

WOMEN WITH TYPE 2 DIABETES MELLITUS: DIABETES SELF-CARE, DIABETES TIME MANAGEMENT, AND DIABETES DISTRESS

BY

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Background

- ▶ The Centers for Disease Control and Prevention (CDC) reports that 34.2 million or 10.5% of the United States (U.S.) population have diabetes, 26.9 million are diagnosed and an estimated 7.3 million remain undiagnosed.
- ▶ Ninety to 95 percent of the diabetes populations are diagnosed with Type 2 Diabetes Mellitus (T2DM). Diabetes Mellitus is a complex, progressive disease process and is the seventh leading cause of death.
- ▶ The economic impact of this disease process is extensive, with estimated costs reaching \$327 billion dollars, \$237 billion in direct medical expenditures and \$90 billion incurred indirectly.

Reference (CDC, 2021)

Problem

- ▶ Research studies have found that many individuals are not performing diabetes self-care at an optimal level (Bean, Cundy, & Petrie, 2007; Hernandez et al., 2014; Holt, Nicolucci et al., 2013; Peyrot et al., 2005).
- ▶ Diabetes self-care is extraordinarily time intensive. Certified diabetes care and education specialists estimate that performing routine diabetes self-care can take approximately 2 hours a day with additional time required for those newly diagnosed or with additional needs (Russell, Suh, & Safford, 2005).
- ▶ A meta-analysis of 55 studies showed that women experience more diabetes distress compared to men (Perrin, Davide, Robertson, Snoek & Khunti, 2017).

Research Questions

- ▶ **Overarching Question:** What are the relationships between and among diabetes self-care, diabetes time management, and diabetes distress in women with T2DM?
 - ▶ Sub-Questions:
 - ▶ What is the relationship between diabetes time management and diabetes self-care?
 - ▶ What is the relationship between diabetes distress and diabetes self-care?
 - ▶ What is the relationship between diabetes time management and diabetes distress?
- ▶ **Hypothesis:** There is an inverse relationship between diabetes distress and diabetes self-care in women with T2DM.

Conceptual Definition: Diabetes Self-Care

- ▶ Diabetes self-care is conceptually defined as actions taken by an individual to facilitate the regulation and promotion of good health. For individuals with diabetes this specifically includes monitoring blood glucose, implementing diet regimens, incorporating exercise routines, administering medications, monitoring foot care, symptom management and keeping healthcare appointments (Beverly et al., 2012; Feil, Zhu, & Sultzer, 2012; Munshi et al., 2013; Shreck, Gonzalez, Cohen, & Walker, 2014; Wu, Tung, Liang, Lee, & Yu, 2014).

