

PIMSA PROJECT REPORT

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**Influence of Clinical and Nonclinical Factors on Diabetes Outcomes:
A Bi-National Comparison of Mexicans and Mexican-American Migrants**

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Executive Summary:

Mexican Americans (MAs) have a disproportionately higher rate (2-3 times) and increased type 2 diabetes (T2DM) mortality and morbidity as compared to non-Hispanic Whites (NHW). The burden of diabetes is also high in Mexico as it is the leading cause of death among adults 30-64 years of age. With higher migration of MAs (documented and undocumented) to the US, the diabetes-related mortality has increased in all US-Mexico Border States. Because many MAs seek traditional medicine as well as receive medical care on both sides of the US-Mexico border, a better understanding of the context and patterns of health care delivery of the migrants in Mexico (more likely to migrate to the US) as well as MAs in the border and interior areas is crucial for developing culturally appropriate interventions. The objective of this study was to examine social, contextual, and individual factors in Mexicans and MAs that influence self-care management, and short- and long-term diabetes outcomes. The sample size comprised of 151 Rural and Urban Mexicans (76% female, 24% male) in El Oro and Toluca City in Mexico and 108 Mexican Americans (78% female, 22% male) in Laredo, McAllen, and Bryan/College Station Texas. Data collection was done through face-to-face interviews by ethnically similar interviewers. Serum samples were analyzed for fasting blood glucose, A1c, and lipid profile, and novel CVD risk factors (adiponectin, leptin, and C-Reactive Protein) at St. Joseph laboratory, Diabetes Diagnostic Lab, and Dr. Riechman's lab at Texas A&M University.

The mean age was 55.1 ± 15.5 years (Mexico) and 47.7 ± 10.7 years (MAs). The average age of onset of the disease was lower for MAs (42 years) as compared to the natives in Mexico (49 years). Eighty percent of the MAs were first generation Mexicans; average number of years lived in the US was 21.5 ± 12.6 years. The majority of MAs (91%) had a high school degree or below, 56% indicated their diet had changed after they moved to the US and 44% use vitamin supplements. Respondents in Mexico had a similar pattern with high level of illiteracy (32.9%) or low education (62.3 up to high school) and 25% indicating the use of vitamin supplements. Mean values for body mass index were $29.1 (\pm 4.9)$, and only 24.5% of the subjects were normal and 14% were morbid obesity ($BMI \geq 35.0$), reflecting the increasing epidemic of obesity in the Mexican population.

The mean levels for biochemical markers for MAs showed average levels for cholesterol at 181 ± 41 mg/dl, triglyceride 195 ± 129 mg/dl, HDL 42 ± 9.6 mg/dl, LDL 100 ± 34 mg/dl, and A1c 7.4 ± 1.7 . 47% of MAs had poor control of the disease as per ADA standards ($A1c > 7.0$). Mexican Americans had significantly higher obesity than Mexicans. No significant differences were identified in the clinical parameters by gender among the Mexicans with the exception of diastolic blood pressure, where males had 47.2 % hypertension, versus 30.7% in female subjects. 57.3% had abnormal values of glycosylated hemoglobin (≥ 7) and slightly higher in females (not statistically significant).

Significant differences were found in demographic, anthropometric, psychosocial, lifestyle, and clinical parameters between Mexicans and MAs. Mexican Americans were significantly more obese, had higher systolic and diastolic hypertension than the Mexican respondents. However, Mexican with diabetes had significantly higher fasting blood glucose and poorer control of the disease and higher levels of depression as compared to MAs ($p < 0.001$). Mexicans had generally healthier nutrition behavior but lower levels of physical activity as compared to MAs. Results indicate the need for self-management education programs in both groups.

The study has been completed as per our targeted timeframe i.e., January 2007 to December 2008. Data analysis and manuscript writing is in progress.

Introduction

Type 2 diabetes, the sixth leading cause of death, affects 21 million (7%) Americans and is associated with significant health and economic burdens in the US. Diabetes and its complications disproportionately burden Mexican Americans who are the largest and fastest growing Hispanic/Latino subgroup, especially along the Border States. Although the emergent burden in this ethnic group is well documented, it is not well understood. Changes in genetic structures likely do not account for the recent epidemic and clinical/ biological factors partly explain the disparity. Studies show that cultural beliefs are often concordant with the biomedical model and Mexican Americans incorporate traditional medicine into prescribed diabetes treatment as well as seek medical care on both sides of the US-Mexico border. Acculturative changes as immigrant Mexicans assimilate in the US also impact their diabetes management behaviors and short- and long-term outcomes. However, there is a paucity of data regarding their knowledge, beliefs, and practices related to this illness. Accordingly, in the present proposal we seek to have a comprehensive examination of clinical factors e.g., metabolic control and outcomes as well as non-clinical factors (e.g., social, behavioral, cultural, and environmental factors) to gain a better understanding of their higher burden crucial for developing culturally appropriate management programs.

