The Impact of Online Asynchronous Diabetes Education Versus In-Person Diabetes Education on Adult Patient Reported Outcomes in Austin, Texas

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Introduction

Diabetes is one of the most common chronic diseases in the world and has steadily increased in prevalence since the early 2000s.[1-9] According to the Center for Disease Control and Prevention (CDC), in 2018, there were 3.6 million patients between the ages of 18-44 diagnosed with diabetes in the United States.[10] Lack of diabetes management can exacerbate ones health, leading to cardiovascular diseases, blindness, foot and leg amputations, and/or renal failure.[1,2] As such, it is important to equip diabetic individuals with the appropriate health literacy and knowledge needed to decrease the burden of diabetes. To effectively reduce health complications due diabetes, individuals must practice self-care behaviors such as medication adherence, exercise, weight management, self-recognition of symptoms, and self-monitoring of glucose levels.[1-5,7] Recent literature suggests that education deployed via in-person or online interventions can successfully improve self-efficacy in diabetes management.[1-9]

In-person educational workshops have improved psychological status, glycemic control, and medication adherence of diabetic individuals.[3-4] Davoust et al. conducted a randomized-controlled trial pilot study to assess the impact of an in-person educational workshop on medication adherence of individuals in a correctional institution. Results indicated that participants showed a significant decrease in blood sugar levels and expressed interest in future educational sessions.[3] In another study conducted by Chai et al., participants who received professional self-management education experienced significant decrease in anxiety and depression and improvement in glycemic control compared to the control group that did not receive the intervention.[4] However, the in-person format of education often experience challenges in access due to geographical barriers, transportation cost barriers, and limited space per workshop.[5-7] On the other hand, online interventions overcome these barriers to access with

material accessible via the internet. In addition, online interventions offer digital gamification and video materials that can be supplemented or revisited as compared to an in person that is not recorded and shared.[8-9] According to Talley et al., gamified education improves individual engagement with their health, which can consequently lead to better self-management behaviors.[9] Despite the convenience of internet-based online education, a setback is the exclusion of individuals without the appropriate technology.

While recent literature suggests that online interventions improve access to diabetes education, the impacts of online education compared to in-person education on patient-reported outcomes remain largely unexplored. There is a lack of literature utilizing patient self-reported outcomes for diabetes education efficacy. As our health-care system shifts from a focus on the volume of health care to the value of health care, patient-reported outcomes (PROs) have become integral in understanding the patient experience of care.[11] More literature is needed comparing the impact of in-person diabetes education versus online diabetes education on PROs. In addition, quantitative data on weight, blood sugar levels, and psychological distress are more commonly collected and analyzed than qualitative data collected directly from patients' experiences.[3-5]

The aim of this study is to compare the impact of a 2-month online asynchronous education program to an in-person 2-month program on patient-reported outcomes for adult persons aged 21 to 44 in Austin, Texas with diabetes type I/II. This study contains an adequate number of subjects and requires a website platform for the online intervention which already exists and is accessible. Data collection is economically feasible; the pre- and post-intervention survey can be sent via email to reduce costs associated with interviews or mailed letters. Results from this study can advise resource allocations to either online or in-person diabetes

management programs, ultimately tailoring the interventions to patient preference and need. In addition, results can aid in the creation or adjustment of diabetes education material that will be deployed in clinical settings or via a website. Physical and mental patient harm is not to be expected from using a diabetes education website nor being in educational workshops held by diabetes educators. This study will be conducted in a non-coercive manner and participants will have the right to drop out of the research at any time with their data excluded from the results.

Based on the trends of previous literature, we hypothesize that online asynchronous patient education will achieve higher rates of patient self-management satisfaction compared to in-person diabetes education in the US diabetic patients aged 21-44. This is a 1-sided hypothesis because it is unidirectional, suggesting that one variable will achieve a greater value than another. Previous studies have stated that the flexibility of online-based educational resources can overcome barriers to access frequently found in in-person educational workshops such as transportation cost, time, and limited seating availability.[5-7]Online material can be tailored into different topics that diabetic patients can choose as relevant to their needs, as opposed to having in-person workshops that includes information a diabetic patient may already know.[6] In addition, gamification and video materials available on online platforms have increased patient engagement, improved diet regimen, and improved glycemic control.[5,8,9]

Methods

Study Design

A quantitative cross-sectional design will be employed for this study. A randomized controlled trial design was considered but not chosen to give participants freedom to choose between an in-person education program and an asynchronous online education program. The participants will also be able to choose between the English and Spanish language for both interventions. The Spanish language was included to accommodate the high prevalence of Hispanic individuals with diabetes mellitus in Texas.[12] A new diabetes education program will be created to answer this research question. The curriculum of both the in-person and online interventions will follow the Diabetes Education Curriculum by the American Association of Diabetes Educators.[13] Although the curriculum is intended for diabetes educators, the information from each module will be converted to lectures relevant for the participants. The educational material of this workshop will be created and deployed by 2 English- and Spanish-speaking registered nurses who are also certified diabetes educators from the Association of Diabetes Care & Education Specialists. Existing workshops in Texas, such as Healthy Living with Diabetes[14] and Ascension Seton Diabetes Education,[15] were considered but not chosen due to the short time frames of the programs. In addition, the mentioned programs lack classes for diabetes monitoring and problem solving compared to the more comprehensive Diabetes Education Curriculum. The modules of the Diabetes Education Curriculum are indicated in Figure 1.

