Mar 23rd, 9:30 AM - 10:45 AM

Assessing the effectiveness of a clinic-based diabetes management program in a community setting

Justin Lupone
University of New Hampshire - Main Campus

The Joslin Diabetes & Wang YMCA Center Diabetes Management Program: Assessing the effectiveness of a clinic-based diabetes management program in a community setting

Justin Lupone
University of New Hampshire, Department of Health Management and Policy

Abstract

Diabetes in the United States occurs in approximately 8% of adults.[1] Diabetes, if not treated, can lead to many health problems such as blindness or loss of physical functioning, sometimes leading to amputation. However, Type 2 diabetes can be cured or kept under control through effective diabetes management. Many Type 2 diabetes patients let their diabetes become out of control through at risk behaviors, such as smoking, and poor diet, which in turn can lead to a worsening of their condition. With effective disease management, patients can avoid more severe effects of the disease and have higher quality of life. Joslin Diabetes Center operates a diabetes management program called "Why WAIT". Why Wait is a medically managed clinic-based program to teach Type 2 diabetes patients how to control and manage their diabetes. Joslin Diabetes Center has modified this program and initiated it in a community setting. Here I evaluate whether the community-based program can have similar outcomes to the clinic-based one. The modified community based program was at the Wang YMCA Center and involved seven participants who had full disclosure of the program in a hope to improve their diabetes management. Outcomes measured were Hemoglobin A1c, weight loss, and patient satisfaction collected through participant surveys and program staff. Bringing the Why Wait medically managed clinic-based program into a community setting at the Wang YMCA brings better benefits to the population of Type 2 diabetes patients through increased patient satisfaction.

Background

Currently, about 25.8 million people in the United States have diabetes and another 79 million have an estimated classification of pre diabetes.[1] Diabetes can also lead to many other health related problems. Diabetes causes the body to have high blood glucose levels, which in turn affects the body's ability to produce and/or use insulin. The body uses insulin, which is produced by the pancreas, to allow glucose to enter into the cells in the body. The blood glucose is either used or stored by the body for energy. Type 2 diabetes has been linked to body weight and physical activity. The body can become resistant to insulin as a result of excess body fat and diet.

A poor diet can lead to an excess amount of sugar in the body. Type 2 diabetes can be kept under control if closely monitored and maintaining proper diet and exercise.[2]

There are two classifications of Diabetes, Type 1 and Type 2 Diabetes. Type 1 diabetes occurs when the pancreas stops producing insulin and the person is insulin dependent. Type 2 is the more common form of diabetes and occurs when the body does not produce enough insulin or the body becomes insulin resistant. When the blood glucose cannot enter into the cells it can cause two problems; a short-term problems is that the body can become starved for energy. The long-term problem results when there is too much blood glucose in the body. High blood glucose can lead to different bad health outcomes such as blindness, loss of physical functioning, amputation, kidney disease, heart disease, nerve damage and high blood pressure.[3] Programs, such as one at the Joslin Diabetes Center, work to provide care for diabetes patients, potentially reversing the effects of Type 2 diabetes in some patients.

Joslin Diabetes Center is a leader in diabetes care, education and research. In an effort to provide better diabetes management knowledge and skills to their patients, Joslin runs a diabetes weight management program for its patients called "Why WAIT". This program has run since 2005 and holds three sessions a year. The Why Wait program is a 12-week medically managed diabetes weight management program designed to educate its participants to manage their diabetes through increased knowledge about their disease, education on how to maintain an effective diet and how to exercise properly. Over the course of the 12 weeks, the participants work with a physician, a nurse practitioner, a psychologist, an exercise physiologist and registered dietitian. Each participant is put on a strict diet that is reported to the dietitian each week. Each participant is also put on an exercise routine, which is reported to and managed by the exercise physiologist. The Joslin Why WAIT program is an effective has show to be an effective program to achieve positive health outcomes for type 2 diabetes patients.[4]

To assess programmatic fit, Joslin's Why WAIT team puts each applicant through a screening process. The screening process includes interviews with each of the team members. Each program contains between 10 and 15 participants with a goal of 12. The screening process is conducted to eliminate participants that will not succeed in the program as a result of an aversion to lose weight and exercise, aversion to working in structured groups or those with co-morbid conditions to their diabetes.