Comparison of Mexican Americans in Texas (a rapidly growing, poorly studied ethnic group at very high risk for DM and CVD) and to natives in Mexico (a non-acculturated group with similar genetic composition, at lower risk for DM and CVD) as well as comparison of clinical parameters is expected to improve our understanding of the mediators and modifiable risk factors.

Study Sites, Sample, and Data Collection

The study used a cross-sectional and cross-cultural design and comprised of diabetic Mexicans, aged 18 years or older, in Tonatico, Coatepec Harinas (las Vueltas) and el Oro in the state of Mexico and MAs in Bryan/College Station, McAllen and Laredo, Texas. A convenience sample of Mexicans and MAs were recruited from local churches, clinics and community in the study sites. Data collection was completed in three phases.

The first phase comprised of survey interviews. **The second phase** consisted of fasting blood work and anthropometric measurements for clinical parameters. Results of blood tests were provided to all the respondents free of cost. Although 124 and 117 interviews were completed in the urban and rural areas of Mexico respectively, several respondents did not come for their fasting blood work. Hence, the final sample size (with complete data) comprised of 151 Rural and Urban Mexicans (76% female, 24% male) in El Oro and Toluca City in Mexico and 108 Mexican Americans (78% female, 22% male) in Laredo, McAllen, and Bryan/College Station Texas. Data collection was done through face-to-face interviews by ethnically similar interviewers. Serum samples were analyzed for fasting blood glucose, A1c, and lipid profile, and novel CVD risk factors (adiponectin, leptin, and C-Reactive Protein) at St. Joseph laboratory, Diabetes Diagnostic Lab, and Dr. Riechman's lab at Texas A&M University. Blood samples were stored in Dr. Riechman's lab in College Station for analysis of the novel risk markers for all sites at one time for standardization. Due to restriction by the Mexican government for importing and exporting of blood collection materials and blood samples to the labs in the United States, analysis of clinical parameters was delayed exponentially for the Mexican sites. Further complicating the issue was transportation issues that led to the ruined samples for which lipid profile could not be performed. **The third phase** comprised of qualitative data collection. Ethnography identifies internal processes utilizing the point of view of the individuals and data was collected by Dr. Bordi through face-to-face interviews (2 in Laredo, 2 in College Station and 4 in Mexico).

Project Aims and Results

Specific Aim 1: To identify and compare clinical and non-clinical (social, environmental, cultural, lifestyle) factors that affect self-management behaviors and diabetes outcomes in diabetic Mexicans (rural and urban) and Mexican Americans (border and interior) in Texas.

Specific Aim 2: To examine the influence of these factors on the general health and diabetes outcomes in the same groups of Mexicans and Mexican Americans using a conceptual model (Appendix 1).

Specific Aim 3: To analyze gender and group differences in access and utilization of health *in the same group of Mexicans and Mexican Americans.*

RESULTS

Mexican Americans in Texas

One-hundred and eight Mexican-American diabetic subjects in Texas were evaluated, of which 22% were males and 78% were females. Mean age for the whole samples was 49.7 (\pm 10.7) years, whereas age at onset of the disease was 42.6 (\pm 11.45) years (Table 1).

49.1% of the Mexican-American sample had education below primary school, this was higher in the female sample, while university or graduate studies were more prevalent in the males. Mean values for body mass index were 34.7 (\pm 8.6), and only 7.5% of the subjects were normal, whereas 46.7% were morbidly obesity (BMI \geq 35.0). Waist-to-hip ratio showed significantly higher values in males and a general mean of .90 (\pm 0.07), with more than 90% of subjects with abnormal values. Body fat and hip circumference were significantly higher in females as expected.

Fasting capillary glucose was higher in males than females, which is also reflected in the higher percentage of abnormal glycosilated hemoglobin values in the same group, however we found no significant differences. Systolic and diastolic pressure was higher in males than females, although no significant differences were found.

