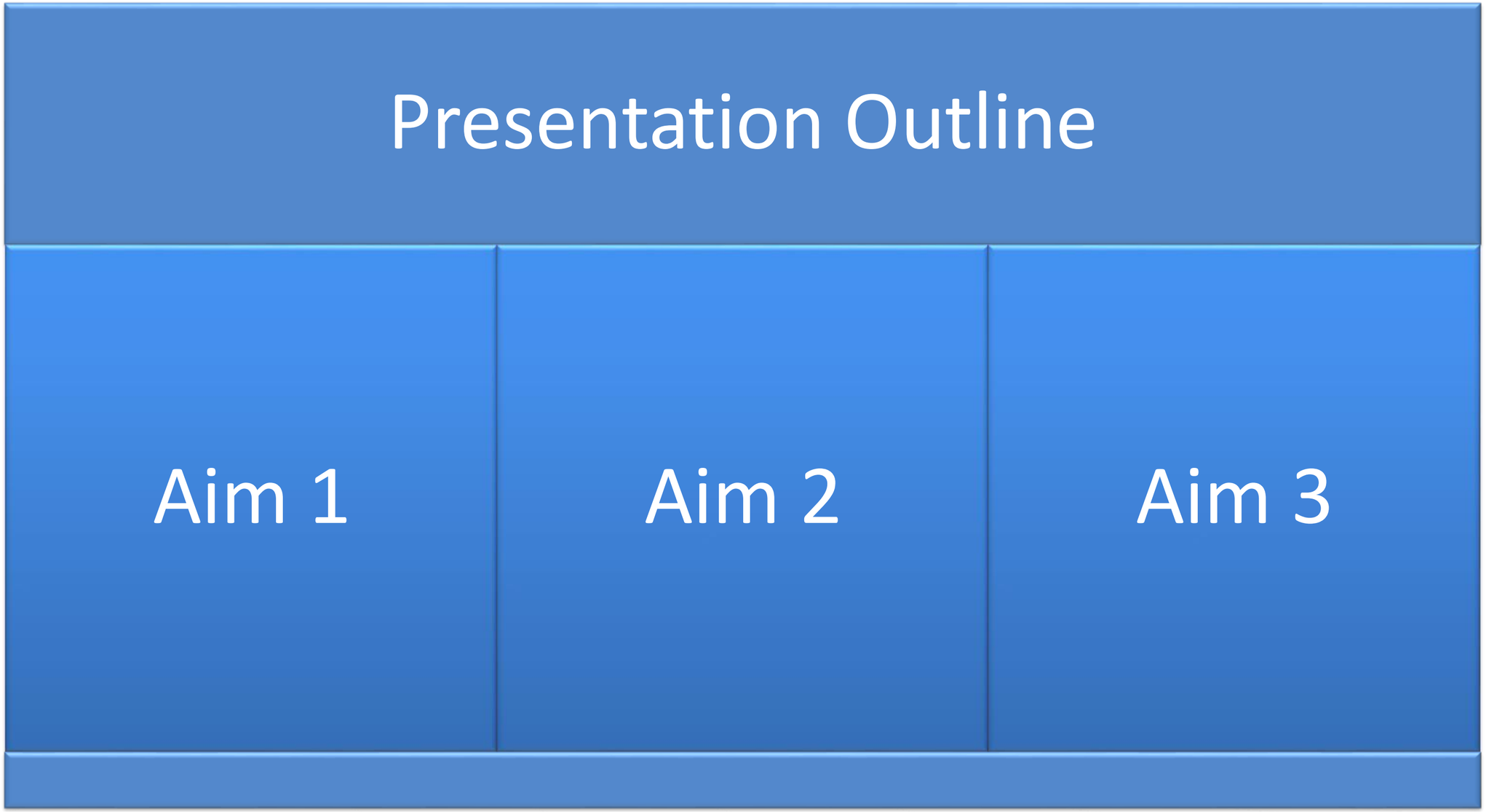
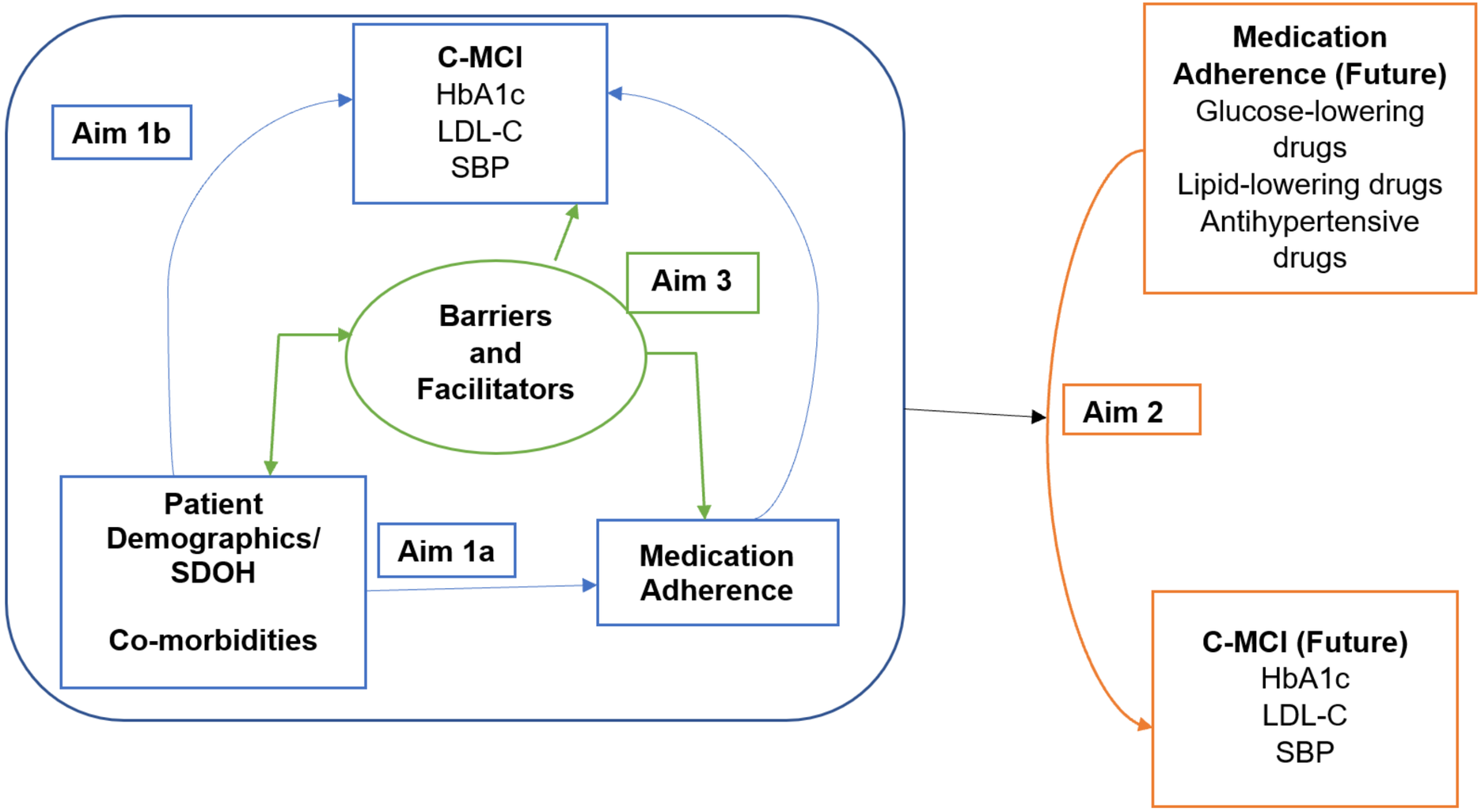
Prescription for Progress: Unraveling the Relationships Between Medication Adherence and Cardio-Metabolic Outcomes in American Indian Adults