Conceptual Definition: Diabetes Time Management

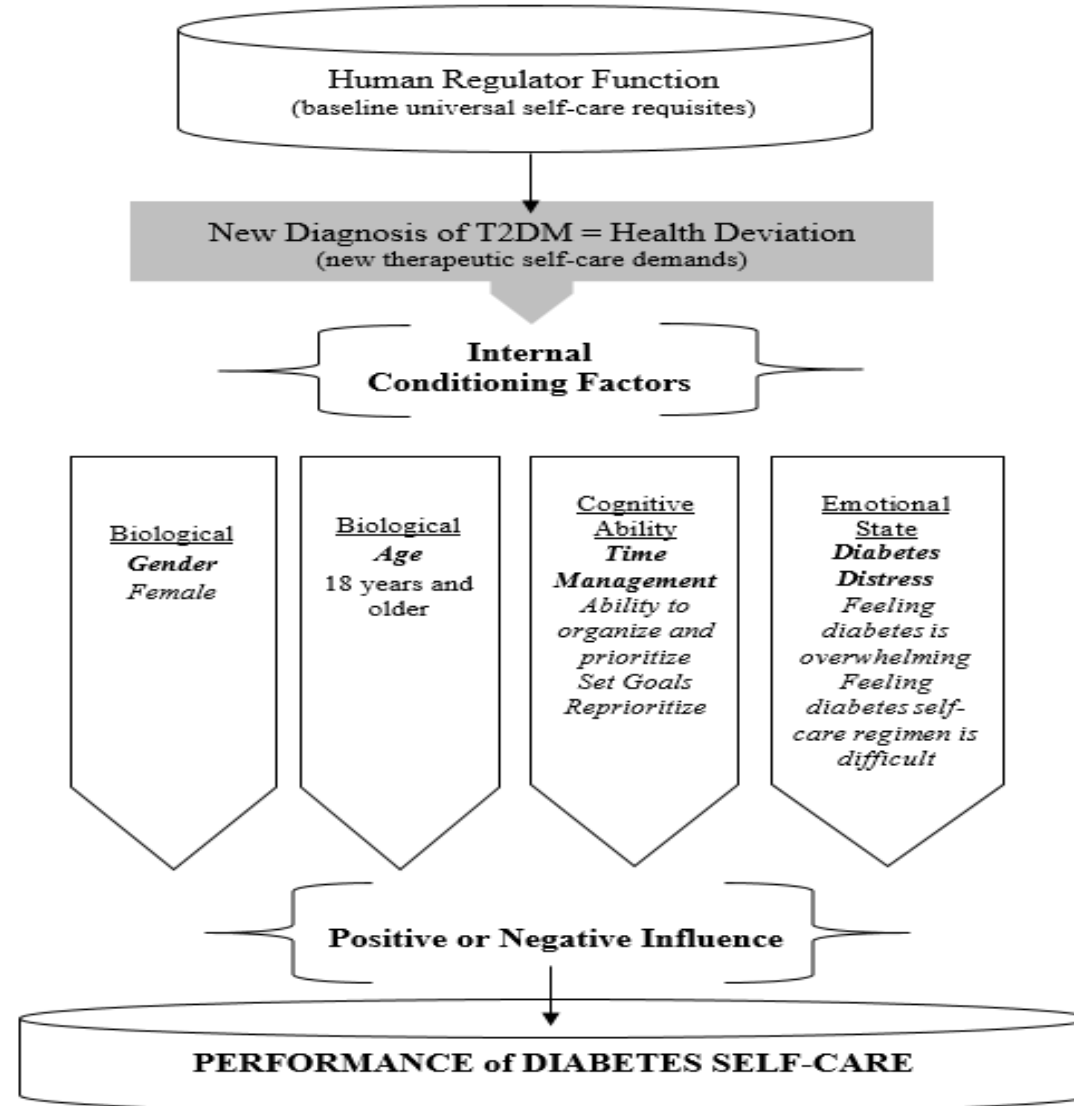
- ▶ Diabetes time management is delineated through the process of organizing, prioritizing, and implementing diabetes self-care actions on the continuum of time (Claessens, Van Eerde, Rutte, &, Roe, 2007).
- ▶ Each diabetes self-care action has specific time-bound elements, such as taking medication at the correct time of the day.

Conceptual Definition: Diabetes Distress

- ▶ Diabetes distress is the emotional impact that living with diabetes can have on an individual (Polonsky et al., 2005).
- ▶ Individuals managing their diabetes daily can feel overwhelmed and burdened with the perpetually daunting tasks of self-care, which is further exacerbated by concerns and worries associated with the progressive nature of the disease, general lack of support and treatment confusion.

Theoretical Framework

Figure 2. Diabetes Time Management and Diabetes Distress within Orem's Framework



Significance

- ▶ Screening for the presence of diabetes distress and diabetes time management skills are not routinely undertaken by health care professionals.
- ▶ A study exclusively examining women is significant because there are physiological and emotional differences between men and women who are living with diabetes.

Study Design

- ▶ A descriptive correlational design
- ▶ Convenience sample
- ▶ Mix-mode survey design (paper & electronic)
- ▶ An uncontrolled or natural setting
- ▶ 97 questions, self-report (3 instruments & 13 profile questions)
- ▶ G*Power using 16 predictor variables yielded a total sample size of 143.

Study Criteria

Inclusion:

- ▶ English literate women; 18 years or older; diagnosis of T2DM one year or longer; and prescribed a pharmaceutical intervention to treat their diabetes.

Exclusion:

- ▶ Diabetes treated with diet and exercise program only; receiving dialysis therapy; kidney transplant related to diabetes; lower extremity amputation due to diabetes complications; pregnancy; and Received chemotherapy infusion or radiation for cancer in the last 12 months.

Recruitment

Paper Survey

- ▶ Three physician offices and two diabetes centers (Bucks County and Montgomery County in Pennsylvania).
- ▶ Office recruitment (posted informational flyer), \$10.00 incentive to reimbursement for time.