With respect to psychosocial parameters, most of the subjects reported feeling a high support for the control of their disease, as well as a high acceptance of it and uncertainty about the presence of social barriers, with no significant differences by gender. Depression was present in 42.9% of the whole sample, more in females than males.

Almost 68% of the subjects reported adequate nutritional practices for the management of their disease; while 77% practiced no physical activity.

Table1. Demographic, Anthropometric, Psychosocial, Lifestyle, and Clinical Parameters for Mexican Americans in Texas (border and interior areas)

Characteristic	Mexican Americans		
	Total (n=108; 100%)	Male (n=22; 22%)	Female (n=80; 78%)
Age – yrs	49.7 \pm 10.7	48.0 \pm 8.6	49.8 \pm 11.3
Age of Onset – yrs	42.6 \pm 11.5	40.2 \pm 10.6	42.2 \pm 11.4
Education			
Illiterate to Primary School (%)	49.1	27.3	54.8

Up to High School (%)	42.4	50.0	40.4
College/Graduate/Professional (%)	8.5	22.7	4.8
Anthropometric Parameters			
Body Mass Index*	34.7±8.6	31.0±5.8	35.9±9.1
Normal (BMI < 25)	7.5	18.2	5.0
Overweight (BMI 25-29.9)	22.4	31.8	18.8
Obese (BMI 30.0 – 34.9)	23.4	27.3	22.5
Morbid Obesity (BMI ≥ 35.0)	46.7	22.7	53.8
Waist Circumference	40.8±5.1	40.5±5.9	40.9±4.8
Hip Circumference**	45.1±5.8	42.0±4.5	45.9±5.8
Waist-hip-ratio***	.90±.07	.96±.04	.89±.07
Normal	9.3	9.1	9.4
Abnormal (M>.90; F>.83)İ	90.7	90.9	90.6
Body Fat (%)***	41.5±7.7	33.0±8.4	43.6±6.0
Clinical Parameters			
Fasting capillary glucose - mg/dL	159.5±59.9	175.4±57.7	155.1±60.0
HbA1c	7.4±1.7	7.6±1.7	7.4±1.7
Normal (<7)	52.8	40.9	55.8
Abnormal (>=7)	47.2	59.1	44.2
Systolic blood pressure	136.6±21.4	144.1±21.3	134.7±21.1
% Hypertension	58.9	72.7	55.3
Diastolic blood pressure	83.5±11.7	88.5±11.2	82.2±11.5
% Hypertension	65.4	77.3	62.4
Psychosocial Parameters			
Social Support	5.67±1.12	5.64±1.11	5.65±1.13
Low support (%)	7.4	9.1	6.0
High support (%)	92.6	90.9	94.0
Acceptance of Diabetes			
Outlook	3.73±.56	3.55±.61	3.77±.56
Confidence**	4.29±.52	4.02±.51	4.37±.51
Inhibition	2.22±.76	2.35±.79	2.20±.76
Social Barrier	2.13±.63	2.00±.59	2.16±.81
Depression	16.4±11.2	14.1±9.3	16.9±11.3
Not Depressed (%)	57.1	63.6	55.1
Clinically Depressed (%)	42.9	36.4	44.9
Lifestyle Parameters			
Nutrition Behavior	1.72±.46	1.66±.45	1.76±.45
Never/Sometimes (%)	32.1	31.8	32.5
Often/Always (%)	67.9	68.2	67.5
Physical Activity Behavior	.94±.68	.80±.50	.98±.71
Never/Sometimes (%)	77.1	86.4	74.7
Often/Always (%)	22.9	13.6	25.3

Independent Samples t-test: *p<0.05; ** p<0.01; *** p<0.001.

Ch-square: + p<0.05.

Rural and Urban Mexicans in Mexico

One-hundred and fifty Mexican diabetic subjects in Central Mexico were evaluated, of which 24% were males and 76% were females and 50.7% were from the rural area. Mean age for the whole samples was 57 (\pm 11.9) years, whereas age at onset of the disease was 48.7 (\pm 10.1) years. We found statistically significant differences in the age at onset by gender, females developed the disease earlier than males (Table 2).