Week 1	Introduction to Diabetes and Prediabetes
Week 2	Healthy Eating
Week 3	Being Active
Week 4	Taking Medication
Week 5	Monitoring
Week 6	Problem Solving
Week 7	Healthy Coping
Week 8	Reducing Risks

Figure 1. *Each topic of the in-person and online intervention by week.*

The in-person workshop will be 60-minutes long and will be taught by the 2 aforementioned 2 registered nurses from the American Association of Diabetes Educators. A previous study on a 90-minute diabetes education workshop led to increased self-management skills such as medication adherence,[3] but this workshop included group activities that will not be used to address the research question. In addition, general practice for nurse-led in-patient diabetes education in Iranian hospitals is 20-30 minutes.[16] Therefore, rather than a 90-minute intervention featuring additional time spent on small group activities, a 60-minute time frame including a 30-minute presentation will be used in this study. Participants will receive a 30-minute lecture facilitated by a PowerPoint slide on the module of the week. The slide will be projected onto a screen in the classroom. Post-lecture, participants will receive 10 minutes to answer a 3-question multiple choice quiz regarding the material of the week. Participants may discuss with their neighbors. Diabetes educators will spend 10 minutes going over the correct and incorrect answers. In the remaining 10 minutes of the workshop, the educators will answer any questions that the participants have. The registered nurses will create the PowerPoint slides and the questions for the multiple-choice quiz. The educators will also alternate between

teaching the English course and the Spanish course which will run concurrently on weekend afternoons. Participants will be given printed handouts with all the slides and a summary of important notes that they will be able to take home for review in the beginning of each workshop. Participants can choose between attending the workshop on Saturday or on Sunday. The study will have a total of 4 workshops each weekend in English or Spanish and on Saturday or Sunday. An additional family member or friend can go with the participant to offer support, but they will not be a part of the study.

Time	**Activity**
30 minutes	PowerPoint lecture
10 minutes	Multiple-choice quiz
10 minutes	Revision of multiple-choice quiz
10 minutes	Q&A between educator and participants

Figure 2. *Approximate time for each activity in the in-person intervention.*

The online asynchronous program will consist of 8 thirty-minute lecture videos that will be uploaded and accessed through the Diabetes HealthSense website. The overall creation of this online program will be facilitated by the registered nurses who are teaching the in-person intervention; the web developer for the Diabetes HealthSense website; and 2 software engineers with experience in gamification, visualizations, and website development. The video will incorporate graphics and charts to facilitate visual understanding of the modules. After completion of each video, the participants will take a 3-question quiz regarding the material of the video which will explain why the answer choices were correct or incorrect. Upon completion of the quiz, the online intervention will also offer additional resources from the Diabetes HealthSense website and interactive games to visually portray effective diabetes management.

The recommended games include Monster Manor, Empower, and HealthSeeker which are available online and via mobile devices. These diabetes educational games have increased patient motivation towards self-efficacy and diabetes health literacy.[17] Participants will have the autonomy to choose to review or not to review further material. Previous materials of each week will still be accessible throughout the 2-month period. Participants will have 1 week to complete each module with the deadline being 7 days from when the module was assigned. The videos will have captioning-services in both English and Spanish to accommodate for participants who are hard-of-hearing.

The curriculum and topics for both the PowerPoints and the videos is depicted in Figure 3.

Introduction to Diabetes and Prediabetes	• Definition and signs of prediabetes and diabetes • Health problems related to exacerbated diabetes • Self-management impact on diabetes
Healthy Eating	• Effects of common food • Portion control techniques • Recommended diet for diabetics
Being Active	• The benefits of exercising • Recommended exercise regimens • Tools that can be used to facilitate exercise
Taking Medication	• Effects of common diabetes pills; how they help • Explanation of insulin • Medication adherence tips and tools
Monitoring	• Importance of glycemic control for diabetes management • Glycemic control tips • Common glycemic control tools and their operation
Problem Solving	• Problem solving steps: identify the problem, find solutions, take action • Contacting diabetes care and education specialists for guidance • Example problem scenarios and solutions
Healthy Coping	• The role of families and friends • Online support groups • Stress management techniques
Reducing Risks	• Self-management techniques on reducing exacerbation • Recommended screenings • Communication with providers

Figure 3*. Curriculum of each topic taught in the in-person and online intervention.*

Participants will receive 2 surveys pre-intervention. The first survey is a demographic survey for age, sex, zip code, preferred speaking language, and their diagnosis (type I/II diabetes). The second survey is the Self-Care Inventory-Revised Version (SCI-5) tool. Post-intervention, participants will take the same survey.