In 2012, the Joslin Diabetes Center in partnership with the Greater Boston YMCA modified this program to be offered in a community setting. The Y Weight Loss program was offered to seven participants at the Boston Massachusetts Wang center from September to December of 2012. The program was based on the proven success of the Why WAIT program offered by Joslin. The program also runs for 12 weeks and has the same structure with some modifications. The program met once a week and included a staff containing a Wang center employee as the program manager, a Wang Center exercise physiologist, a registered dietitian and an observer from Joslin Diabetes Center. The pilot program was smaller only containing 7 participants versus 10 to 15 and did not include any medical personnel. Each participant had to partake in the diet and exercise guidelines set by the Why WAIT program and went through a similar screening process to eliminate people that would not fit, the program manager of the pilot from the Wang center handled screening.

If successful, offering community based programs such as this creates tremendous opportunities for diabetics and communities seeking to better manage and care for diabetes. Here, I evaluate whether a clinic-based medically managed weight management program can be effectively redesigned for deployment in a community setting with similar outcomes given modifications. The outcome measures used to measure this research question are weight loss, hA1c levels and patient satisfaction. I hypothesize that the community based diabetes management program will yield similar outcomes as the medically managed clinic-based program using measures of weight loss and Hemoglobin A1c levels while increasing patient satisfaction.

Methods

The pilot program at the Wang center was heavily based of the Why WAIT program conducted at Joslin Diabetes Center. The participants were self selected and sought out programmatic information from the Wang YMCA. They did not have to be members of the YMCA. There was no cost to participate. After initial inquiry, each potential participant then entered the screening process. This insured that each person with Type 2 diabetes that was not currently on insulin, was willing and able to lose 5 to 7% of total body weight, was able to attend 12 two hour weekly sessions at the YMCA, could participate in daily exercise and a meal plan taken from the Why WAIT program at Joslin and attend classroom sessions once a week for the duration of the program about diabetes

involving group discussions. Each participant was also required to have an active relationship with a primary care physician (PCP).

Once enrolled, each participant was required to see their PCP in order to obtain a pre, mid way, and post hemoglobin A1c tests. Although not required, participants could see their primary care physician more often if participant felt it was necessary. The program also included a pre and post survey with questions related to satisfaction with the program and its attributes. This tool used a total of eight questions and was conducted at the first and last session of the program. The survey followed a standard 5-point likert scale with an open-ended question at the end. The first three questions on the pre survey were designed to gauge the participant's current confidence in their ability and skill level in the management of their diabetes, weight control and health related goals set forth by the program. The next three questions of the pre survey evaluated how each participant liked the social environment, location and schedule of the program. The last question on the pre survey was an open-ended question asking for feedback on their choice of the program. The post survey was devised to show the improvement over the course of the program using the pre survey as a baseline. Questions were identical with modified language to reflect program completion. Please see Table 1 and 2 in Appendix A for the survey questions and results

Each participant was weighed in each week at the beginning of every session to track weight loss over the course of the program. This was followed by a one-hour exercise session. Upon completing each workout, the participants proceeded to the classroom for a PowerPoint presentation conducted by either the program manager, registered dietitian or exercise physiologist designed to educate each participant. The PowerPoint presentation was then followed by a group discussion, where participants were given the opportunity to share with the group and make the lessons personal.