Presenters:
Lisa Scarton and Tarah Nelson

Research Team

Lisa Scarton, PhD, RN
University of Florida, College of Nursing
--
Rikki LaRoche
Public Health Director
Department of Public Health
Choctaw Nation of Oklahoma
--
Tarah Nelson, PhD, APRN, FNP-C
University of Florida, College of Nursing
--
Chasity Pierre, BSN
University of Florida, College of Nursing
--
Marilyn E. Aguila
UF College of Public Health and Health Professions
--
Anatolia B. Legaspi
University of Florida, College of Pharmacy
--
Yingwei Yao, PhD
University of Florida, College of Nursing
--
Diana Orozco
University of Florida, College of Nursing
--
Chanler Podany
Public Health Representative
Department of Public Health
Choctaw Nation of Oklahoma
--
Dannielle Branam
Public Health Representative
Department of Public Health
Choctaw Nation of Oklahoma
--
Ashley DeVaughan Circles, PharmD, MBA, BCPS
Choctaw Nation Health System Authority/
Lawton Indian Hospital
--
Richard Segal, PhD
University of Florida, College of Pharmacy
--
R. Turner Goins, PhD
Western Carolina University, College of Health and Human Sciences
--
Diana J. Wilkie, PhD, RN
University of Florida, College of Nursing
--
Spero Manson, PhD
University of Colorado Anschutz Medical Campus, Colorado School of Public Health
--


Presentation Outline
Aim 1
Aim 2
Aim 3


C-MCI
HbA1c
LDL-C
SBP
Aim 1b
Aim 3
Barriers
and
Facilitators
Patient
Demographics/
SDOH
Co-morbidities
Aim 1a
Medication
Adherence
Medication
Adherence (Future)
Glucose-lowering
drugs
Lipid-lowering drugs
Antihypertensive
drugs
Aim 2
C-MCI (Future)
HbA1c
LDL-C
SBP

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Aim 1:
Number of Medications and Medication Adherence

Introduction

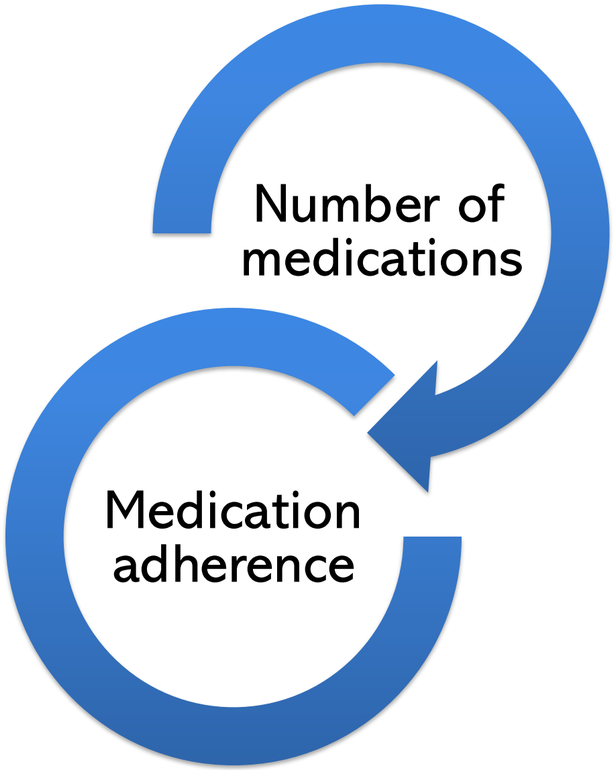
Low medication adherence is associated with increased risk of diabetes-related complications among patients with type 2 diabetes (T2D)[1,2]

Adherence may be impacted by the number of medications taken by a person

Patients with T2D often need multiple cardiometabolic medications to follow treatment guidelines and manage comorbidities[3]

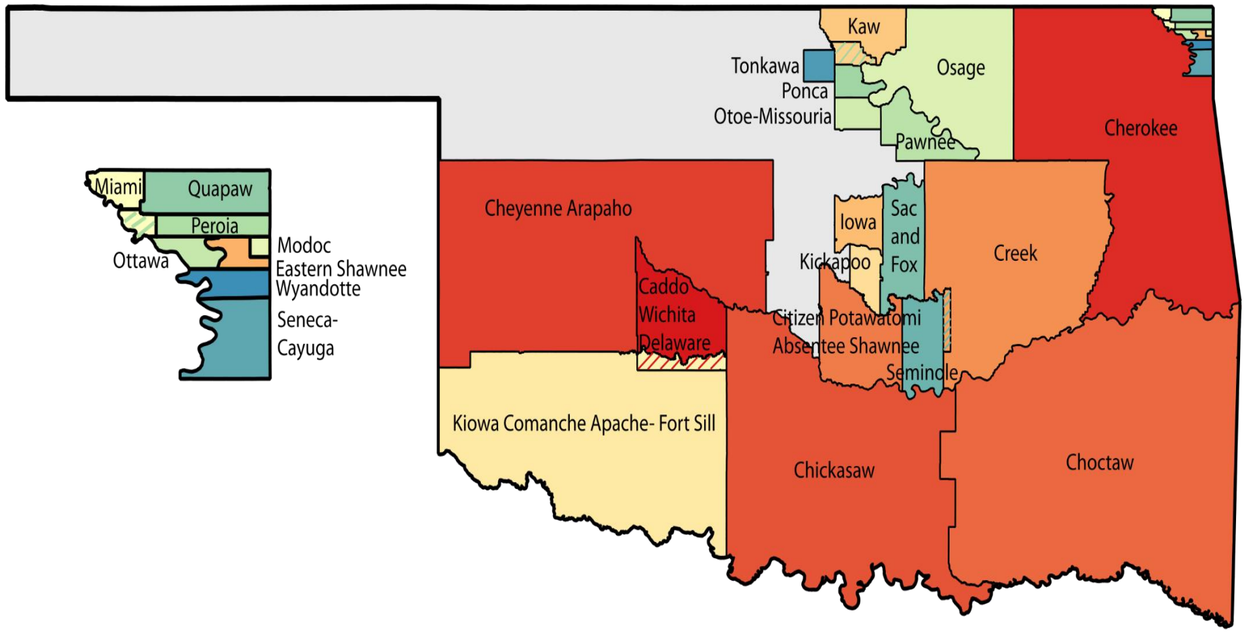
Purpose

The purpose of this study was to examine the association between the number of cardiometabolic medications and medication adherence among American Indian adults with T2D using Tribal health services.



Methods

- Choctaw Nation Tribal Health Services Authority (CNHSA)
- 2019 medication dispensing data and patient electronic health record (EHR) data


Kaw
Tonkawa
Ponca
Otoe-Missouria
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Pawnee
Cherokee
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Quapaw
Peroia
Ottawa
Modoc
Eastern Shawnee
Wyandotte
Seneca-
Cayuga
Cheyenne Arapaho
Iowa
Sac
and
Fox
Kickapoo
Creek
Caddo
Wichita
Delaware
Citizen Potawatomi
Absentee Shawnee
Seminole
Kiowa Comanche Apache- Fort Sill
Chickasaw
Choctaw

(6)


CHOCTAW NATION
DIABETES WELLNESS CENTER

Methods

Inclusion criteria

- Aged ≥ 20 years
- Diagnosed with type 2 diabetes
- Received or picked up ≥ 1 cardiometabolic medication from a CNHSA pharmacy in 2019

Exclusion criteria

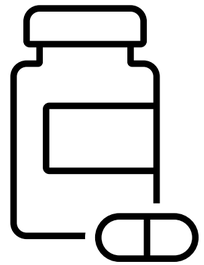
- Prescribed only insulin
- Diagnosed with:
  - Other specified diabetes mellitus (DM)
  - DM due to an underlying condition with chronic kidney disease
  - End-stage renal disease

(7)

Methods

Medication adherence

- Pharmacy record data
- Proportion of days covered (PDC)
- First calculated the PDC for each medication
- Averaged the PDC across all cardiometabolic medications for each patient
- PDC of ≥ 0.80 considered adherent



Methods

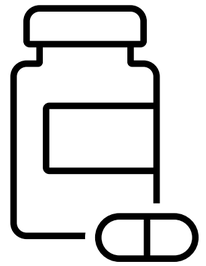
Definition of medication adherence

- PDC was defined as:
  - Percentage of days a patient had access to a medication within a period of interest

- The period of interest was defined as:
  - First dispense of medication (or first day of the 2019)

    and
  - Last dispense ran out (or last day of 2019)