Electronic Survey

- ▶ Diabetes support group network and two hospitals (Bucks County and Montgomery County in Pennsylvania).
- ▶ Invitation letter to participate.
- ▶ No incentive.

Ethical Considerations

- ▶ IRB Approval
 - ▶ Seton Hall University Approved
 - ▶ Mercy Health System Approved
 - ▶ St. Mary Medical Center Exempt Approved
 - ▶ Permission to use instruments obtained
 - ▶ Permission to recruit in private physician office and diabetes support group obtained.
 - ▶ Consent was implied by participation

Data Cleaning

- ▶ Paper survey was entered in Excel and double checked for data entry errors
- ▶ Electronic and paper were cleaned and combined
- ▶ Missing data was replaced using K-nearest neighbors (KNN) imputation
- ▶ Missing data was from paper survey only (0.16%) with no pattern

Data Collection Findings

- ▶ Data collected from September 2018 through January 2019
- ▶ Total sample used 188
- ▶ Paper survey participants (n =83)
 - ▶ Paper survey ineligibility rate was 8.7% (n =8)
- ▶ Electronic survey participants (n = 95)
 - ▶ Electronic survey abandonment rate was 20.9% (n=43); ineligibility rate was 34.2% (n =56)

Operational Definition: Diabetes Self-Care

- ▶ **Diabetes self-care was measured using Diabetes Self-Management Questionnaire (DSMQ)**
- ▶ Developed by Schmitt et al. (2013)
- ▶ DSMQ is a 16-item, 4-point Likert scale instrument with 4 dimensions and one item rating overall self-care; the dimensions include glucose management (5 items), dietary control (4 items), physical activity (3 items), and healthcare-use (3 items).
 - ▶ Higher score represents more effective self-care
 - ▶ Flesch-Kincaid (8th grade reading level).
 - ▶ Total score was calculated and transformed between 0 to 10 (Schmitt et al., 2013).
 - ▶ Established reliability: $\alpha = 0.96$ (Bukhsh, 2017), $\alpha = 0.72$ (Mehravari, 2015), and $\alpha = 0.84$ (Yadav, 2016).

Operational Definition: Diabetes Time Management

- ▶ **Diabetes time management was measured using Diabetes Time Management Questionnaire (DTMQ).**
- ▶ Developed by Gafarian et al. (1999)
- ▶ 49-item, 5-point Likert scale
 - ▶ Higher DTMQ scores indicate less effective time management
 - ▶ Flesch-Kincaid (6th grade reading level)
 - ▶ Total score was calculated and transformed between 0 to 10
 - ▶ Established reliability of the instrument demonstrated a Cronbach's alpha total score of $\alpha = 0.82$ (Gafarian et al., 1999).

Operational Definition: Diabetes Distress

- ▶ **Diabetes distress was measured using Diabetes Distress Scale (DDS)**
- ▶ The DDS was developed by Polonsky et al. (2005)
- ▶ The DDS is a 17-item , 6-point Likert scale with 4 dimensions and includes emotional burden (5 items), physician-related distress (4 items), regimen-related distress (5 items), and diabetes-related interpersonal distress (3 items) and a total diabetes distress score
 - ▶ Flesch-Kincaid (8th grade reading level)
 - ▶ Total distress score calculated by sum, and then divided by the total item numerator (17) to produce a mean item value (Fisher et al., 2012)
 - ▶ A score of less than 2 indicates little to no distress, a score range of 2.0 to 2.9 indicates moderate level of distress, and 3 or more indicates high level of distress (Fisher)
 - ▶ Reliability established: $\alpha = 0.94$ (Chew et al. (2015); $\alpha = 0.95$ (Gonzalez et al. ,2014); $\alpha = 0.93$ (Polonsky, 2005); $\alpha = 0.89$ (Schmitt et al. (2015); $\alpha = 0.92$ (Wardian and Sun , 2014).