Hemoglobin A1c levels were measured at three separate times during the program in order to track the changes. Hemoglobin A1c is a medical lab test based on the blood glucose levels of an individual on a three month time period. The hemoglobin A1c is used to measure the severity of the disease; please see Table 3 in Appendix A for the classification of hemoglobin A1c. Patient satisfaction was tracked through surveys as well as week-to-week open-ended observational notes taken by the Joslin observer present at every session of the program.

Analysis

The Joslin Why WAIT program has been running since 2005, producing three sessions a year with 10 to 15 participants each time providing enough information for a statistical analysis. The hemoglobin A1c and weigh in data from the pilot program at the Wang center was analyzed and compared on the same outcome measures with the Joslin Why WAIT participants. The pre and post survey data was analyzed and compared to some satisfaction with the Wang center program, however the Wang Center Y weight program was a pilot program with only seven participants which was not enough to perform any statistical comparisons.

Mean and standard deviation measures were calculated for the Wang Center diabetes management program and the Joslin Why WAIT program for the four outcome measures of the program: hemoglobin A1c, body mass index, average weight loss and percentage of total body weight at the beginning and end of each program. The survey data for the Wang Center program was compared pre and post to show change in results as an increase or a decrease over participation time.

Results

The Joslin Why WAIT program data is presented using an N of 115 drawing from a larger pool of participants. The Wang YMCA diabetes management program data is presented using an N of 7 considering it was a pilot program. Baseline characteristics for both the Joslin Why WAIT program and the Wang YMCA program are presented in Table 4 below. These characteristics measures include age, BMI, weight, waist size and hemoglobin A1c.

Table 4: Baseline Characteristics

Parameter	Mean ± SD	
	Joslin	Wang
BMI	43.9 ± 10.4	36.8 ± 5.9
Weight	242.0 ± 41.0	231.5 ± 31.8
Waist	46.7 ± 0.6	45.9 ± 3.7
HA1c	7.5 ± 0.14	7.06 ± 1.2

Average weight loss The average weight loss for the Joslin Why WAIT program compared to Wang YMCA program data is shown in Table 5 below. The average weight loss for the Joslin Why WAIT program was 24 pounds with a standard deviation of ± 11.2 pounds. The Wang YMCA program had an average weight loss of 13 pounds with a standard deviation of ± 5.4 pounds.

Hemoglobin A1c The hemoglobin A1c levels before and after for the Joslin Why WAIT program compared to the Wang YMCA program data is shown in Table 5 below. The before and after hemoglobin A1c levels for the Joslin Why WAIT program are as follows respectively. Hemoglobin A1c before 7.5% with a standard deviation of ± 0.14% and after 6.6% with a standard deviation of ± 0.12%. The Wang YMCA program hemoglobin A1c levels before was 7.06% with a standard deviation of ± 1.2% and after levels of 6.26% with a standard deviation of ± 0.7%.

Body Mass Index The body mass index average of the participants for each the Joslin Why WAIT program and the Wang YMCA program are shown in Table 5 below. The body mass index average before the Joslin Why WAIT program was 43.9 and the after body mass index average was 40.2. The Wang YMCA program before and after body mass index was 36.8 before and 35.3 after.

