Sugar and cholesterol are hard to process for the body especially with a suffering endocrine system. Reducing consumption of those substances is a priority. Tracking both of those with a threshold to warn the patient to limit any more consumption for that day would allow the patient to change their actions.

Conclusion

Using our Sugar-free Software, any insurance company like Aetna collaborated with its affiliated hospitals can develop a strategic management plan to proactively screen, assess, follow-up, and evaluate patients with prediabetes to achieve their target goals and objectives making a difference in the healthcare community. This is also a very affordable option instead of having patients spend a lot of money on things like a nutritionist and having multiple doctor's appointments for continuing care.

Our dashboards are beneficial for any healthcare facility and society because prediabetes affects millions of people throughout the United States and countless others in the world. For the sake of this country's public health, healthcare facilities need to be able to find the people who are at risk for developing diabetes and provide them with the education and means to avoid becoming diabetic.

Symptoms may not be obvious to many people- the Mayo Clinic lists increased thirst, frequent urination, excess hunger, fatigue, and blurred vision to be the main symptoms.

These symptoms appear when glucose levels are either too high or too low, and not everyone gets every symptom. It is extremely important for people to be aware of symptoms, because if someone has pre-diabetes without knowing about it, lifestyle changes cannot be made to improve worsening the diabetes even further.

Having the ability to track one's own nutritional levels and learning about the importance of keeping track will allow people to understand that pre-diabetes should be seen as a warning, and that change is urgently needed to avoid worsening the condition .The focus of this data collection and understanding the output is to track some important risk factors daily.

Our Diabetes dashboard is very beneficial in weeding out anyone who might be close to getting diabetes. After we know who needs it, our Nutritional dashboard helps every individual have more control over their own healthcare. Since there are so many factors that go into someone reaching the diabetic stage, it helps to have an application that can help supplement the changes in lifestyle that are needed to avoid it.

For customers, it improves patient care and improves overall quality and satisfaction of patients. Patients will feel like they have more control over their own care and can-do things that will naturally help them have a healthier lifestyle instead of jumping to medications. This emphasizes how holistic care can be helpful in preventing conditions like diabetes. Having a healthier lifestyle because of the application will help with things besides just diabetes as well such a weight loss and people's relationship with food. All of this will help the population by creating an affordable path to reducing cases of diabetes.

Many people who develop diabetes also end up developing other problems in turn. The rate of people who have other issues like cardiovascular disease or even obesity could benefit from an application like this in the long run, since a lot of the risk factors we are trying to correct in those with diabetes are the same with other conditions. Finally, in case of emergencies, it can prove useful for the companies to perform collaborative care for the patients if the patients feel like switching to a different hospital.

This will also deepen the relationship with the healthcare organization and patients because the doctor will act as the go-to person for when the results are not good, and the AI determines a visit is needed. Physicians will have to be less involved in the process of the continuing care.   By sharing medical records immediately with the insured hospitals, these applications can impact lesser wait time in appointment scheduling and mainly on insurance verification.

With Aetna's application installed on people's smart devices, the outreach of the company would enhance along with the patient education. Aetna needs applications like this that will make it more popular and likeable in the long run. This will allow a large portion of the population to easily access and monitor themselves. It's also better for accessibility because in some cases, these kinds of monitoring devices can be covered by insurance to make it easier for most people to obtain.

This is an application that will give the company a competitive advantage over other health insurance companies because it has a focus on preventative care and lifestyle changes instead of having a focus on the pharmaceutical drugs.

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