Project Title:

Beyond the needle: Evaluating the Accuracy of Continuous Glucose Monitors Among UCF Students

Project Objective or Aim:

This project aims to determine how effective a specific continuous glucose monitor (GCM) is in predicting average blood-glucose levels. Through the collection of self-reported data from students, this research will aid in determining how accurate CGM's are at predicting A1C levels in diabetics. In addition, we would like to find out if machine learning models can accurately predict A1C results and identify potential at-risk individuals earlier than standard clinical testing. We hope this research on determining CGM accuracy will help reduce emergency situations and improve users' management of their diabetes in their day to day lives.

Project Background and Significance:

Diabetes is a widespread and oppressive condition. It impacts tens of million adults in the United States. Hundreds of thousands of children are also impacted. Many run into emergencies as a result of this condition, with hospitalization or even death as a result. What is important to note is these emergency scenarios can be preventable and avoidable with proper detection. Early detection is key. This research will compare CGM data to A1C values, the gold standard, in a controlled sample of UCF students. With the addition of self-reported data, we aim to evaluate whether a machine learning model can enhance A1C prediction accuracy.

Research Methods:

This project would be created in phases, with each lasting 2-3 weeks. Phase 1 (7/1-7/14) would be dedicated to finalizing the study design, creating consent forms, and determining recruitment materials to get participants in the study. Approximately 30 UCF students with Type 1 or Type 2 diabetes should be recruited for the study. A1C blood tests should be scheduled for participants via a local lab.

Phase 2 (7/15-8/14) would consist of the initial data collection. CGM data would be tracked through reports that participants submit. These must be verified. The participants will also log their diet info and any notable glucose events on a daily basis. We will be communicating with the participants each week to make sure they are logging info at the correct intervals.

Phase 3(8/15-10/15) will be used to continue monitoring the participants info and issue a midway survey. This survey will ask the participants about their confidence in the accuracy of their CGM, as well as any lifestyle changes that have been influenced over the course of this study. This is also where preliminary data visualization of glucose trends will take place.

Phase 4 (10/16-10/31) will include the final phase of data collection, as well as collecting final A1C blood work results from the participants. All their CGM data from the last 90 days will be downloaded, and we will verify that the data is complete. We will also conduct an exit interview with the participants to gather some feedback on their CGM use.

Phase 5 (11/1-11/15) is for data analysis. The correlation between the CGM reported average glucose and lab reported A1C will be analyzed through regression. Measurements like the mean absolute difference and percentage within the clinical accuracy threshold. This threshold will be officially determined at this time. As of now, plus or minus 10% is the likely threshold. An “extra” goal for this phase is to use a machine learning model to accurately predict A1C results based on the logged diet and lifestyles of the participants. This is an exploratory goal.

Phase 6 (11/16-11/30) will be the final phase. Here we will be focused on creating visualizations of what the team learned for accuracy of the CGM devices, documentation and poster preparation. Charts and graphs will be created to showcase glucose trends and A1C comparison scatterplots. A final written report will be created, drawing conclusions on how accurate the CGM devices are at estimating A1C. In addition to that main conclusion, we will also be outlining findings on common discrepancy sources such as food types and lifestyle changes (stress, vacations, etc).

Expected Outcome:

The expected outcome can be sorted into 4 main categories. Deliverables, Knowledge Gained, Impact on the field, and impact on the UCF community.

Deliverables will include a dataset of CGM and lifestyle data with corresponding A1C values. There will also be a trained machine learning model to predict subjects A1C results from the combination of CGM and lifestyle data collected. There will be comparisons between the CGM predictions against the actual A1C values of the UCF participants. A poster will be created to showcase our research groups findings in a way that easily conveys our results.

For knowledge gained, this project will serve as insight into how well CGM’s actually predict these diabetes related metrics in the young adult population. It will also include knowledge on how to create a machine learning model that can be used to monitor and predict health metrics.

Speaking of the field, our research will contribute to the building field of understanding CGM effectiveness in this lesser studied demographic. The majority of field research is aimed towards the older, more often impacted generation. Our research will also support future research in understanding health metrics through machine learning. The machine learning advancements in this day and age are unprecedented, and similar ML algorithms can be applied to other medical condition analytics.

With regards to the UCF community, this model will show students how they can apply technical skills to provide support and solutions to health challenges plaguing the medical industry. It can also serve to inspire other students to create their own project based on their interests. Our project will show them that the technical support pipeline can bridge a gap in any industry. The research, both on health metrics and machine learning, can be applied in a variety of ways with future research teams at this school.