Setting

This study will take place in Austin, Texas. The in-person educational workshops will be held at the University of Texas on Saturdays and Sundays for 2 months. Saturday and Sunday were chosen to accommodate for participants who work on weekdays. Free bus passes will be provided for participants. The online educational workshop will be accessible via the Diabetes HealthSense website. Accounts and log-in credentials will be provided to the participants.

Participants

Recruitment will be conducted via online ads on Facebook, newspaper ads and articles, radio ads, and poster ads placed in the University of Texas and public transportation stations. Participants who are diagnosed with type 1 or type 2 diabetes at the St. David's North Austin Medical Center or at the St. David's South Austin Medical Center will be emailed the advertisement. The inclusion criteria will be explicitly written and stated in the advertisements. Participants who wish to enroll will either call or email the research team with their name, preferred day of intervention (Saturday or Sunday), preferred language of intervention (English or Spanish), and preferred style of education (online or in-person). As a screening procedure, participants will also be required to email or mail proof of diabetes diagnosis to the research team. Participants will be notified via their email if they are selected for the study. If at any point the participants want to drop out of the study, they will still be allowed to participate in the interventions, but their survey data will not be included in the final results section. The survey

data of participants who miss more than 2 of the in-person workshops or 2 online modules will not be included in the final results.

The inclusion criteria include the following: participants who are clinically diagnosed with type 1 or type 2 diabetes mellitus by the time of this study, participants who are prescribed diabetes pills and insulin, and participants who are between the age range of 21-44 by the start of the study. Participants who do not have appropriate internet and computer access either at home, at a friend's location, or at a public library will be excluded from the online intervention but will be given the choice to attend the in-person intervention. Participants who cannot speak, read, or write in English or Spanish will be excluded from this study due to the limited language availability of the interventions. Participants who are hard of hearing and who do not have an audio-assistance device will be excluded from the in-person education but will be given the choice to attend the online intervention which offers captioning services.

Variables

The self-management skills will be self-reported by participants using the Self-Care Inventory-Revised Version (SCI-5) tool which asks the participants to choose 1-5 on a Likert scale ranging from never to always.[18] Participants who choose an average of 1-2 for a variable will be marked as having low outcomes. Participants who choose an average of 3 for a variable will be marked as having medium outcomes. Participants who choose an average of 4-5 for certain variables will be marked as having high outcomes.

Average of 1-2	Low outcome
Average of 3	Medium outcome
Average of 4-5	High outcome

Figure 4*. Numerical scores in the SCI-5 tool and their categorical outcomes used in this study.*

Glycemic control will be measured based on their tendency to check blood glucose with their monitor, record glucose results, check ketones when their glucose level is high (for those with type 1 diabetes), carry quick acting sugar to treat low blood glucose, and if they adjust their insulin dosage based on glucose values, food, and exercise. Medication adherence will be measured by their tendency to take the correct dose of diabetes pills or insulin and to take the pills at the right time. Diet control based on their tendency to eat the correct food portions, eat meals/snacks on time, keep food records, read food labels, and treat low blood glucose with the recommended amount of carbohydrates. General practice will be measured based on their tendency to attend clinical appointments, wear a Medic Alert ID, and do physical activity.

Data sources/measurement

The SCI-5 tool from the University of Miami will be used to assess patient reported outcomes for self-management in both groups. The 15-question survey will be emailed or mailed to participants before the start of the intervention. The participants will receive the same survey post-intervention.

Self Care Inventory-Revised Version (SCI-R)

This survey measures what you *actually do*, not what you are advised to do. How have you followed your diabetes treatment plan in the past 1-2 months?

	Never	Rarely	Sometimes	Usually	Always	
1. Check blood glucose with monitor	1	2	3	4	5	
2. Record blood glucose results	1	2	3	4	5	
3. If type 1: Check ketones when glucose level is high	1	2	3	4	5	Have type 2 diabetes
4. Take the correct dose of diabetes pills or insulin	1	2	3	4	5	Not taking diabetes pills or insulin
5. Take diabetes pills or insulin at the right time	1	2	3	4	5	Not taking diabetes pills or insulin
6. Eat the correct food portions	1	2	3	4	5	
7. Eat meals/snacks on time	1	2	3	4	5	
8. Keep food records	1	2	3	4	5	
9. Read food labels	1	2	3	4	5	
10. Treat low blood glucose with just the recommended amount of carbohydrate	1	2	3	4	5	Never had low blood glucose
11. Carry quick acting sugar to treat low blood glucose	1	2	3	4	5	
12. Come in for clinic appointments	1	2	3	4	5	
13. Wear a Medic Alert ID	1	2	3	4	5	
14. Exercise	1	2	3	4	5	
15. If on insulin: Adjust insulin dosage based on glucose values, food, and exercise	1	2	3	4	5	Not on insulin