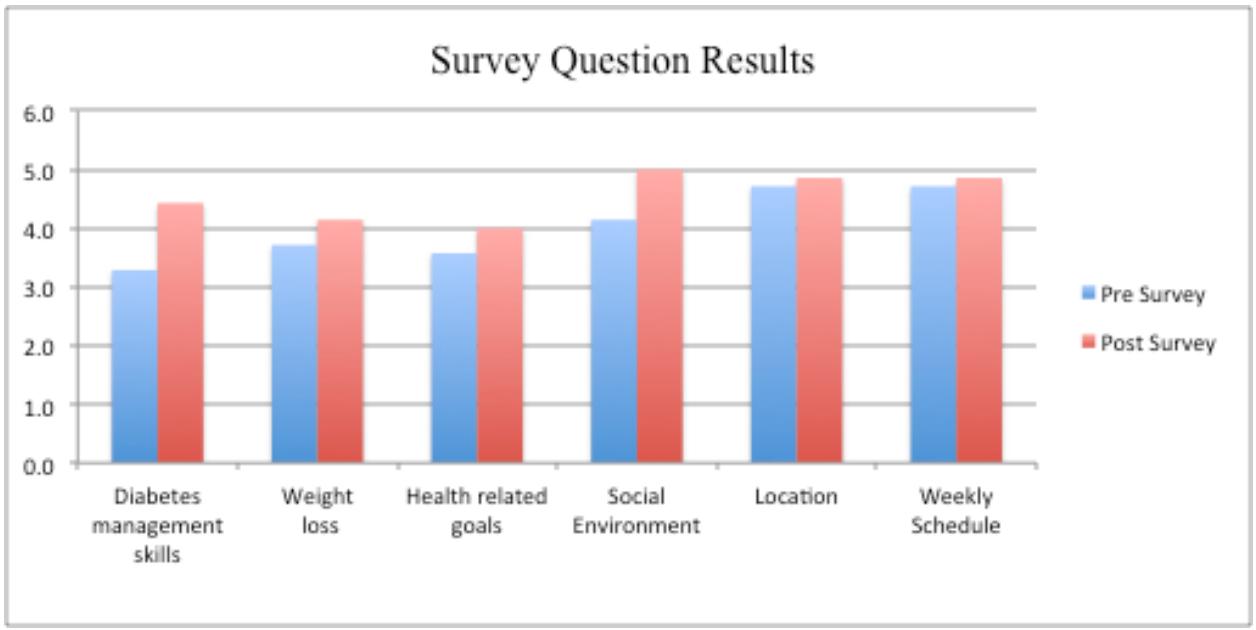
Body weight percentage the total percentage of body weight lost during each program is displayed in Table 5 below. The average percentage of the participant's total body weight lost during the Joslin Why WAIT program was 9.9%. The Wang YMCA program had a 5.6% average of the total body weight lost during the program.

Table 5: Outcome Measures

Parameter		**Joslin**	**Wang**
Hemoglobin A1c	Before	7.5 ± 0.14	7.06 ± 1.2
	After	6.6 ± 0.12	6.26 ± 0.7
-Average % Change		-12.00%	-11.30%
Body Mass Index	Before	43.9	36.8
	After	40.2	35.3
-Average % Change		-8.43%	-4.08%
Average Weight Loss		24.0 ± 11.2	13.0 ± 5.4
Total % Body Weight Lost		9.9%	5.40%

Pre and Post Surveys The Wang YMCA program pre and post surveys data can be found in Table 2 in Appendix A displayed at the end of the paper. The survey data results are represented by average and standard deviation for each question asked on the different likert scales along with average percent change measures between pre and post. The average response for the pre survey questions and standard deviation are as follows in corresponding order. Pre survey question 1 addressed confidence in diabetes self management had an average and standard deviation of 3.3 ± 1.3, question 2 addressed confidence in ability to loss weight and had 3.7 ± 1.2, question 3 addressed confidence in ability to ready health related goals and had 3.6 ± 0.9, question 4 addressed likeableness of the social environment and had 4.1 ± 1.0, question 5 and 6 addressed location and weekly schedule of the program and recorded a mean and standard deviation of 4.7 ± 0.5. The average response for the post survey questions and standard deviation are as follows, question 1 was 4.4 ± 1.0, question 2 was 4.1 ± 1.4, question 3 was 4.0 ± 1.3, question 4 was 5.0 ± 0.0, question 5 was 4.9 ± 0.3 and question 6 was 4.9 ± 0.3.

Chart 1: Survey Question Results



Discussion:

The Wang YMCA diabetes management program was modified from the Joslin Why WAIT diabetes management program an able to increase patient satisfaction while continuing to see results based on hemoglobin

A1c and weight loss as the major outcomes measures. The Wang YMCA program showed increased patient satisfaction on the outcome measures of diabetes self-management knowledge and skills, accessibility, group dynamic support and overall likeability of the program.