- Medications with POIs < 90 days in 2019 were excluded



Methods

Number of cardiometabolic medications

- Glucose-lowering, lipid-lowering, and antihypertensive medications
- Calculated the average number of medications in 2019
  - Number of cardiometabolic medications may vary over a calendar year
- Patients were grouped into 3 categories:
  - ≤ 2 medications (31% of patients)
  - > 2-4 medications (43% of patients)
  - > 4 medications (26% of patients)

Methods

Demographic characteristics

- Sex
- Age
  - Elder age cutoff: ≥ 55 years
- Marital status

Comorbidities

- Renal
- Stroke or vascular
- Cardiovascular
- Cancer

Insulin usage

Statistical Analysis

Descriptive statistics

- Mean, standard deviation, frequency, and percentage

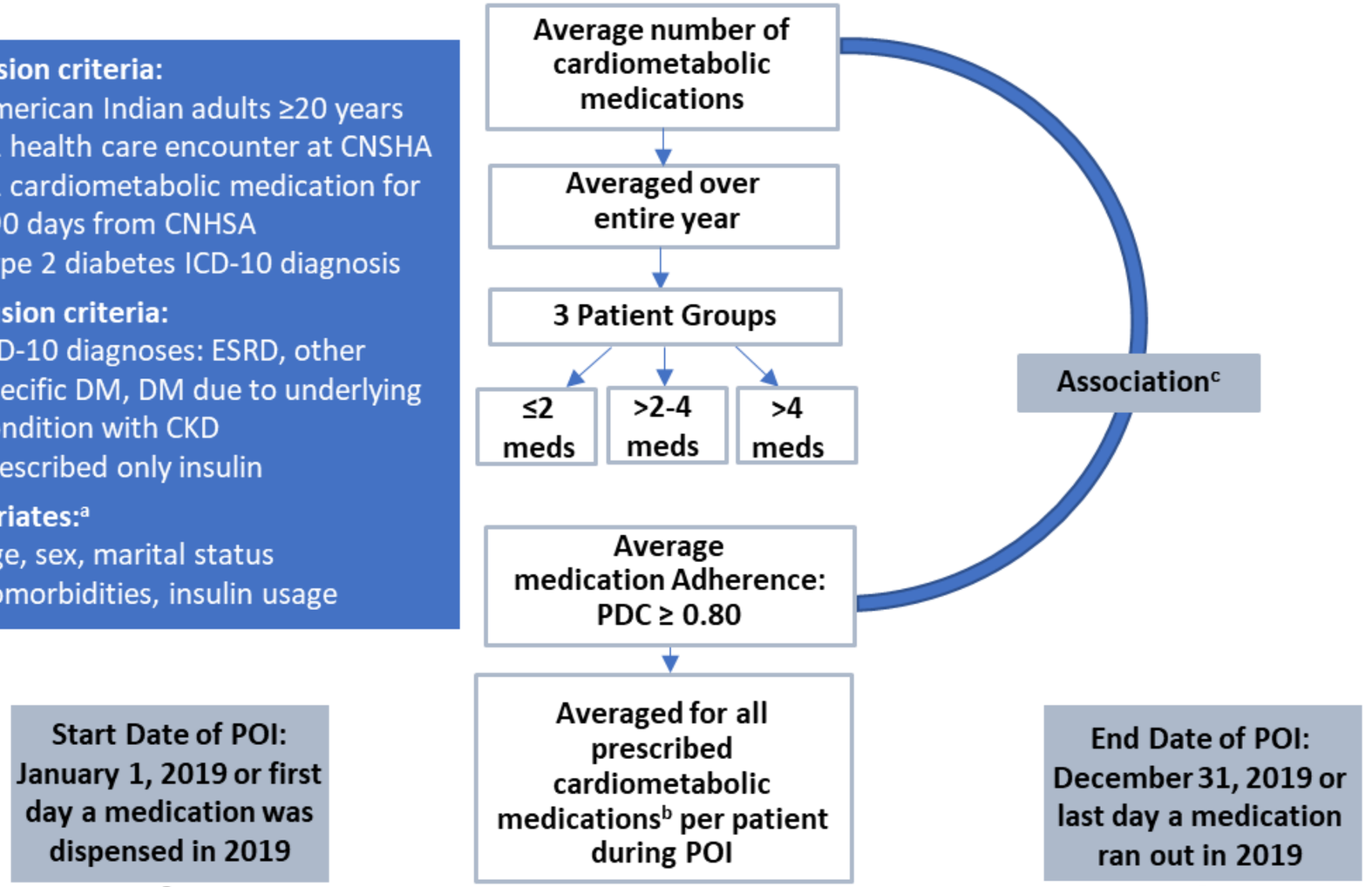
Multiple linear regression model

- Association of PDC in 2019 with:
  - Number of medications
  - Patient demographics
  - Insulin usage
  - Comorbidities
- Significance set at alpha < 0.05
- R was used for this analysis

Inclusion criteria:
- American Indian adults ≥20 years
- ≥1 health care encounter at CNSHA
- ≥1 cardiometabolic medication for ≥90 days from CNHSA
- Type 2 diabetes ICD-10 diagnosis

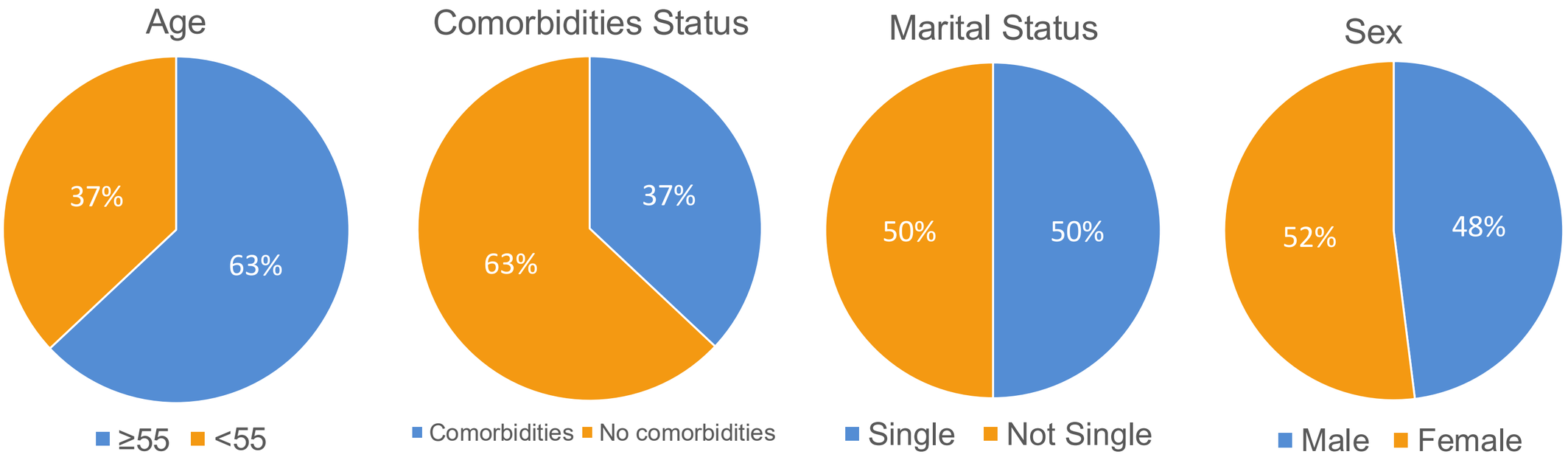
Exclusion criteria:
- ICD-10 diagnoses: ESRD, other specific DM, DM due to underlying condition with CKD
- Prescribed only insulin

Covariates:[a]
- Age, sex, marital status
- Comorbidities, insulin usage



Results

Sample size: 6,774 American Indian adults



Mean age: 58.4 ±13.2 years

Results

Overall, 61% of the sample were adherent (PDC ≥0.80)

Percentage of Adherent Patient by Average Number of Cardiometabolic Medications in 2019