Figure 5*. Self Care Inventory-Revised Version (SCI-5) from the University of Miami.*

Bias

There may be selection bias which will lead to a sample that does not provide a representative sample of the adult diabetic population in Austin, Texas. To mitigate this potential bias, we included many methods of advertisements ranging from online and radio to print

material. The printed advertisements will be placed 10 streets north, east, south, and west from the University of Texas. The study will also be advertised on major transportation stations in the Capital Metro, which is a public transportation service in Austin, Texas. In addition, the St. David's North Austin Medical Center and St. David's South Austin Medical Center were strategically chosen to be advertisement centers since one is located in the north of Austin and the other is located in the south of Austin. This will provide a participant sample from locals who frequent the north and the south of the city.

Study size

The recruitment period will end after there are at least 80 enrollees in the in-person intervention and at least 80 enrollees in the online intervention. The minimum enrollees will be 20 per classroom for the in-person intervention. The maximum enrollees will be 30 per classroom to accommodate the classroom size in the University of Texas. The Health Care Finance Administration recommends a classroom size of 2-20 students,[19] but we increased the maximum number to 30 to accommodate for participants who may switch to another workshop during the 2-month period due to schedule conflicts.

Results

The dataset used for analysis showcases the participant demographic information of diabetes self-management courses in Austin, Texas from 2015 to 2017. The information was published in 2019 on the Austin government website. Due to the purpose of this dataset, there were a majority of categorical variables and a few numerical variables such as age, year of the education workshop, and Problem Area in Diabetes (PAID) Scale score. Before cleaning up the data, there were 1688 observations and 25 features. An analysis of this dataset can bring forth sociodemographic information regarding diabetes self-management which can aid in diabetes research, diabetes education preparation, and diabetes education deployment.

The dataset was analyzed with the Python language and Pandas library via the cloud platform Google Colab. Before an analysis of this dataset was conducted, the dataset required transformation to a usable format via locating missing values and conducting value counts for each feature. There were missing values in all features with the exception of 'Class', 'Class Language', and 'Year'. The solutions used to mitigate the missing data were deleting the observations with NaN in 'Age' and filling in the rest of the categorical values with 'No data'. The NaN values in 'Problem Area in Diabetes (PAID) Scale Score' were kept in their original states to keep the data type as float, rather than converting to object. In addition, the features 'ZIP code (address)', 'ZIP code (city)', and 'ZIP code (state)' did not have any data. These three features were deleted since they did not bring forth any information. Another issue was the inconsistent format of the 'Food Measurement', 'Carbohydrate Counting', and 'Fruits & Vegetable Consumption' features. Some responses did not include 'days' as the unit. To resolve this issue, the responses (1-3, 4 or more) that did not have 'days' were appended with 'days'. After conducting a value count of all the features, results indicated that 'Sex', 'Race/Ethnicity',

'Diabetes Status (Yes/No)', 'Heart Disease (Yes/No)' and 'Education Level' contained 1-2 observations that does not bring forth relevant information. Such observations were deleted. Post-data-cleanup resulted in 1639 observations and 23 features.

An analysis of the Austin self-management dataset brought forth valuable information in terms of outliers, skewed data, participant demographics useful for workshop development, and support for previous literature indicating that health literacy impacts self-management tendencies. Visualizations were created by importing Seaborn, Matplotlib, and Plotly into Google Colab. Based on the boxplots in Figure 6 and Figure 7, there are no identified outliers found in age and Problem Area in Diabetes (PAID) Scale Score.

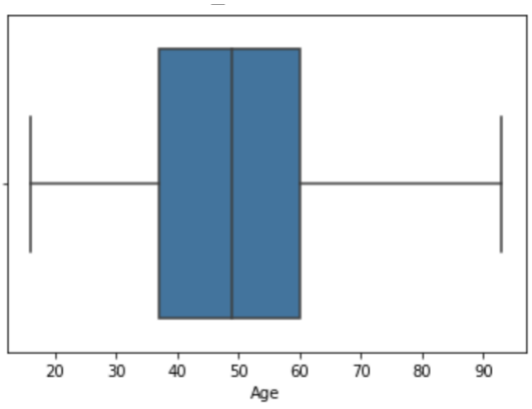

Figure 6*. Boxplot for age of participants.*

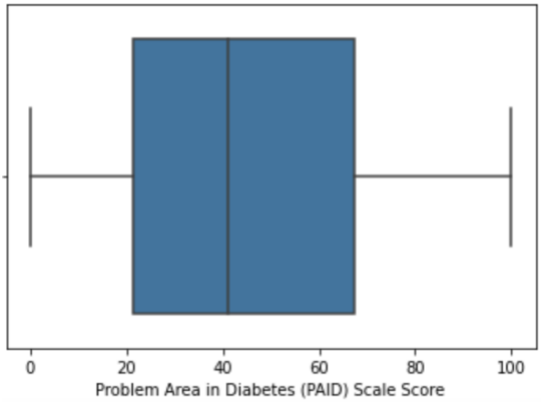

Figure 7*. Boxplot for PAID Scale score.*

Figure 8 is a histogram depicting that that the data for Problem Area in Diabetes (PAID) Scale Score is skewed to the left. However, this can be attributed to the fact that a score of 40 or above indicates severe emotional distress due to diabetes.[20] Subsequently, Figure 8 suggests that overall, half of diabetes workshop participants from 2015-2017 are not experiencing emotional distress.