Perhaps most important were measures for the Hemoglobin A1c. For a diabetes medically managed program to be removed from the clinic and put in a community setting hemoglobin A1c measures have to be consistent with the clinic based program. Hemoglobin A1c is a blood test in which the amount of hemoglobin A1c in your body is measured by looking at the amount of glycated hemoglobin caused by excess glucose in the blood.[5] In other words, it is an average of your blood glucose levels over a span of about three months. Hemoglobin A1c indicates how severe a person's diabetes is and is a strong indicator of the need for insulin. As shown in Table 3 a person with a hemoglobin A1c of 6.5% or higher is classified as having diabetes.[5] Similarly a person with diabetes that has a hemoglobin A1c of 7% or lower is considered to have their diabetes under control.[5] The Joslin Why WAIT program sets a hemoglobin A1c goal for its participants to effectively manage their diabetes at 7% or lower and for those that want to change their diabetes status from having diabetes to having pre diabetes at 6.5% or lower. The Why WAIT program at Joslin has an average post Participant hemoglobin A1c post program of 6.6% ± 0.12. A hemoglobin A1c of 6.6% ± 0.12 indicates that the programs participants are reaching the set goal and demonstrating an average percent change decrease of about 12% during the program. Given these benchmarks, the Wang program participants were also able to reach theses goals. The average hemoglobin A1c post Wang YMCA program was 6.26 ± 0.7, also showing an average percent change decrease of about 12% during the program. The average hemoglobin A1c in the Wang YMCA was below 6.5% with 6.26% implying that on average the participants were able to change their status to pre diabetes.

The Wang YMCA program was also able to demonstrate an overall weight loss during the program comparable to the Why WAIT at the Joslin Diabetes Center. Both programs set a weight loss goal for each participant to lose between 5 – 7% of his or her total body weight. The Joslin Why WAIT participants show an average total weight loss percentage of 9.9%. The Wang YMCA program participants on average during the 12 week program showed a total weight loss of 5.6%, which is within the set goals provided by Joslin. The Joslin Why WAIT program has shown an average weight loss per participant of 24 ± 11.2 overall. The Wang YMCA showed an average weight loss per participant of 13 ± 5.4 pounds. The average weight loss at the Wang YMCA was about

half of the Joslin weight loss. Reasons for this are likely due to the fact that the Joslin Why WAIT program used more participants. Such a small N for the community program is prone to higher variability from sample size constraints. In addition, the Joslin Why WAIT participants had a higher initial weight and BMI on average than did the Wang YMCA (242 ± 41 pounds and a BMI of 43.9 pounds for Joslin and 231.5 ± 31.8 pounds and a BMI of 36.8 pounds for the Wang YMCA respectively).

The Wang YMCA program was evaluated on patient satisfaction outcome measures through means of a pre and post survey as well as weekly observation. Over the duration of the program the average percent change increased for every survey question asked. Question 1, measuring the confidence level of diabetes self-management skills showed a positive change of 34.78%. Question 2, measuring the confidence in ability to loss weight showed a positive change of 11.54%. Question 3, measuring the confidence in the ability to reach health related goals showed a positive gain of 12%. Question 4, measuring the likableness of the social environment showed a positive change of 20.69%. Both questions 5 and 6 had a positive change of 3.03%; the criteria of what these questions measured may suggest why the change was low. Questions 5 and 6 measured the location and weekly schedule of the program; the low change during the program can be as a result of an already high satisfaction with the schedule and location, the average response changed from 4.7 to 4.9 out of 5. The measured positive change in the survey response from participants can be a result of the education and tools gained from the program.