≤2 medications	>2-4 medications	>4 medications	*P* value
49%	62%	72%	<.001

Results

		Overall (N = 6774)	Number of Medications[a]			P value[b]
			≤ 2 (n = 2092)	> 2-4 (n = 2921)	> 4 (n = 1761)	
PDC %, n	M (SD)	0.79 (0.20)	0.73 (0.24)	0.80 (0.18)	0.85 (0.15)	<.001
	≥ 0.8	60.6%	49.0%	62.1%	71.8%	<.001
Sex	Female	52.2%	57.1%	53.2%	44.7%	<.001
	Male	47.8%	42.9%	46.8%	55.3%	
Age	M (SD)	58.4 (13.2)	55.1 (14.6)	59.2 (12.8)	61.1 (11.1)	<.001
	≥ 55	63.4%	53.2%	65.1%	72.6%	<.001
	< 55	36.6%	46.8%	34.9%	27.4%	
Marital status	Married	50.4%	50.2%	48.3%	54.3%	<.001
	Single	49.6%	49.8%	51.7%	45.7%	
Comorbidities	M (SD)	0.51 (0.75)	0.35 (0.67)	0.54 (0.77)	0.63 (0.79)	<.001
	None	63.1%	74.1%	60.5%	54.5%	<.001
	1 or more	36.9%	25.9%	39.5%	45.5%	
Insulin	Yes	29.4%	24.5%	29.9%	34.6%	<.001

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	1 or more	36.9%	25.9%	39.5%	45.5%	
Insulin	Yes	29.4%	24.5%	29.9%	34.6%	<.001

Results

Adherence was associated with:

- Higher number of medications (β=0.026, p<.001)
- Older adults (≥55 years) (β=0.062, p<.001)
- Male sex (β=0.009, p=.046)
- Presence of comorbidities (β=0.033, p<.001)

Low adherence was associated with:

- Being single (β=-0.034, p<.001)
- Insulin use (β=-0.019, p<.001)

Discussion

- To our knowledge, this is the first study demonstrating the association between higher number of medications and better adherence in American Indian adults using a Tribal health center
- Patients who take more medications were more likely to have better adherence compared to those who took fewer medications.
- The existing literature on the relationship between adherence and number of medications is inconclusive,[8] despite the common belief that adherence decreases as the number of medications increase.[9]

Future Research

- Patients using Tribal health services receive medications at no cost, which removes financial barriers to medication adherence.
- Future research should focus on factors associated with nonadherence identified in this population, such as younger age and fewer medications.
  - Develop targeted, strength-based interventions
  - Improve adherence and health outcomes in American Indian adults with T2D

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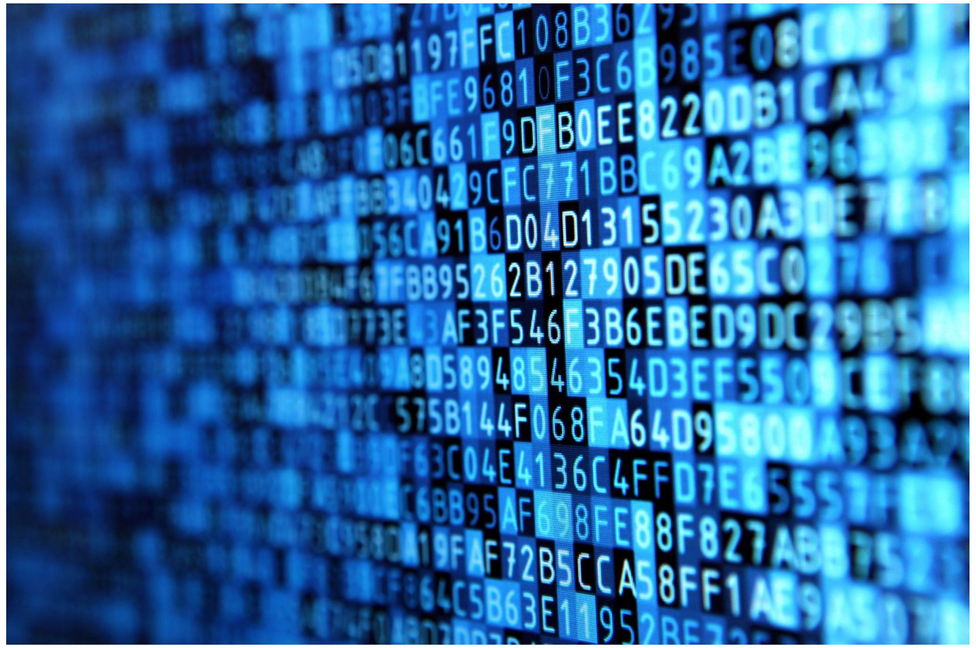
Aim 2:
Machine-learning models

Purpose of Aim 2

- *Develop machine-learning models for predicting future C-MCI from the previous year medication adherence, demographics, co-morbidities, and common labs.*

- *We will identify the models that perform best in predicting patients at-risk to develop potential intervention targets.*



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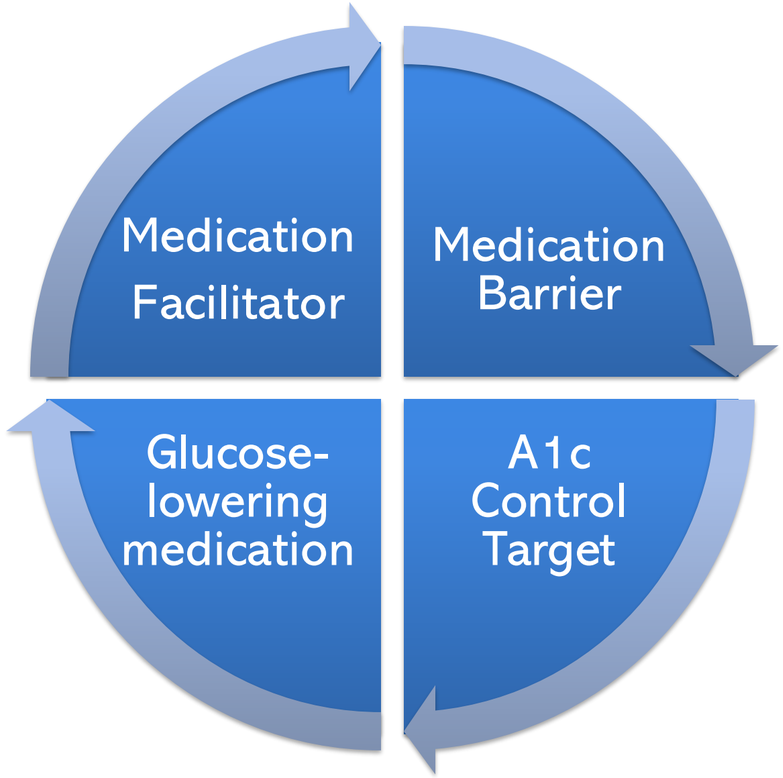
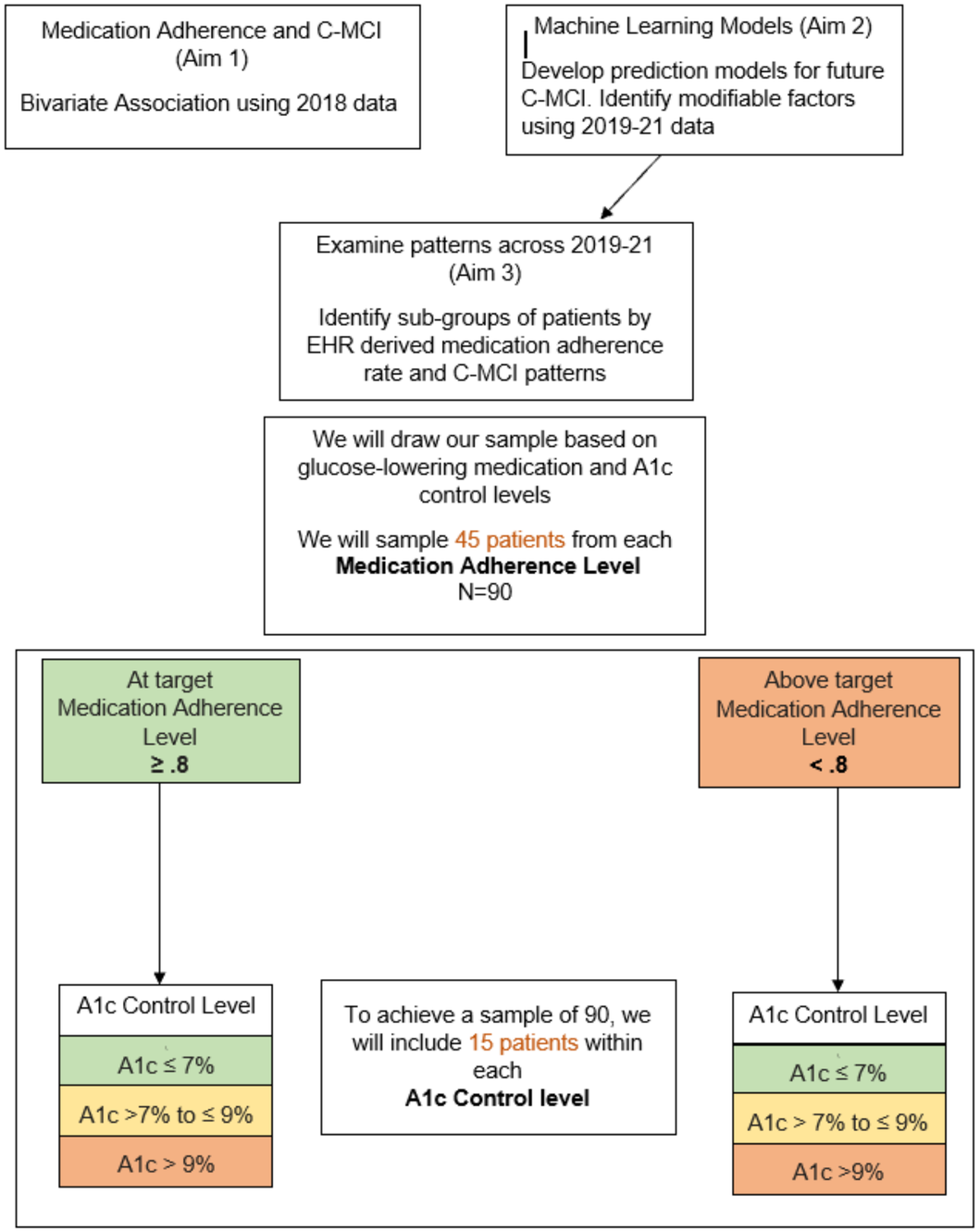
Aim 3:
Facilitator of and Barriers to Medication Adherence within the Context of Social Determinants of Health