Demographic & Descriptive Characteristics

Range, Mean and Standard Deviation of Age & Duration of Diabetes (N = 188)

Self-Reported Characteristics	Range	<i>M (SD)</i>
Age	20-88	60.66 (12.35)
Diabetes duration in years	1-56	13.08 (10.40)

Frequency Table on Participant's Characteristics (N = 188)

Characteristics	N	Percent
Race/Ethnicity		
African	16	8.5%
Asian	10	5.3%
Latino	1	0.5%
Mixed	2	1.1%
Other	6	3.2%
White	153	81.4%
Total	188	100%
Income		
< \$30,000	35	18.6%
[\$30,001, \$50,000]	32	17.0%
[\$50,001, \$70,000]	19	10.1%
[\$70,001, \$100,000]	28	14.9%
> \$100,001	32	17.0%
Prefer not to answer	42	22.3%
Total	188	100%
Education		
Below high school	14	7.4%
High school	34	18.1%
Some college (no degree)	46	24.5%
Associate's degree	21	11.2%
Bachelor's degree	37	19.7%
Graduate degree	29	15.4%
Doctorate	7	3.7%
Total	188	100%
Employment		
Full time	56	29.9%
Part time	21	11.2%
Retired	67	35.6%
Unemployed	36	19.1%
Prefer not to answer	8	4.3%
Total	188	100%

Working Participants

Frequency Table on Work Environment (n = 114)

Favorable Work Environment	N	Percent
Always favorable	62	54.4%
Often favorable	16	14.0%
Somewhat favorable	23	20.2%
Not at all favorable	13	11.4%
Total	114	100%

Frequency Table on Participant's Health Characteristics (N = 188)

Self-Reported Characteristics	N	Percent
Recent HbA1c		
< 6	20	10.6%
6.1 – 6.5	44	23.4%
6.6 – 7.0	22	11.7%
7.1 – 7.5	45	23.9%
7.6 – 8.0	11	5.9%
> 8	36	19.1%
I don't know HbA1c	10	5.3%
Total	188	100%
Other health conditions		
1	33	17.6%
2	56	29.8%
3 or more	79	42.0%
None	15	8.0%
Not sure	5	2.7%
Total	188	100%
Diabetes Status		
Diabetes is getting better	54	28.7%
Diabetes is staying the same	93	49.5%
Diabetes is getting worse	41	21.8%
Total	188	100%
Medication regimen		
Oral medication only	98	52.1%
Combination oral medication and insulin	57	30.3%
Insulin pen or syringe injection only	27	14.4%
Insulin pump only	6	3.2%
Total	100	100%
Neglect self-care		
Rarely	127	67.6%
Half the time	54	28.7%
Most of the time	7	3.7%
Total	188	100%

Characteristics of Caregiver Roles (N = 188) and the Number of Roles Identified (n = 127)

Self-Reported Characteristics	N	Percentage
Caregiver Roles		
No additional caregiver roles	61	32.4%
Additional caregiver roles	127	67.6%
Total	188	100%
Characteristics of Caregiver Roles		
1 caregiver role	79	62.2%
2 caregiver roles	37	29.1%
3 caregiver roles	11	8.7%
Subtotal caregiver roles	127	100%

Instrument Reliability

Test of Reliability for Main Study Instruments and Subscales from Study Participants (N = 188)

Instrument	Cronbach's Alpha	N of Items
Diabetes Self-Care (DSMQ)	0.83	16
Subscale dietary control	0.68	4
Subscale glucose management	0.73	5
Subscale physical activity	0.74	3
Subscale physician contact	0.64	3
Diabetes Time Management (DTMQ)	0.89	49
Diabetes Distress (DDS)	0.93	17
Emotional burden	0.90	5
Physician distress	0.92	4
Regimen distress	0.90	5
Interpersonal distress	0.76	3

Range, Median, Mean, and Standard Deviation of the Diabetes Self-Care Questionnaire, Diabetes Time Management Questionnaire, and Diabetes Distress Scale (N = 188)

Instrument	Range	Median	Mean	SD
Diabetes Self-Care	3.75-9.58	7.29	7.11	(1.40)
Subscale dietary control	0-10	5.83	5.55	(1.98)
Subscale glucose management	0-10	8.0	7.83	(1.85)
Subscale physical activity	0-10	6.66	6.01	(2.74)
Subscale physician contact	2.22-10	10	8.97	(1.76)
Diabetes Time Management	2.97-7.18	5.02	4.98	(0.83)
Diabetes Distress Scale	1-6	1.94	2.24	(1.05)
Subscale emotional burden	1-6	2.2	2.45	(1.28)
Subscale physician distress	1-6	1	1.57	(1.15)
Subscale regimen distress	1-6	2.2	2.61	(1.35)
Subscale interpersonal distress	1-6	1.66	2.18	(1.37)

Paper vs. Electronic Continuous Variables

Independent T-test Comparison Between Survey Method and Continuous Variables.