Qualitative analysis of the open-ended questions also support program success and adherence. I reported in my week 6 notes of the program, "the participants were in full swing of the program with a complete understanding of the diet and exercise plans - they are really getting it." In week 9 I reported that "the participants felt very positive and motivated today much more than normal, having fun and laughing with the program and really getting involved with the program and working hard." As the program went on, the participants took the program to heart and it became a lifestyle not just an activity. Such a conceptual change has been shown to have a direct impact on the prevention and delay in Type 2 diabetes.[6]

The post survey given to the participants asked questions regarding the likableness of the location and time of the program; both questions had an average response rate of 4.9 out of 5. A major contributing factor to the increased patient satisfaction in the Wang YMCA program may have to do with accessibility, which can be broken

down into three areas: location, time, and cost. The YMCA program could have been viewed as more accessible than the Program held at the Joslin. The Longwood area is expensive to park in opposed to the Wang YMCA center, which provides free parking. The time of the program may have also been more convenient for working participants meeting once a week for two hours after work hours, compared to the Joslin Why WAIT program that meets twice a week for two hours during the morning hours making it difficult for working participants in the program.

Cost can be analyzed in two ways, first by cost of program to the individual participant and second as cost saving to the individual participant over time. The program at the Wang YMCA was a pilot program having no charge to each participant other than the co-payments and deductible fees indicated by insurance for lab work and physician visits during the program. The Joslin Why WAIT program is a medically managed program involving the presence of a physician, nurse practitioner and psychologist, whose time is billable and comes at a cost. The Joslin Why WAIT program also charges each participant an administrative fee of $250 with additional charges for co-payments and deductibles indicated by the participant's medical insurance. However, these initial participation charges are one time and must be offset by the continued savings from the program. The most visible of these savings is in medication costs. The Why Wait team at Joslin performed a cost saving analysis for a set of 85 previous participants of Why WAIT based savings from changes in medications as a result of the program. The analysis found that on average a participant of Why WAIT saved $46.78 monthly, or $561.37 per year on medication. A cost saving analysis for the Wang YMCA program were not measures during this pilot, however, given that the program was free the cost saved on medication would be high and beneficial to the community. It is unlikely that future programs could come at a completely subsidized cost, however, with an average yearly savings of $561, even a marginal cost should still create cost savings, in addition to the health benefits.

Differences in clinical outcomes measures between the two programs could have been due to the removal of the more intensive medial management component of the program, or simply due to the small sample size at the Wang site. The Wang YMCA did not include the presence of a physician, nurse practitioner or psychologist. This could have two effects. One could be that patients are less motivated due to the lower frequency of medical personnel contact. However, there is some evidence that physician visits can also result in higher blood pressures than normal when in the doctor's office due to the anxiety caused by being evaluated by a physician.[7]

The Wang YMCA program also utilized a smaller group learning dynamic than the Joslin Why WAIT program, including more frequent group discussions with half the number of participants and a smaller group of staff members. This created an atmosphere of a friendly social gathering with a common interest rather than a medical intervention. The YMCA personnel work with their members and try to connect on a personal level to satisfy their personal needs and keep them coming back as a YMCA member after the conclusion of the program. The Wang YMCA program participants reported developing relationships with each other during and outside of the program sessions. These relationships were utilized to provide support and advice between the participants helping to yield favorable outcomes. The post survey asked a question concerning the social group dynamic of the program, the average response to the likeableness question was a perfect 5 out 5 showing every participant strongly liked the social environment.

Notes from participants included: "Joslin and YMCA staff have gone above and beyond to encourage and instill a new lifestyle within all of us. I will forever be grateful."

"This program was terrific for me. It got me to get beyond the plateau I was stock on and lose a significant amount of weight (25 lbs.) it was a much better program than the one at Huntington YMCA because of the seriousness and structure. I never missed a meeting and followed all of the advice so that I meet with success and am on my way to being a fit female!!"

"Community weekly support is key!"