Purpose of Aim 3

To identify facilitators of and barriers to glucose-lowering medication adherence within the context of SDOH and A1c control targets (at target, above target, and uncontrolled).



Recruitment flow diagram

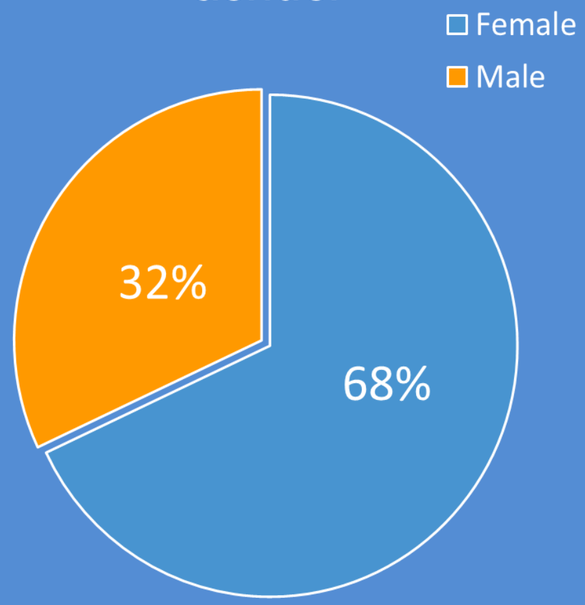


Completed Interviews

Group	Count	Males	Females	< 45 years	45-65 years	> 65 years
1	8	3	5	2	3	3
2	9	5	4	2	4	3
3	7	4	3	3	3	1
4	3	0	3	0	1	2
5	6	2	4	3	2	1
6	3	0	3	2	1	0
7	4	0	4	2	2	0
8	5	1	4	2	3	0
9	5	1	4	3	2	0
Total	50	16	34	19	21	10