Variable	Paper		Electronic		<i>t</i> (<i>df</i>)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Diabetes self-care	7.16	(1.43)	7.06	(1.37)	0.49 (186)
Diabetes time management	4.98	(0.86)	4.99	(0.8)	0.03 (186)
Diabetes distress	2.02	(0.95)	2.42	(1.09)	2.66** (186)
Age	63.54	(12.79)	58.39	(11.6)	-2.89** (186)
Years living with diabetes	15.24	(10.18)	11.37	(10.3)	-2.57** (186)

** $p < 0.01$

Survey Methods with Income and Work

Cross Tabulation of Survey Method with Income and Employment

	<u>Survey Method</u>				$X^2(df)$	ϕ	Sig.
	Paper		Electronic				
	n (%)		n (%)				
Income					14.05 (5)	0.27	0.015*
< \$30,000	18	(51.4%)	17	(48.6%)			
\$30,001 - \$50,000	20	(63.5%)	12	(37.5%)			
\$50,001 - \$70,000	7	(36.8%)	12	(63.2%)			
\$70,001 - \$100,000	5	(17.9%)	23	(82.1%)			
> \$100,000	16	(50.0%)	16	(50.0%)			
Prefer not to answer	17	(40.5%)	25	(59.5%)			
Total	83	(100%)	105	(100%)			
Employment					15.31 (3)	0.28	0.002*
Full time	13	(22.8%)	44	(77.2%)			
Part time	11	(52.4%)	10	(47.6%)			
Retired	40	(54.1%)	34	(45.9%)			
Unemployed	19	(52.8%)	17	47.2%)			
Total	83	(100%)	105	(100%)			

* $p < 0.05$

Bivariate Analyses

Bivariate Correlations (Pearson's) for Continuous Variables (N=188)

Variable	1	2	3	4	5
1. Diabetes self-care	—	-0.605**	-0.331**	0.056	-0.030
2. Diabetes time management		—	0.394**	-0.183*	0.007
3. Diabetes distress			—	-0.288**	-0.144
4. Age				—	0.459**
5. Years living with diabetes					—

** $p < 0.01$ level, * $p < 0.05$ level (2-tailed).

- No violations of normality, linearity, and homoscedastic.
- Large inverse relationship between self-care and time management
- Medium inversion relationship between self-care and diabetes distress
- Medium positive relationship between time management and diabetes distress

One-way ANOVA Tests for Mean Difference in Diabetes Self-Care Between Categorical Levels of Employment, Work Environment, Self-Care Neglect, and Diabetes Status

Variable	N	M	SD	F (df)	p
Employment¹				4.47 (4, 183)	0.002
Full time [*]	56	6.51	(1.37)		
Part time [*]	21	7.6	(1.35)		
Retired [*]	67	7.21	(1.28)		
Unemployed [*]	36	7.55	(1.48)		
Prefer not to answer	8	7.08	(1.06)		
Total	188	7.11	(1.4)		
Work Environment²				3.77 (3, 110)	0.013
Always favorable [*]	62	7.4	(1.39)		
Often favorable	16	6.72	(0.84)		
Somewhat favorable [*]	23	6.49	(1.48)		
Not at all favorable	13	6.46	(1.5)		
Total (unemployed excluded)	114	7.01	(1.41)		
Neglect Self-Care³				7.9 (2, 185)	0.00
Rarely [*]	127	7.37	(1.32)		
Half the time [*]	54	6.66	(1.4)		
Most of the time [*]	7	5.95	(1.5)		
Total	188	7.11	(1.4)		
Diabetes Status⁴				14.20 (2, 185)	0.00
Getting better [*]	54	7.84	(1.08)		
Staying the same [*]	93	7	(1.45)		
Getting worse [*]	41	6.42	(1.27)		
Total	188	7.11	(1.4)		

Note: ^{*}Asterisk indicates post-hoc test significant differences.

1. Employment indicated the mean self-care for part time and retired was significantly higher than the mean full time.

2. Work environment indicated the mean self-care for always favorable work environment was significantly higher than the mean somewhat favorable work environment.

3. Neglect self-care indicated the mean self-care for rarely neglect was significantly higher than neglect half the time and most of the time.

No violation of test of assumptions and Leven's homogeneity

Multivariate Analysis

Simultaneous Regression Predicting Diabetes Self-Care from Diabetes Time Management and Diabetes Distress.