One of the main problems we encountered was the high level of illiteracy (32.9%) or low education (62.3 up to high school), issue that was overcome by personal support for the questionnaire application. Mean values for body mass index were 29.1 (\pm 4.9), and only 24.5% of the subjects were normal and 14% were morbid obesity (BMI \geq 35.0), reflecting the increasing epidemic of obesity in the Mexican population. Waist-to-hip ratio showed statistically significant differences by gender with higher values in males and a general mean of 0.93 (\pm 0.09), which is higher than the normal cut-off for males. Body fat was significantly higher in females as expected. No differences were found in waist or hip circumference.

No significant differences were identified in the clinical parameters by gender with the exception of diastolic blood pressure, where males had 47.2 % hypertension, versus 30.7% in female subjects. We had 57.3% abnormal values of glycosylated hemoglobin (\geq 7), higher in females, although no statistically significant differences were found.

With respect to psychosocial parameters, most of the subjects reported feeling a high support for the control of their disease, as well as a high acceptance of it and uncertainty about the presence of social barriers. Whereas depression was present in 91.2% of the whole sample, no differences were noted between genders.

Almost 99% of the subjects reported adequate nutritional practices for the management of their disease; while 89.4% practiced no physical activity.

Table 2. Demographic, Anthropometric, Psychosocial, Lifestyle, and Clinical Parameters for Mexicans in Mexico (rural and urban)

<i>Characteristic</i>	<i>Male (n=36; 24%)</i>	<i>Female (n=114; 76%)</i>	<i>Total (n=150; 100%)</i>
<i>Age – yrs (Mean \pm SD)</i>	58.8 \pm 12.5	56.4 \pm 11.7	57.0 \pm 11.9
<i>Age of Onset – yrs (Mean \pm SD)*</i>	51.8 \pm 10.9	47.6 \pm 9.6	48.7 \pm 10.1
<i>Education</i>			
Illiterate	34.2	35.5	32.9
Up to High School	57.0	59.1	62.3
Some College/Graduate/Professional	5.3	5.5	4.8
<i>Anthropometric Parameters</i>			
<i>Body Mass Index</i>	29.5 \pm 5.1	28.0 \pm 4.1	29.1 \pm 4.9
Normal (BMI < 25)	28.6	23.1	24.5
Overweight (BMI 25-29.9)	45.7	34.3	37.1
Obese (BMI 30.0 – 34.9)	17.1	26.9	24.5
Morbid Obesity (BMI \geq 35.0)	8.6	15.7	14.0
<i>Waist Circumference</i>	32.2 \pm 4.8	29.8 \pm 4.7	37.1 \pm 4.6
<i>Hip Circumference</i>	39.1 \pm 2.7	40.2 \pm 4.1	39.9 \pm 3.9

Waist-hip-ratio**	.97±.07	.91±.09	.93±.09
Normal	13.9	17.0	16.2
Abnormal(M>.90 F>.83)	86.1	83.0	83.3
Body Fat (%)***	27.8 ± 5.4	36.7 ± 6.5	35.6 ± 3.2
Clinical Parameters			
Fasting capillary glucose –mg/dL.	172.9 ± 83.1	186.0 ± 98.1	182.9 ± 94.6
HbA1c	8.0±2.7	8.5 ± 2.6	8.4±2.6
Normal (<7)	25.4	40.3	42.7
Abnormal (≥7)	37.7	59.7	57.3
Systolic blood pressure (mm/Hg)	129.5±19.9	124.1±15.9	125.4±17.0
% Hypertension	47.2	35.1	38.0
Diastolic blood pressure (mm/Hg)*	78.9±11.1	74.2±10.2	75.3±10.6
% Hypertension +	47.2	30.7	36.0
Psychosocial Parameters			
Social support	4.8±1.4	5.3±1.5	5.1±1.5
Low Support (%)	20.0	16.4	17.2
High Support (%)	80.0	83.6	82.8
Acceptance of Diabetes			
Outlook	3.7 ± 0.6	3.6 ± 0.7	3.6 ± 0.7
Confidence	4.0 ± 0.5	4.2 ± 1.0	4.1 ± 0.9
Inhibition	2.5 ± 0.7	2.6 ± 0.8	2.6± 0.8
Social Barriers	2.7 ± 0.8	2.6 ± 0.7	2.7 ± 0.8
Depression	25.7 ± 13.6	29.3 ± 13.5	28.5 ± 13.6
Not Depressed (%)	16.1	6.7	8.8
Clinically Depressed (%)	83.9	93.3	91.2
Lifestyle Parameters			
Nutritional Behavior	2.4 ± 0.42	2.5 ± 0.48	2.5 ± 0.47
Never/Sometimes	2.9	0.9	1.4
Often/Always	97.1	99.1	98.6
Physical Activity	0.61 ± 0.5	0.65 ± 0.74	0.64 ± 0.69
Never/Sometimes	91.4	88.8	89.4
Often/Always	8.6	11.2	10.6

Independent Samples t-test: *p<0.05; ** p<0.01; *** p<0.001. Ch-square: + p<0.05.