Demographic Characteristics

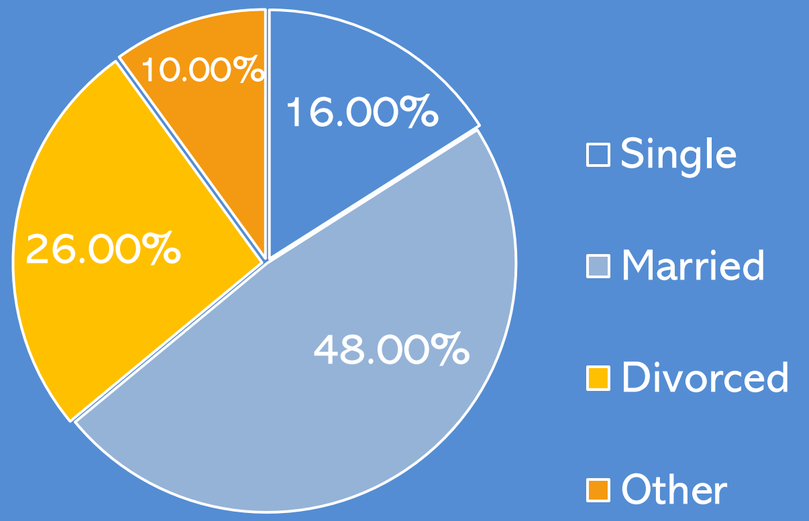
Gender



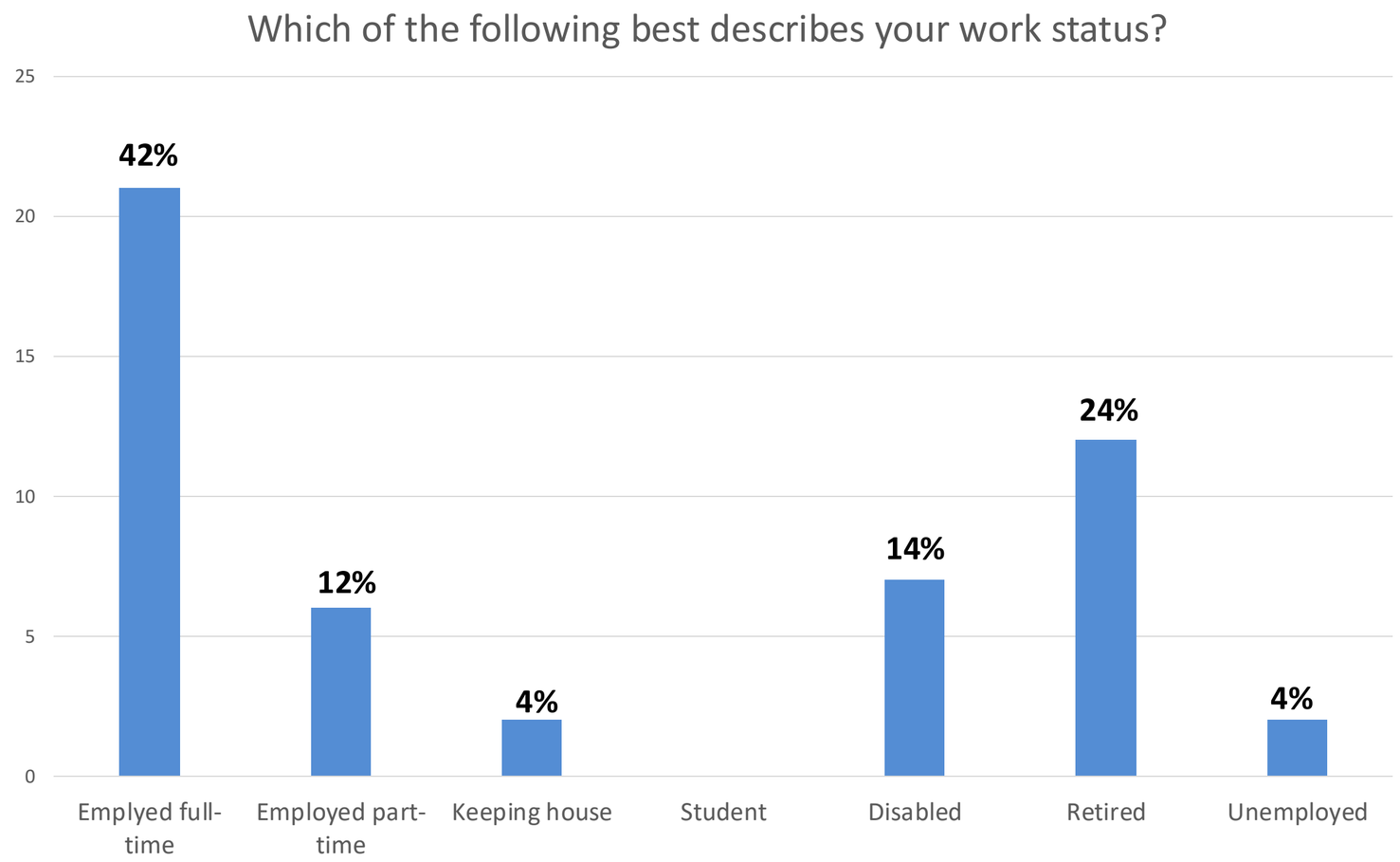
Patients' Ages in years

<45	**19 (38%)**
45-65	21 (42%)
>65	10 (20%)