"At first I was not sure about this program I thought I could not do it. Now I feel so much better and I feel I can continue to keep up with the program. I am going to miss out on the coming here each week"

"Please continue this program!! I lost 20 lbs. and my doctor is pleased!! Me too."

Limitations and Next Steps

The modification made to the Wang YMCA program to apply it in a community setting rather than a medically managed clinic setting did create some limitations with in the program. The Wang YMCA had certain limitations relative to enrollment, staffing personnel, medical management, communication and time. The Wang

YMCA program had a goal of 10 to 12 participants but ultimately only had 7 total participants, possibly reflecting the lack of advertisement resources. Participants at the Wang YMCA program were self-selected and then screened where as Joslin patients are typically referred. The Wang YMCA participants were also all women. The meal and exercise plan set forth by Joslin are different for men versus women, and the Joslin Why WAIT program included both men and women. This may not be a strong limitation but might reflect metabolic differences in the outcomes measures.

Additionally, the personnel at the Wang program were not medically trained to the same extent as the staff at the Joslin Why WAIT program, and this was their first time implementing the program. This is not a limitation per-se given the positive supporting environment reflected by participants. However, medically trained staff can provide participants differential knowledge for dealing with diabetes medications and other diabetes-related questions. The Wang YMCA program needed to answer medical questions through the Joslin's medically trained personnel on a weekly basis.

A final limitation is that the Joslin Why WAIT program meets on two days each week for two hours where as the Wang YMCA program meets once a week for two hours. This provides only half the time to achieve desired outcomes. However, given program successes, this could also be a positive finding that similar outcomes can be achieved with less intervention effort and resources.

The pilot at the Wang YMCA center was able to produce positive results on the desired outcomes measures during the program. The possibility of allowing Type 2 diabetes patients who are on insulin to participate in the program may be the answer to avoiding having another program with a small number of participants who were all women. This was avoided given that the Wang staff were not qualified to monitor insulin levels. This would need to be addressed. It might also be useful to have the next program run an analysis on medication changes and the costs associated with medication changes. While these would most likely be self-reported measures, it would provide both a medical outcome and a cost outcome for comparison and evaluation. These suggestions will more than likely require more diabetes based training for the YMCA staff, which could ultimately be more beneficial to the program as a whole. The more knowledge about the diabetes as a disease and the care of diabetes could lead to better outcomes for the program participants.

Conclusion

These findings support the hypotheses that a medically managed clinic based diabetes management program can be modified for implementation in a community setting while maintaining similar measured health outcomes and levels of patient satisfaction. However, given the singular sample size, more data should be collected from ongoing participants to validate these findings. If conclusive, the Wang YMCA program model could be modeled to run in other community settings. Doing so both further the organizational mission of the Joslin Diabetes Center to provide education and care for all people with diabetes in the community along with the YMCA's goal of improving the health status of the community while providing a low cost method for addressing diabetes management at a population level.[8,9]

Appendix A: Tables

Table 1: Survey Questions

Pre Survey

		Not Confident	Some What Confident	Unsure	Confident	Very Confident
1)	How confident are you in your diabetes self management skills?	1	2	3	4	5
2)	How confident are you in your ability to lose weight?	1	2	3	4	5
3)	How confident are you in reaching your health related goals?	1	2	3	4	5
		Strongly Dislike	Dislike	Neither like nor Dislike	Like	Strongly Like
4)	How do you feel you will like the social environment of this program?	1	2	3	4	5
5)	How do you feel you will like the location of this program?	1	2	3	4	5
6)	How do you feel you will like the weekly schedule of the program?	1	2	3	4	5

7) Please give us some feedback on why you choose this particular program and any suggestions you might have