Comparison of Mexican and Mexican Americans

Mexicans and MAs were compared for demographic, anthropometric, psychosocial, lifestyle, and clinical risk factors that affect diabetes management and outcomes. Significant differences were found in most of the demographic, anthropometric, psychosocial, lifestyle, and clinical parameters (p<.01). Mexican respondents were older with a higher age of onset as compared to their MA peers. However, Mexican Americans were significantly more obese than the Mexican respondents (as measured by BMI, waist, hip, Waist-hip-ratio, and % body fat). This pattern was also observed for both systolic and diastolic hypertension. However, Mexican with diabetes had significantly higher fasting blood glucose and poorer control of the disease (as measured by glycosylated hemoglobin levels or HbA1c) than MAs. Acceptance of diabetes was generally high in both groups. When data were categorized in normal or abnormal category of depression, a higher percentage of Mexican respondents reported clinical levels of depression as compared to MAs (p<0.01). Mexicans had generally healthier nutrition behavior but lower levels of physical

activity as compared to MAs. Results indicate the need for self-management education programs in both groups.

Table 3: Comparison of Mexican and Mexican Americans

Characteristic	Bi National Comparison			
	Mexicans	Mexican American	T-value	P-value
Age – yrs	56.9	49.7	4.99	<.001
Age of Onset – yrs	48.6	42.5	4.31	<.001
Anthropometric Parameters				
Body Mass Index	29.1	33.5	5.57	<.001
Waist Circumference	37.0	39.9	5.00	<.001
Hip Circumference	39.9	44.1	7.49	<.001
Waist-hip-ratio	.93	.91	2.39	.017
Body Fat (%)	34.5	40.0	5.94	<.001
Clinical Parameters				
Capillary glucose -mg/dl In the fasting state*	182.7	145.0	4.11	<.001
HbA1c	8.4	7.4	3.04	.003
Systolic blood pressure	125	136	4.91	<.001
Diastolic blood pressure	75	81	4.93	<.001
Psychosocial Parameters				
Social Support	5.1	5.7	3.06	.002
Acceptance of Diabetes Outlook				
Confidence	4.1	4.3	1.71	.08
Inhibition	2.6	2.2	3.33	.001
Social Barrier	2.6	2.1	5.42	<.001
Depression	28.4	16.5	7.27	<.001
Lifestyle Parameters				
Nutrition Behavior	2.5	1.7	12.61	<.001
Physical Activity Behavior	.64	.94	3.44	.001

Specific Aim 4: *To use traditional ethnography to determine the importance of rituals, religion, traditions, and cultures on lifestyle choices that affect self-management behaviors and diabetes outcomes.*

Qualitative research was carried out by Dr. Vizcarra-Bordi in different sites - Tonatico, Mexico (March to April 2008; three men between 63 and 70 years old and five women between 50 and 65 years old), College Station and Laredo Texas (July 2008; one man and one women in College Station and two women in Laredo). Direct and participant observation and depth-interviews were based on life stories. Information regarding food and eating habits, social relations (with relatives and non-relatives) such as civil festivities were recorded. Analysis showed that women from both bi-national contexts are more concerned with having a healthy food and have

medicine to control changes on glucose and blood pressure. Men care also for their health but their measures are different from women's. Men do physical exercise; however, they are aware that their activity levels are not adequate because of their age and diabetes. Changes on food habits are more focused on trying not to eat certain food than a complete change of diet. Loneliness is a common feeling in Mexicans of advanced age and has children living in the United States. The fact that they do not have close relatives living in the same community makes them feel anxious, depressed, and uncertain about their future.