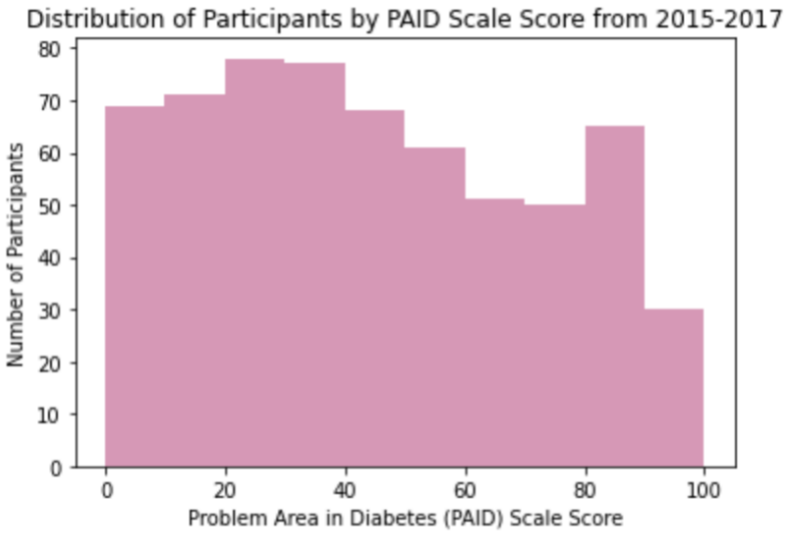

Figure 8. *Histogram depicting the distribution of PAID Scale score amongst all participants.*

To further analyze the distribution of PAID scale scores, the ages were grouped into Child, Adult, and Older Adult with the following age ranges: 0-20, 21-44, and 45-100. As indicated in Figure 9 when grouped by age, adults aged 21-44 tend to experience higher emotional distress due to diabetes as compared to older adults. Results from this analysis suggests that future curriculums of diabetes education workshops should emphasize emotional wellbeing and coping mechanisms especially for adults aged 21-44.

	count	mean	std	min	25%	50%	75%	max
AgeGroup								
Child	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Adult	139.0	50.575540	27.591361	0.0	28.75	48.75	74.375	96.25
Older Adult	481.0	42.546778	27.064216	0.0	20.00	38.75	66.250	100.00

Figure 9. *Descriptive table of PAID scale scores per age group (child, adult, and older adult).*

An analysis on the ZIP code data indicates the top 5 most frequent ZIP codes in this dataset: 78744 (8.18%), 78745 (7.87%), 78753 (7.38%), 78724 (6.77%), and 78723 (6.53%). Due to a

lack of coding knowledge, a map labeled Figure 10 was created using Adobe Photoshop. The map was derived from the Mary Sells Austin website[21] while the red markers were added via the editing program. Figure 10 showcases that the most frequent addresses of participants fall on the outer edges of Austin. This information suggests that the location of diabetes workshops can be placed on the outer edges or in the center of Austin to reduce potential transportation barriers.