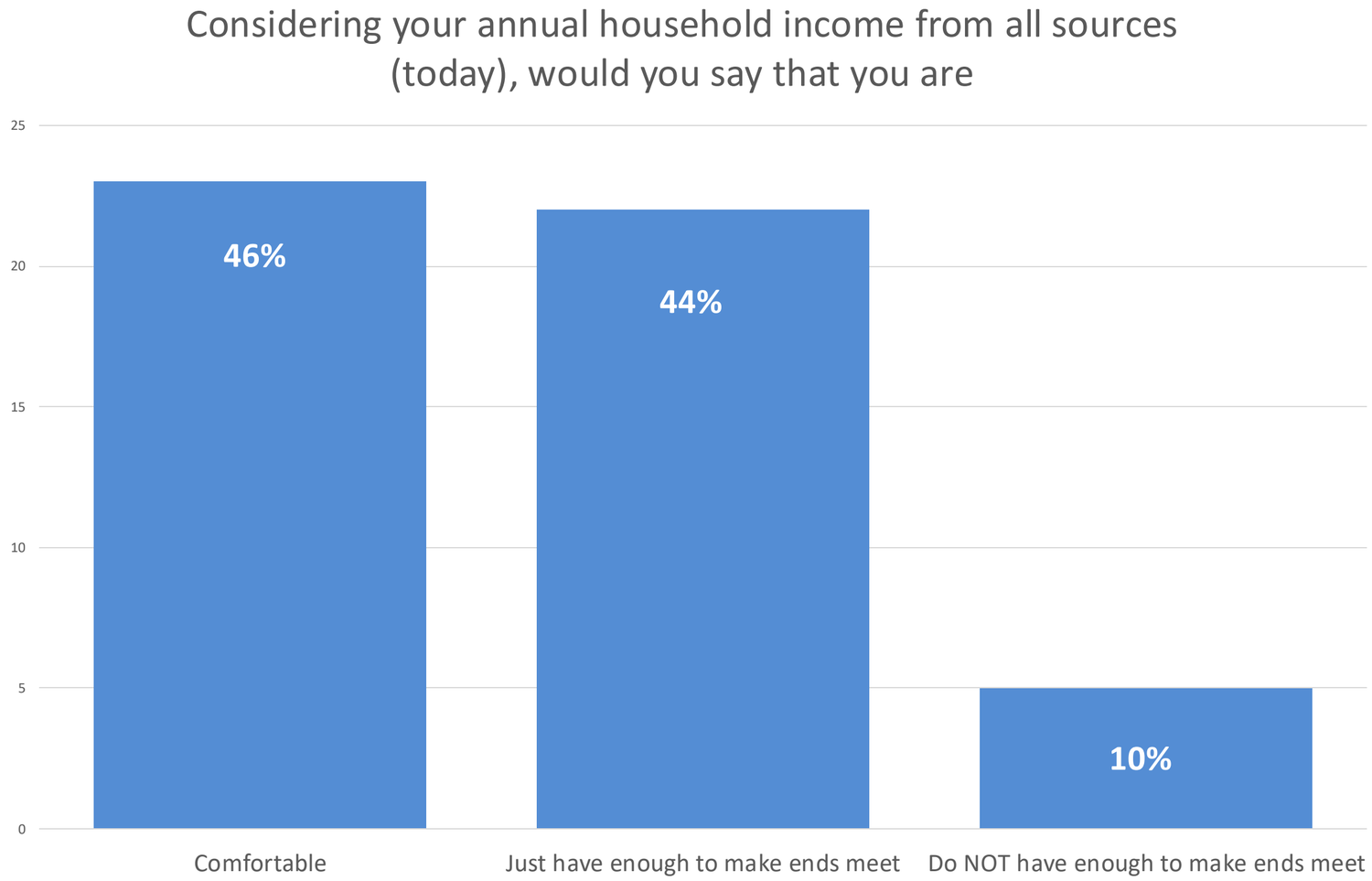
Marital Status



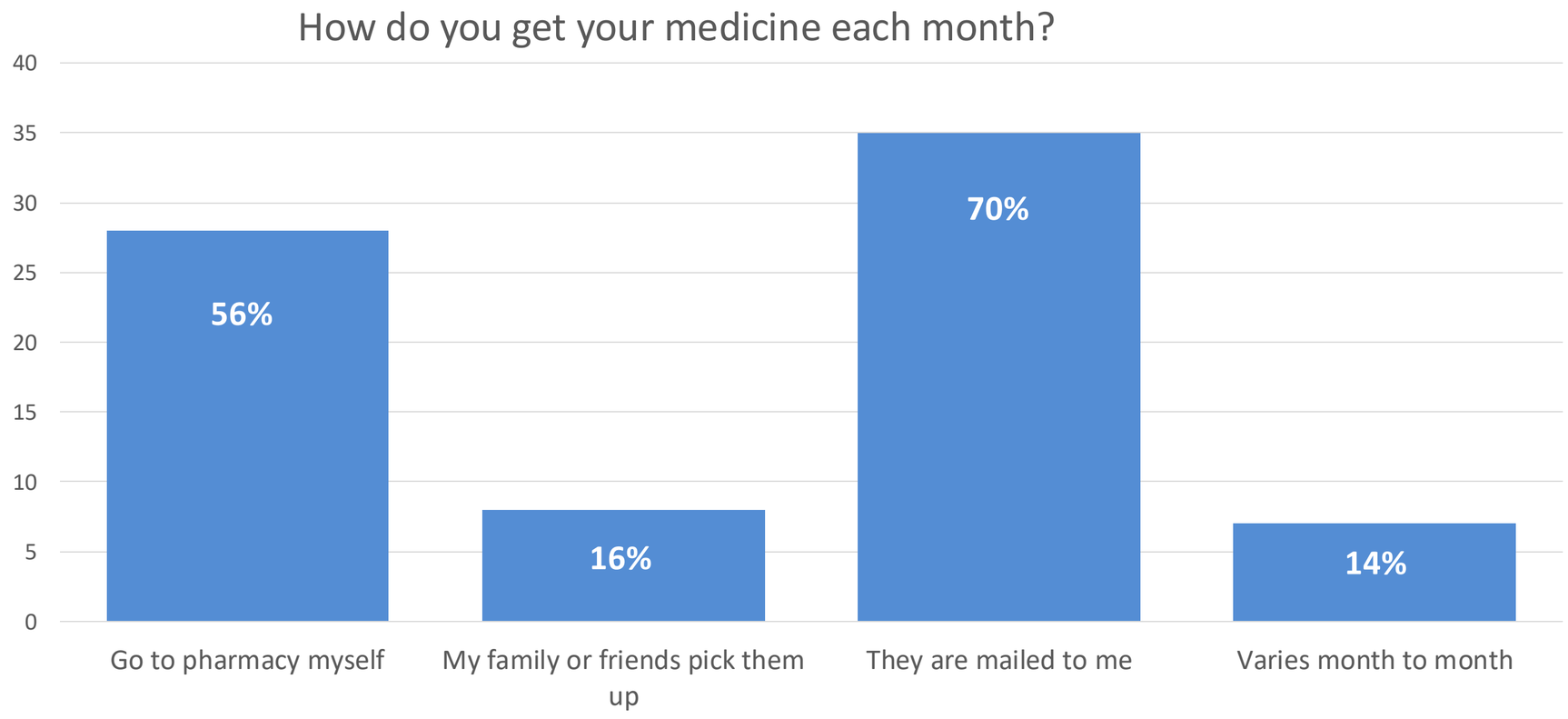
Employment status



Income status

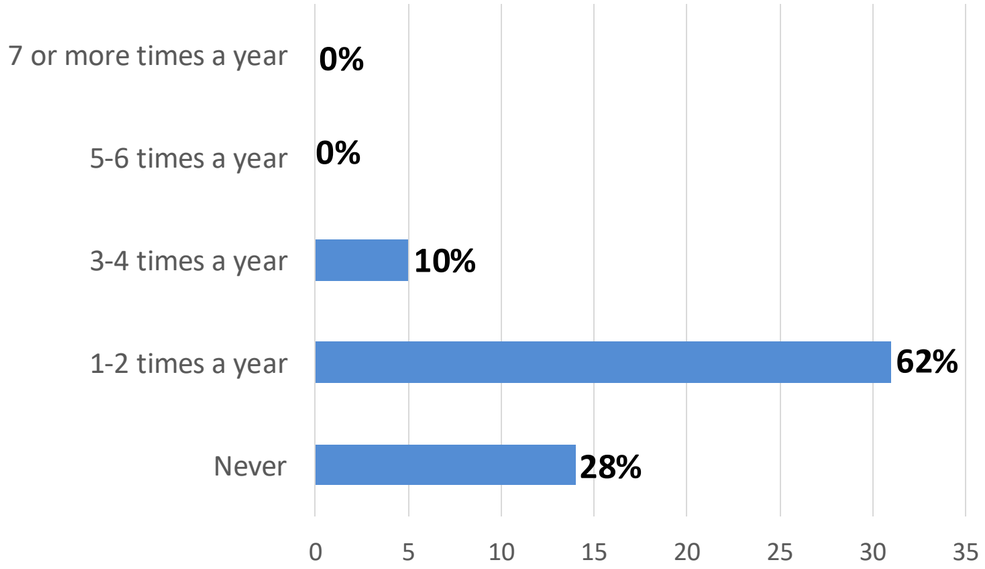


Understanding Medication Use

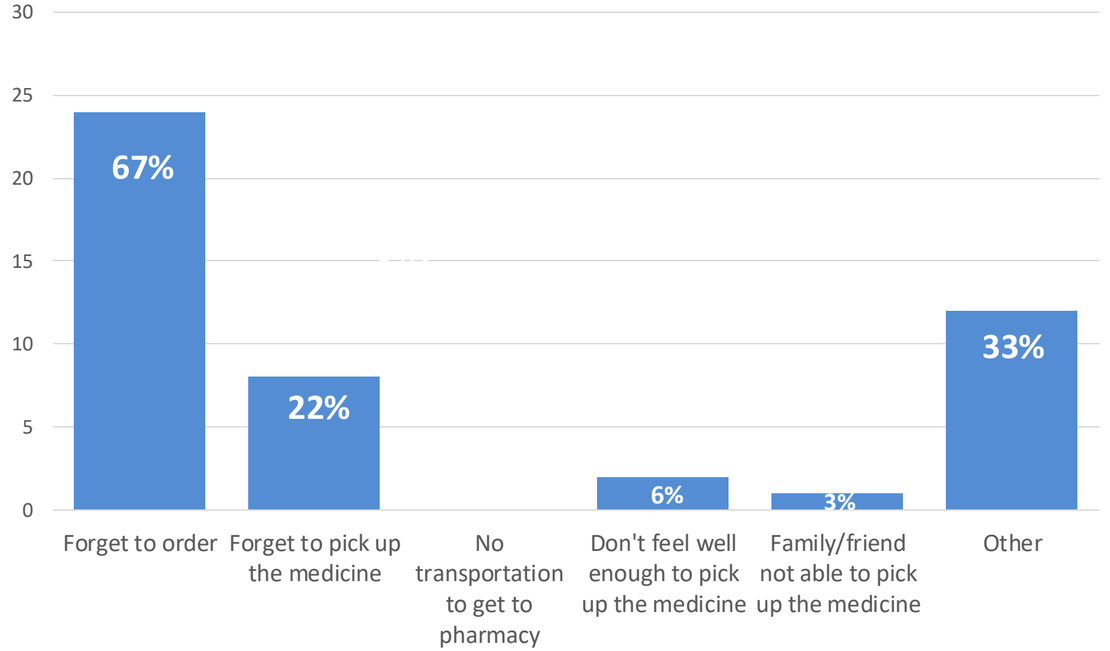


Understanding Medication Use

In the last year, how often did you run out of your medicine before you get a new supply?

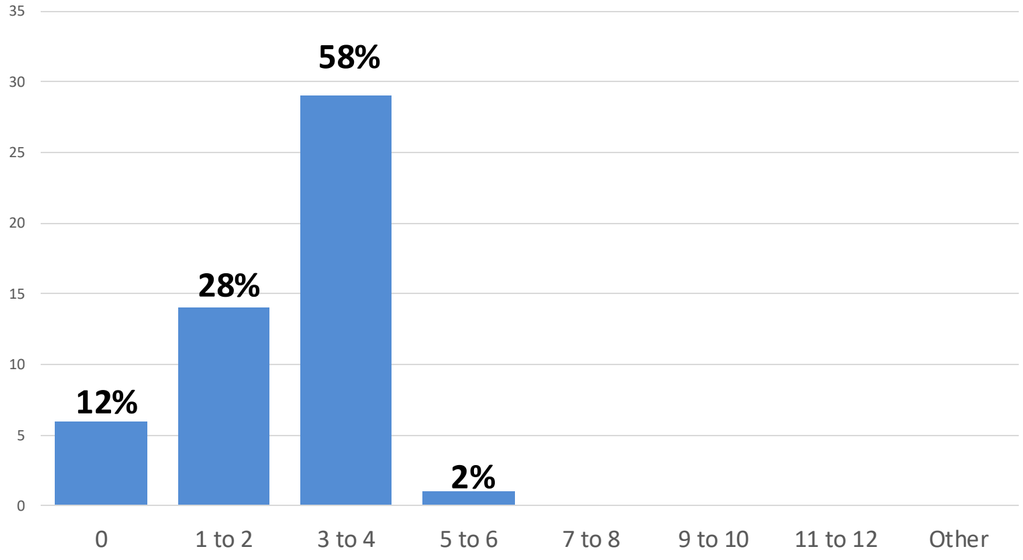


If you run out of your medicine before you get a new supply what are some reasons?



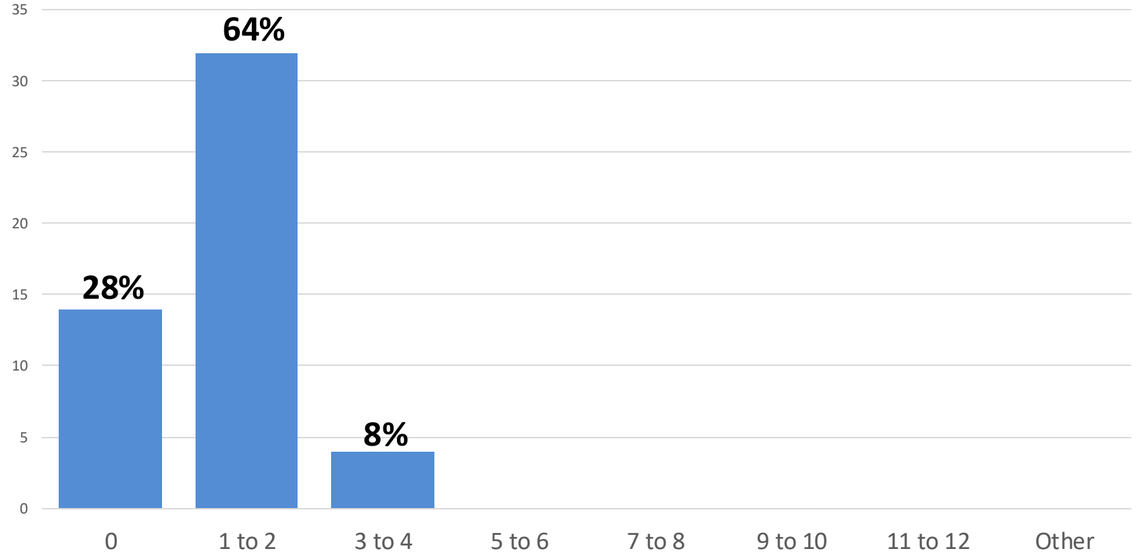
Primary Care Visits

In the last 12 months, how many times did you visit a primary care provider to manage your diabetes?