Literature Review.

Biswas, A., Chakraborty, G., & Roy, S. (2025). Portable IoT-Based Health Monitoring and Prediction System with Machine Learning. *2025 AI-Driven Smart Healthcare for Society 5.0*, 218–223. https://doi.org/10.1109/ieeeconf64992.2025.10963009

This article was looking at a portable Internet of Things based health monitoring system used to predict health in an accurate manner. The researchers collected certain vitals like heart rate and oxygen saturation, using the machine learning model to anticipate if they were at risk of health issues. The findings of the study led researchers to believe that a lightweight monitoring device with this technology can be effective in proactively taking action to prevent health issues. This will be useful in understanding how portable devices impact health monitoring for individuals.

K, S., P R, A., R, G. J., & P, H. (2024). Short-Term Prognosis of Asthma Flare-ups: A Predictive Model. *2024 4th International Conference on Innovative Practices in Technology and Management (ICIPTM)*, 1–5. https://doi.org/10.1109/iciptm59628.2024.10563498

This study aimed to develop a predictive model for short-term asthma flare-ups. They used patient data, environmental factors, and supervised learning techniques to accomplish this goal. My research is following a similar format, and I can use the same methodologies, predicting A1C anomalies in contradiction to asthma flare-ups.

Kim, N., Lee, D. Y., Seo, W., Kim, N. H., & Park, S.-M. (2022). Toward Personalized Hemoglobin A1c Estimation for Type 2 Diabetes. *IEEE Sensors Journal*, *22*(23), 23023–23032. https://doi.org/10.1109/jsen.2022.3215004

This study focused on evaluating the accuracy of Flash Glucose Monitoring (FGM) systems. Researchers compared FGM readings and referenced blood glucose values, finding that their is strong accuracy in the results. This journal article will be essential for understanding the limitations of CGM's. It will also provide a frame for evaluation criteria for accuracy in my own research.

Ogochukwu Ugbomeh, Versse Yiye, Ebuka Ibeke, Chinedu Pascal Ezenkwu, Sharma, V., & Alkhayyat, A. (2024). Machine Learning Algorithms for Stroke Risk Prediction Leveraging on Explainable Artificial Intelligence Techniques (XAI). *2024 International Conference on Electrical Electronics and Computing Technologies (ICEECT)*, 1–6. https://doi.org/10.1109/iceect61758.2024.10739320

This journal details how researchers are using XAI techniques to identify key metrics that would predict stroke risk. This study resulted in highly accurate predictions from the models. This journal will be helpful in my research for understanding how complex processes of the body can be recorded and used to train machine learning models.

Rishi Manikanta Adapala, Yaswanth Kancharla, Shaik, B. A., & Jyotsna C. (2025). Leveraging Machine Learning to Predict Obesity Trends: Insights from Lifestyle and Biometric Data. *2025 International Conference on Computational, Communication and Information Technology (ICCCIT)*, 417–423. https://doi.org/10.1109/icccit62592.2025.10927991

This study was focused on analyzing people's behavior and biometric data using machine learning to predict obesity trends. The ML model used metrics like activity level, BMI, and diet to achieve highly accurate predictions. My goal is to research metrics for preventing future health issues, so a similar researching strategy will be employed, and I can use this as a sample layout to follow.

Preliminary Work and Experience:

I am currently an undergraduate student, working towards my B.S. in Computer Science at UCF. My relevant coursework includes Algorithms in Machine Learning, Data Structures, and Mobile App Development. I previously worked as an undergraduate researcher at the same school, where I used machine learning to analyze metrics of the heart. This experience gives me a strong foundation in the machine learning and research spaces. My personal motivation for this project comes from my family, and how they have to navigate through life with caution due to health concerns. My youngest brother has asthma, and from his experience I can see how valuable research is on determining accuracy of health measurement systems.

IRB/IACUC statement:

This project will involve collecting physiological data from human participants. As a result, IRB approval will be required.

Budget. Total: $1302

Item	Amount	Purpose
2 CGM Devices	$800 (about $100) per device per month for 4 months	Monitor participants' glucose in the event they do not have access to one.
Diet Tracker App Subscription	$90	Premium access of food logging to make the process efficient and easy
Cloud Storage for Data	$40	Reliably and securely store participant data
Gift Cards (Participant compensation)	$300	30 $10 gift cards to entice volunteers for testing
Poster Printing	$72	Large poster for presenting findings