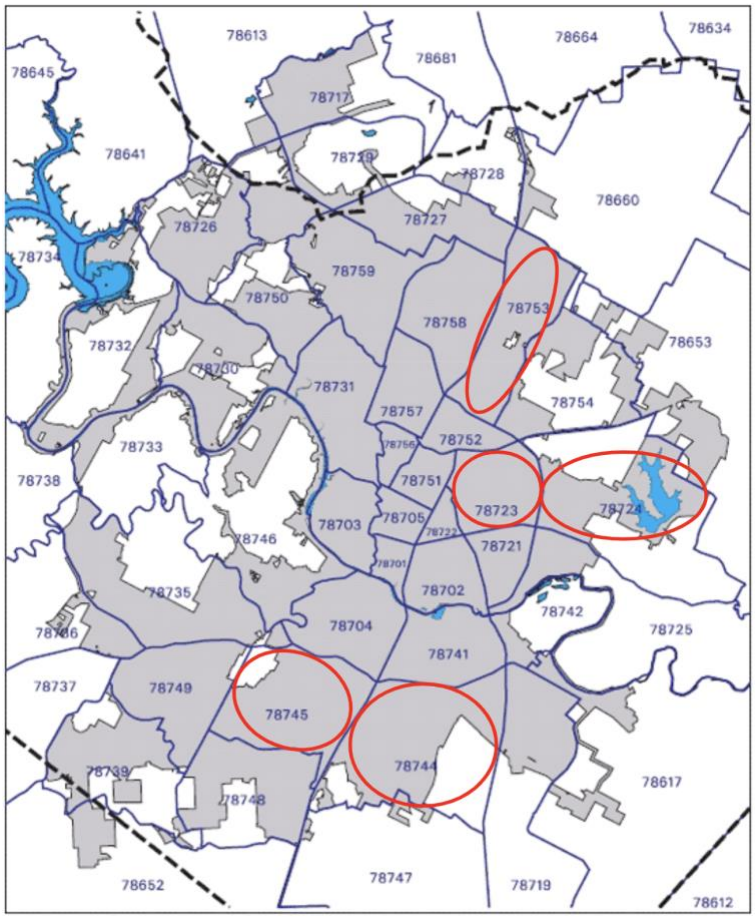

Figure 10*. Map of Austin, Texas from Mary Sells Austin website edited with the top 5 most frequent zip codes amongst participants of diabetes workshops from 2015-2017.*

In addition to presenting information for diabetes self-management curriculum development and workshop location, an analysis of the dataset also supported previous literature indicating that diabetes health literacy can lead to good self-management. Figure 11 depicts that participants with poor and fair diabetes knowledge tend to have 0 days of exercise while participants with

good diabetes knowledge tend to have 2 days of exercise. In addition, Figure 12 depicts that participants with poor and fair diabetes knowledge tend to have 0 days of food measurement while participants with good diabetes knowledge tend to have 1-3 days of food measurement. The results of this analysis demonstrate the beneficial impact on self-management habits for diabetic individuals, which can be improved via diabetes education.

Diabetes Knowledge	count	unique	top	freq
Fair	726	8	0 days	190
Good	425	8	2 days	86
No data	141	8	No data	40
Poor	347	8	0 days	99

Figure 11. *Table depicting frequency of days of exercise amongst participants with fair, good, and poor diabetes knowledge.*

Diabetes Knowledge	count	unique	top	freq
Fair	661	4	0 days	319
Good	387	4	1-3 days	138
No data	100	4	IDK how	34
Poor	325	4	0 days	175

Figure 12. *Table depicting frequency of days of food measurement amongst participants with fair, good, and poor diabetes knowledge.*

An analysis for a descriptive table on age, year of the workshop, and PAID scale score was also conducted and is reflected in Figure 13. Based on the figure, the range of the participants who

attended self-management workshops in Austin, Texas between 2015 and 2017 is 16 to 93 years old. The average age of participants is 49. The average year is 2016, which indicates that from 2015-2017, there were the most participants who attended in 2016. The PAID Scale Score in this dataset ranged from 0 to 100, with a mean of 44. In the 50% quartile, the PAID Scale Score is 49 which is higher than the 39 threshold for low emotional distress. Based on the data, the average participant warrants special attention in terms of emotional distress.

	Age	Year	Problem Area in Diabetes (PAID) Scale Score
count	1639.000000	1639.000000	620.000000
mean	49.322148	2016.033557	44.346774
std	15.219274	0.772369	27.366796
min	16.000000	2015.000000	0.000000
25%	37.000000	2015.000000	21.250000
50%	49.000000	2016.000000	41.250000
75%	60.000000	2017.000000	67.500000
max	93.000000	2017.000000	100.000000

Figure 13*. Descriptive table on age, year, and PAID scale score of diabetes workshop participants in Austin, Texas from 2015-2017.*

Despite transforming the dataset to a usable format, an unresolved issue that remained is the inability to create visualizations showcasing the values 2015, 2016, and 2017 for the feature ‘Year’. When visualizations are attempted, each value is sectioned into quarters such as 2015.25, 2015.50, 2015.75 despite ‘Year’ having an integer datatype. Due to a lack of time and coding knowledge to resolve the issue, the feature was not transformed. Visualizations using ‘Year’ was not conducted nor included in the final Google Colab file.

Conclusion

This research study was designed over a course of 6 weeks with the following steps: designing a research question, choosing a research design that best fits the question, locating a dataset that answers part of the question, analyzing the dataset, and interpreting the results. To pose a research question, one must start broad and narrow down to the limitations of previous literature to develop a question that is feasible, ethical, novel, interesting, and relevant to the community. In addition, choosing a design and developing a method to answer this research question requires extensive thought, planning, and efforts between a team of researchers. An issue during dataset selection was that there is no publicly available dataset for patient demographics on online education workshops. The dataset chosen for analysis only includes demographic data from participants who attended in-person workshops in Austin, Texas. As such, this dataset did not produce valuable insights for the workshop development of online self-management education. Although the chosen dataset did not fully answer the research question, it still brought forth valuable information for diabetes self-management education development and also supported previous literature indicating the benefits of health literacy on diabetes management. To effectively start the analyzation and visualization process, the dataset requires transformation into an analyzable usable format. Lack of knowledge in data analyzation tools such as Python can be compensated via resources from YouTube tutorials and evidence-based codes from Stack Overflow. In addition, depending on the volume and variety of the data, data analysis can answer sub-questions related to the primary research question. The information presented in this dataset, such as health information, education level, and current diabetes knowledge can be applied during the future development of diabetes self-management education interventions.