There is a differentiated access to health public services and medicine of low cost. Mexicans are receiving the service of *Seguro Popular* (a federal governmental program) which bring medicine to control the disease. However, some medicines are not always available. Patients do not have other alternative but buying the medicine which sometimes has a very high cost and cannot be purchased. In fact, many patients do not follow the treatment because they are not in the economic position to buy high cost medicine. The same happen to newly US residents. They give priority to fulfill family needs and spent the remaining money to buy medicine. Sometimes, even they do not buy any medicine at all. Meanwhile, the Mexican-Americans who have fully settled down know how the State social security works and take the services they need to treat diabetes. However, this State social security in a way allows diabetic people to have food out of home. Mexican-American with longer time living in the US is obese.

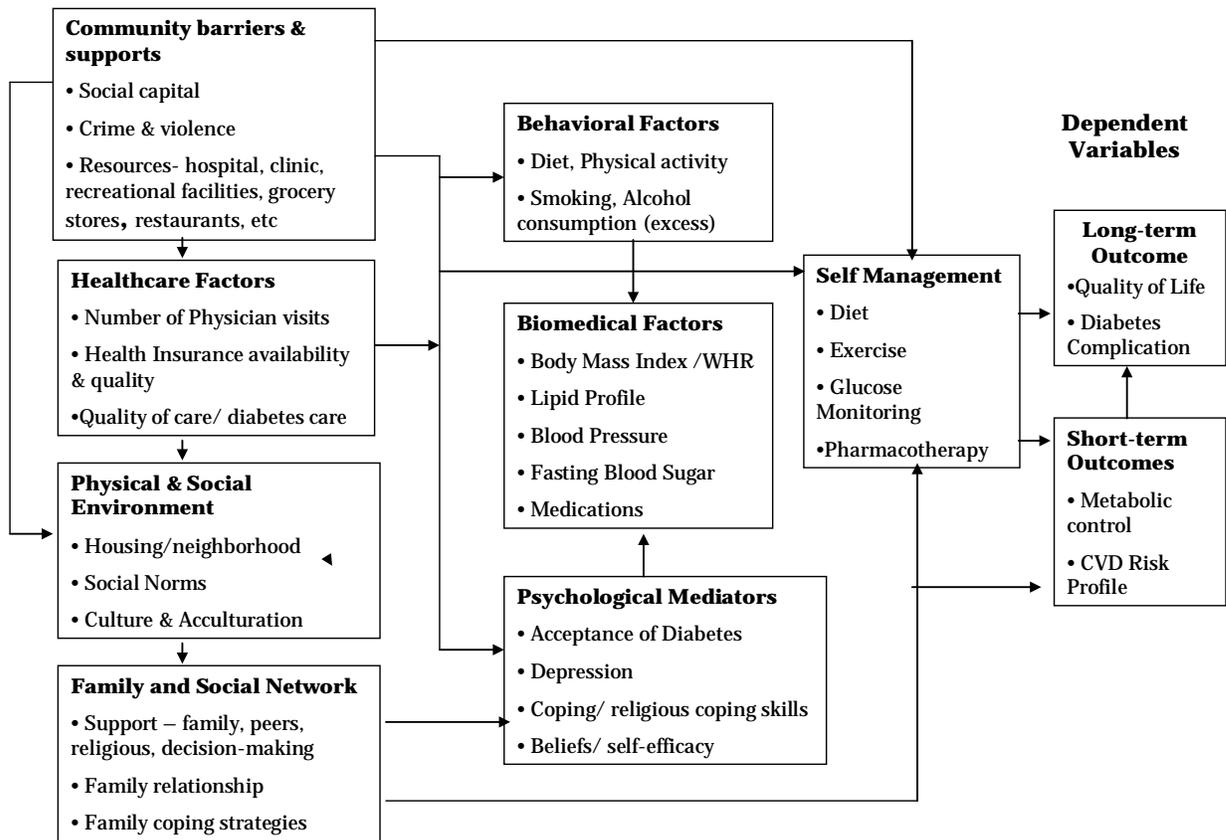
Presentation/Publications and Future Funding

Abstract (and manuscripts) will be submitted for Experimental Biology, American Academy of Health Behavior, and American Public Health Association conference and different health journals.

We also plan to submit a R-21 grant to NIH, based on our preliminary results for exploring psychosocial factors and its role in acceptance of diabetes and self-management behaviors for developing intervention programs.

APPENDIX 1 – Conceptual Model

Figure 1 - Conceptual & Contextual Factors that Influence Self-management and Diabetes Outcomes



Subjective Factors: social, family, physical, community, health care, **individual (behavior and psychosocial mediators)**
Objective Factors: HbA1c, Lipid Profile, Blood pressure, BMI, WHR