Variable	B	SE	β
Diabetes time management score	-0.95	0.11	-0.56**
Diabetes distress score	-0.15	0.08	-0.11
R^2	0.37		
F	55.86		
ΔR^2	0.37		
ΔF	55.56		

Note: * $p < 0.05$, ** $p < 0.001$. Full Model: R Squared = 0.377, Adjusted R Squared = 0.370, $F(2, 185) = 55.86$, $p < 0.001$.

- No evidence of multicollinearity.
- No violation of normality, linearity, homoscedastic were violated.
- The ANCOVA procedure was performed to calculate the η^2 effect size on the model. Time management demonstrated a large effect size (0.300) and diabetes distress had a small effect size (0.016).

Research Questions

- ▶ The overarching question was answered in the simultaneous regression model.
Diabetes time management and diabetes distress explained 37.7% of the variance in diabetes self-care, $F(2, 185) = 55.86, p < 0.001$
- ▶ The sub-research questions were answered from the bivariate correlational analyses:
 - ▶ (1) the relationship between time management and diabetes self-care showed a strong, inverse statistically significant relationship, $r(n = 186) = -0.60, p < 0.001$;
 - ▶ (2) the relationship between diabetes distress and diabetes self-care showed an inverse, medium statistically significant relationship, $r(n = 186) = 0.33, p < 0.001$;
 - ▶ (3) the relationship between time management and diabetes stress showed a medium, positive, statistically significant relationship, $r(n = 186) = 0.39, p < 0.001$.
- ▶ The study's hypothesis stated that an inverse relationship between diabetes distress and diabetes self-care exists among women with T2DM. The statistically significant findings from Pearson's correlation supports rejecting the null hypothesis, therefore, the study's hypothesis is accepted.

Sample Bias (Paper vs Electronic)

- ▶ Slight bias was found between the two survey methods (paper vs. electronic)
- ▶ Paper survey group was older and lived with diabetes longer
- ▶ Electronic survey group had slightly higher diabetes distress levels, income, and full-time employment.

Strengths

- ▶ Data collection from multiple sites
- ▶ Participants from several regions across the U.S., although the majority of the respondents lived in the Mid-Atlantic region (64.04%)
- ▶ Participants with diverse income and education levels
- ▶ Limited missing data points (0.16%)
- ▶ This is the first study to examine diabetes self-care, diabetes time management diabetes, and diabetes distress
- ▶ Reliable instruments
- ▶ First study in the North America to use the DSMQ instrument.

Limitation

- ▶ Convenience sampling may introduce motivational bias
- ▶ Predominately White sample (81.4%)
- ▶ Monetary, uncontrolled bias for paper survey participants (44%, n = 83)
- ▶ Potential incentive, direct bias could include converting reluctant participants who would otherwise not complete the survey as well as introducing measurement error where the participants feel obligated to give desirable responses rather than a true response.
- ▶ The electronic participants did not receive monetary incentives, thereby introducing potential motivational differences between paper and electronic participants.
- ▶ Self-reporting poses a threat to accuracy as the data points are subjective (Gray et al., 2017).

Implications

- ▶ Expanded Orem's self-care theory by including disease specific variables as internal conditioning factors to show the influence on self-care.
- ▶ Diabetes time management and diabetes distress negatively impact diabetes self-care, with time management as the strongest predictor with the implication to improve patient outcomes.
- ▶ Diabetes time management, an under-studied variable in individual's with T2DM, has the potential to be a contributor to improve patient outcomes.

Future Research Recommendations

- ▶ To include:
 - ▶ (a) sampling techniques that include more diverse ethnic and racial participants,
 - ▶ (b) consent to obtain A1c values directly from healthcare provider to improve accuracy,
 - ▶ (c) inclusion of participants with T1DM, and
 - ▶ (d) inclusion of men.
- ▶ Future research to related to diabetes self-care and employment by examining the potential impact of diabetes time management and diabetes distress.
- ▶ Long term future research needs focus on diabetes time management interventional studies whereby improvement in diabetes self-care and outcomes measures are evaluated

Conclusion

- ▶ This the first study to identify that diabetes time management is a large statistically significant predictor of diabetes self-care.
- ▶ Now that diabetes time management has been identified as impactful to diabetes self-care on predominately White woman, it is recommended that healthcare professionals evaluate the how these individuals are managing time and self-care.