Due to a lack of coding knowledge, a visualization showcasing a map of the most frequent ZIP codes was not created in Google Colab, but rather manually created in Adobe Photoshop. With sufficient time and knowledge, future data visualization can include an interactive map of Austin featuring the most frequent ZIP codes of participants. Additionally, a future action for data analysis is grouping ZIP codes into counties and creating a map of the heat map of participants. This information can aid in the location selection of diabetes workshops. However, due to the lack of time and knowledge of counties in Austin, the ZIP codes were not grouped into a new feature.

While this research study was designed with the expectation of unlimited resources, a potential issue if conducted in real-life is the cost of hiring stakeholders and developing the online intervention. Next steps include screening and hiring English and Spanish-speaking diabetes educators and hiring software developers to develop the in-person workshop videos, visualizations, and games on the Diabetes HealthSense website. The workflow of the former is depicted in Figure 14 while the latter is depicted in Figure 15. Before the development of the online intervention can occur, consent is needed from the Diabetes HealthSense website to participate in this research and serve as a platform for online learning. As previously stated, the proposed research question will contribute to the body of literature for diabetes self-management education. Comparing the effect of an online education to an in-person education on PROs will shift efforts in development to the more effective intervention. Subsequently, results from this research question may improve health outcomes and increase patient engagement for diabetic individuals.