Post Survey

		Not Satisfied	Some What Satisfied	Unsure	Satisfied	Very Satisfied
1)	How satisfied are you with your diabetes management in this program?	1	2	3	4	5
2)	How satisfied are you with your weight loss in this program?	1	2	3	4	5
3)	How satisfied are you in reaching your health related goals in this program?	1	2	3	4	5
		Strongly Dislike	Dislike	Neither like nor Dislike	Like	Strongly Like
4)	How did you feel you liked the social environment of this program?	1	2	3	4	5
5)	How did you feel you liked the location of this program?	1	2	3	4	5
6)	How did you feel you liked the weekly schedule of the program?	1	2	3	4	5

7) Please give us some feedback on how you feel about this particular program and any suggestions you might

Table 2: Survey Question Results

Questions	Pre Survey		Post Survey		Average % Change	
	Average Score	SD	Average Score	SD	Difference	% change
1) Diabetes management skills	3.3	± 1.3	4.4	± 1.0	1.1	34.78%
2) Weight loss	3.7	± 1.2	4.1	± 1.4	0.4	11.54%
3) Health related goals	3.6	± 0.9	4.0	± 1.3	0.4	12.00%
4) Social Environment	4.1	± 1.0	5.0	± 0.0	0.9	20.69%
5) Location	4.7	± 0.5	4.9	± 0.3	0.1	3.03%
6) Weekly Schedule	4.7	± 0.5	4.9	± 0.3	0.1	3.03%

*Question asked on a scale of 1 to 5

Table 3: Hemoglobin A1c Breakdown

hA1c Level	Classification
< 5.4 %	Normal hA1c Levels
6.5% ≤ x ≥ 5.4%	Pre Diabetes
7.0% ≤ x ≥ 6.5%	Diabetes Under Control
10.0% ≤ x ≥ 7.0%	Diabetes care needs to be addressed
> 10.0%	Diabetes insulin dependent

References

[1] Diabetes.niddk.nih.gov (2011). *National Diabetes Statistics, 2011 - National Diabetes Information Clearinghouse*. [online] Retrieved from: http://diabetes.niddk.nih.gov/dm/pubs/statistics/index.aspx#fast [Accessed: 21 Mar 2013].

[2] Diabeticcareservices.com (1999). *Diabetes and Obesity: Explore the Relationship Between Obesity and Diabetes*. [online] Retrieved from: http://www.diabeticcareservices.com/diabetes-education/diabetes-and-obesity [Accessed: 21 Mar 2013].

[3] Diabetes.org (2012). *A1C - American Diabetes Association*. [online] Retrieved from: http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/a1c/ [Accessed: 21 Mar 2013].

[4] Hamdy O, Carver C, Grant G, Shahar J, Goebel-Fabbri A, Capelson R, Beaton J, Elsayed N, Abrahamson M. Weight achievement and intensive treatment (Why WAIT?): An innovative clinical programme for weight management in diabetes. (Presented at the 19th World Diabetes Congress of the International Diabetes Federation, Cape Town, South Africa, December 2006)

[5] Diabetes.org (2012). *A1C - American Diabetes Association*. [online] Retrieved from: http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/a1c/ [Accessed: 21 Mar 2013].

[6] Unknown. (2007). REDUCTION IN THE INCIDENCE OF TYPE 2 DIABETES WITH LIFESTYLE INTERVENTION OR METFORMIN. *The New England Journal of Medicine*, VOLUME 346 (number 6), pp.1 - 11.

[7] Ncbi.nlm.nih.gov (2009). *Prevalence and predictors of white-coat hypertension in a large database of ambulatory blood pressure monitoring*.. [online] Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/19554987 [Accessed: 21 Mar 2013].

[8] Ymcaboston.org (1851). *Mission & History | YMCA of Greater Boston*. [online] Retrieved from: http://www.ymcaboston.org/our-cause/mission-history [Accessed: 21 Mar 2013].

[9] Joslin.org (2012). Mission | Joslin Diabetes Center. [online] Retrieved from: http://www.joslin.org/diabetesinnovation2012.html [Accessed: 22 Mar 2013].