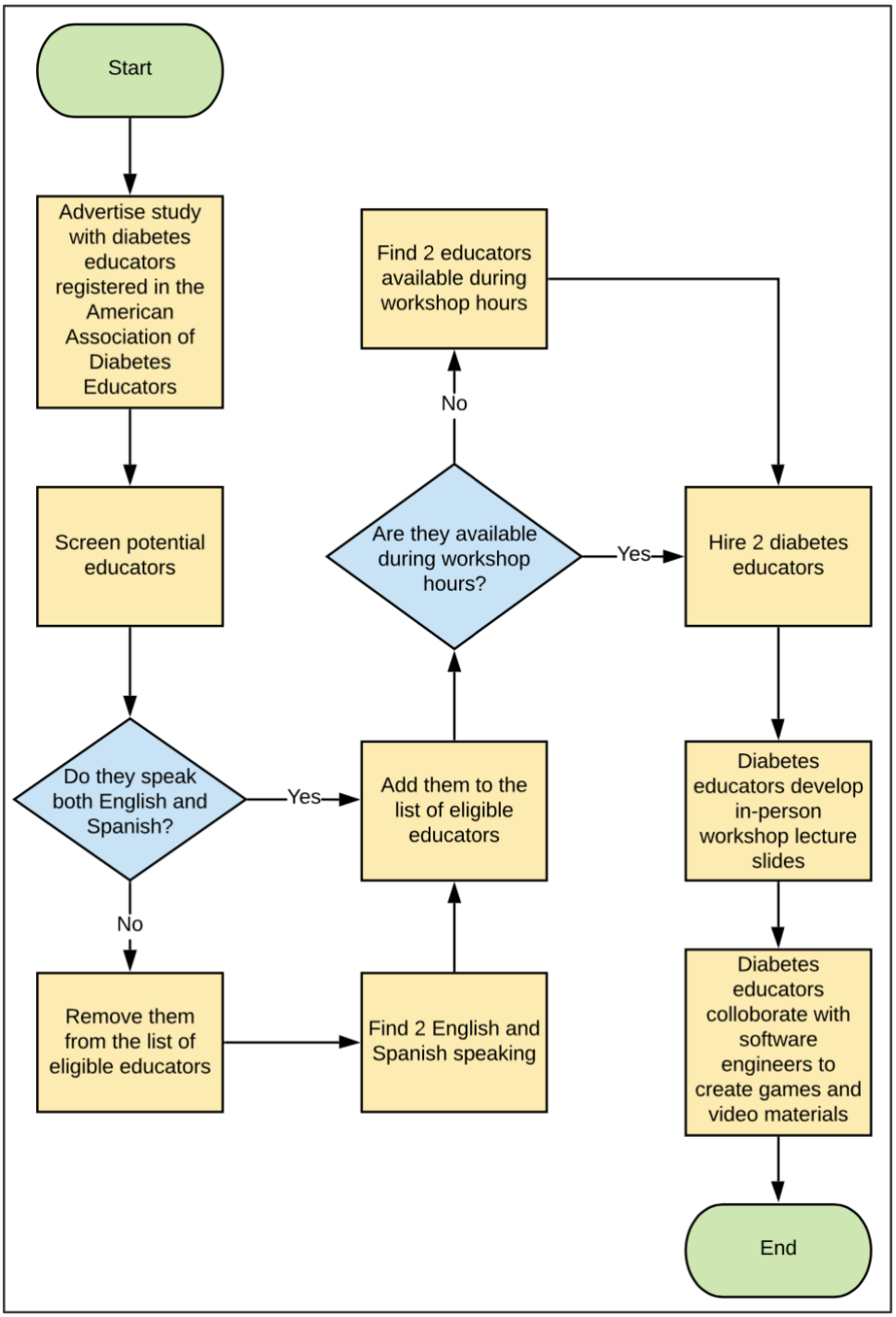

Figure 14*. Workflow diagram depicting activities for a diabetes educator before the deployment of the research study.*

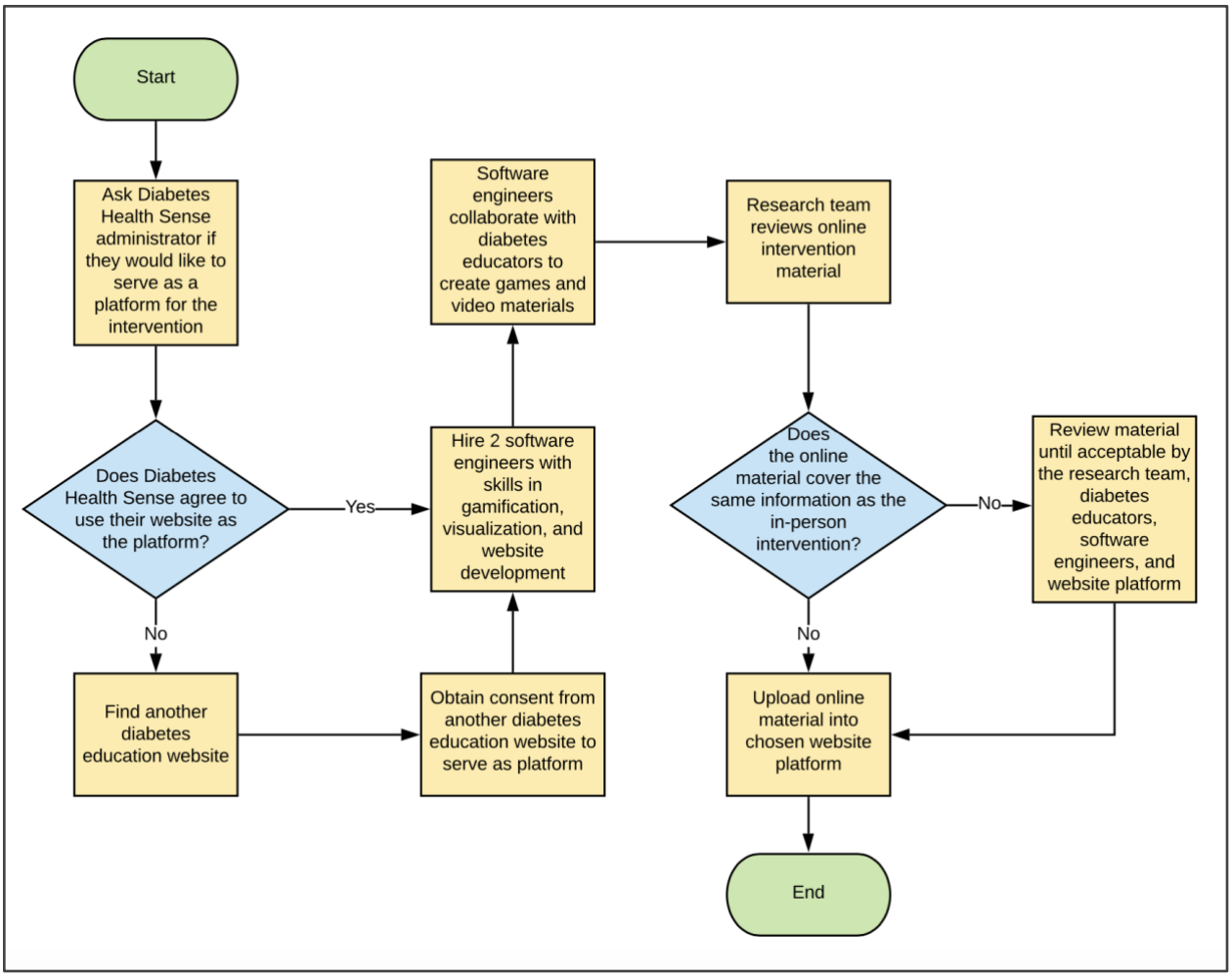

Figure 15*. Workflow diagram depicting the steps involved in creation of the online intervention*

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