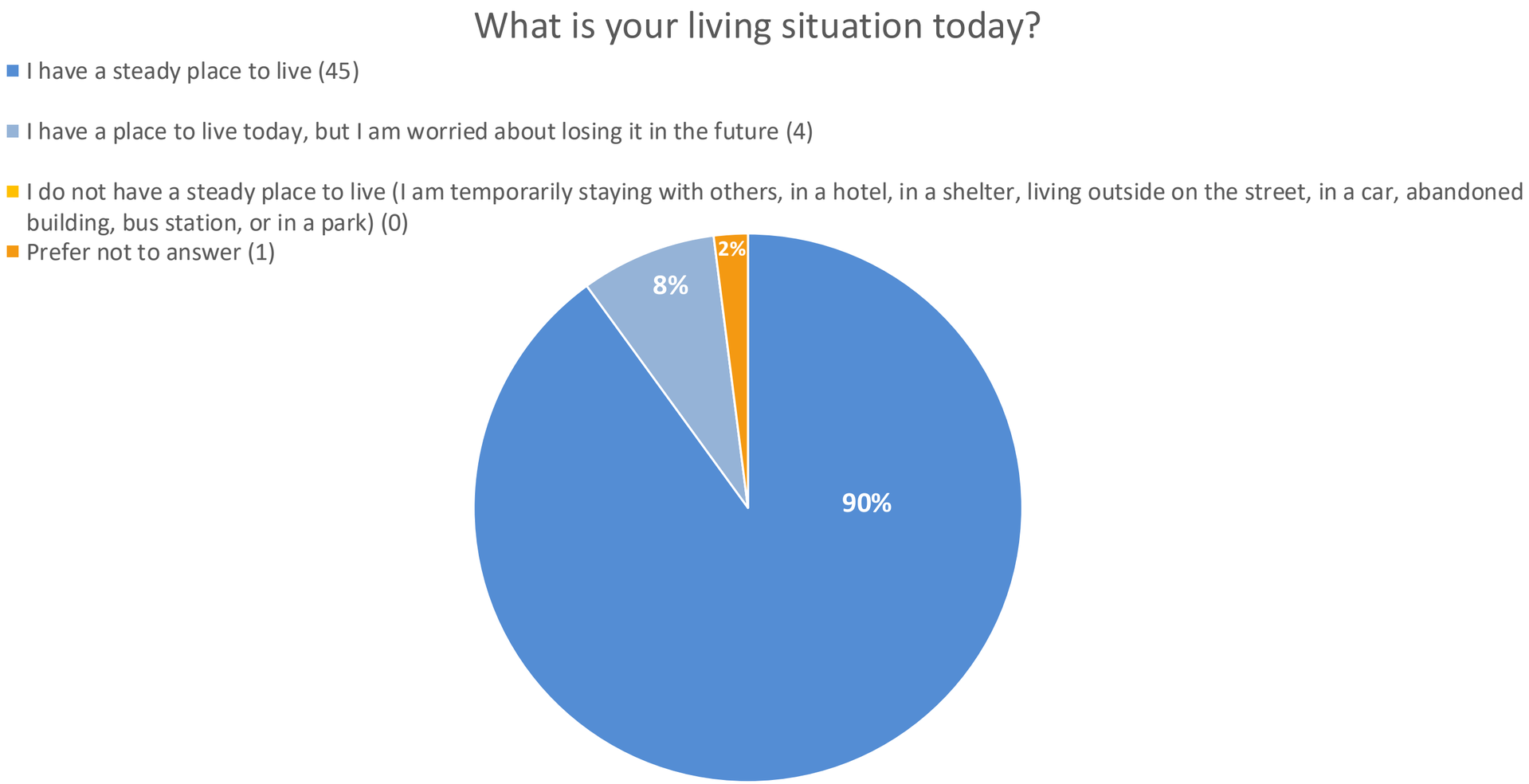


Diabetes Educator or Dietitian Visits

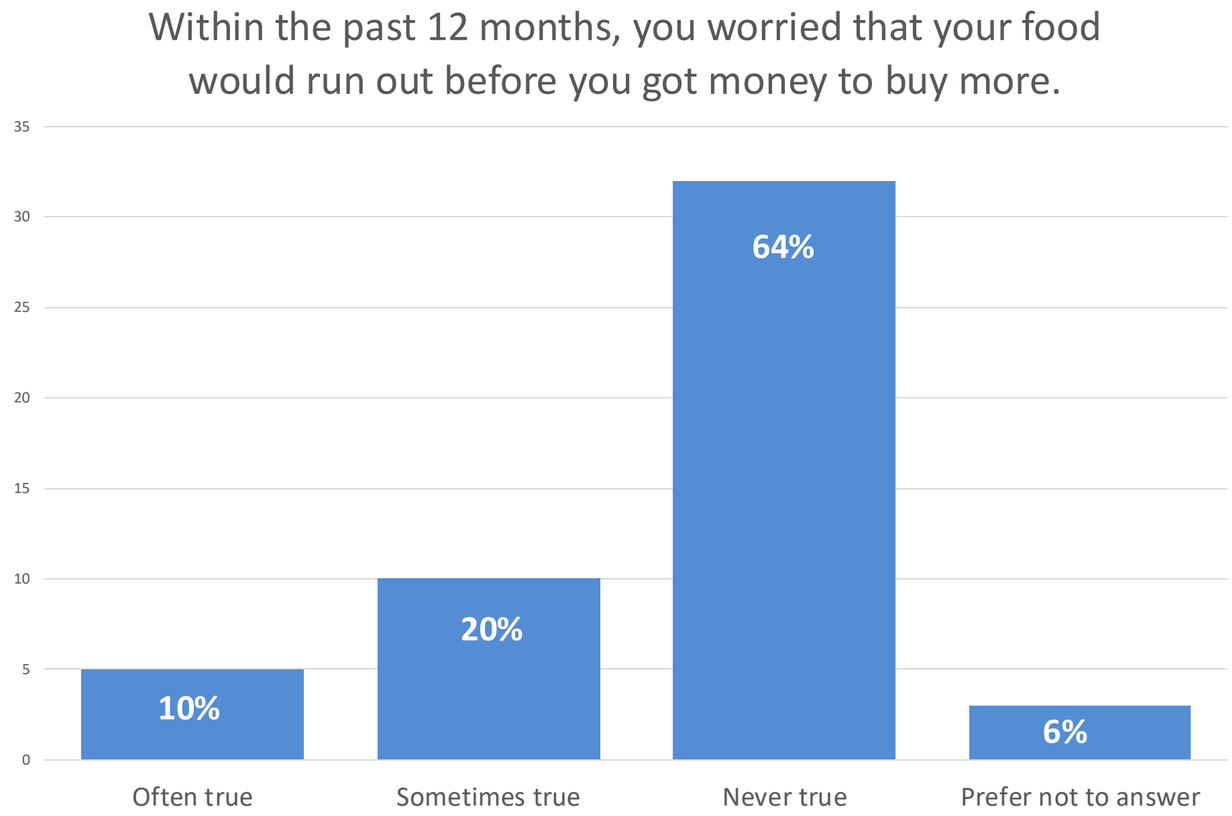
In the last 12 months, how many times did you visit a diabetes educator/dietitian to manage your diabetes?



Housing Security



Food Security



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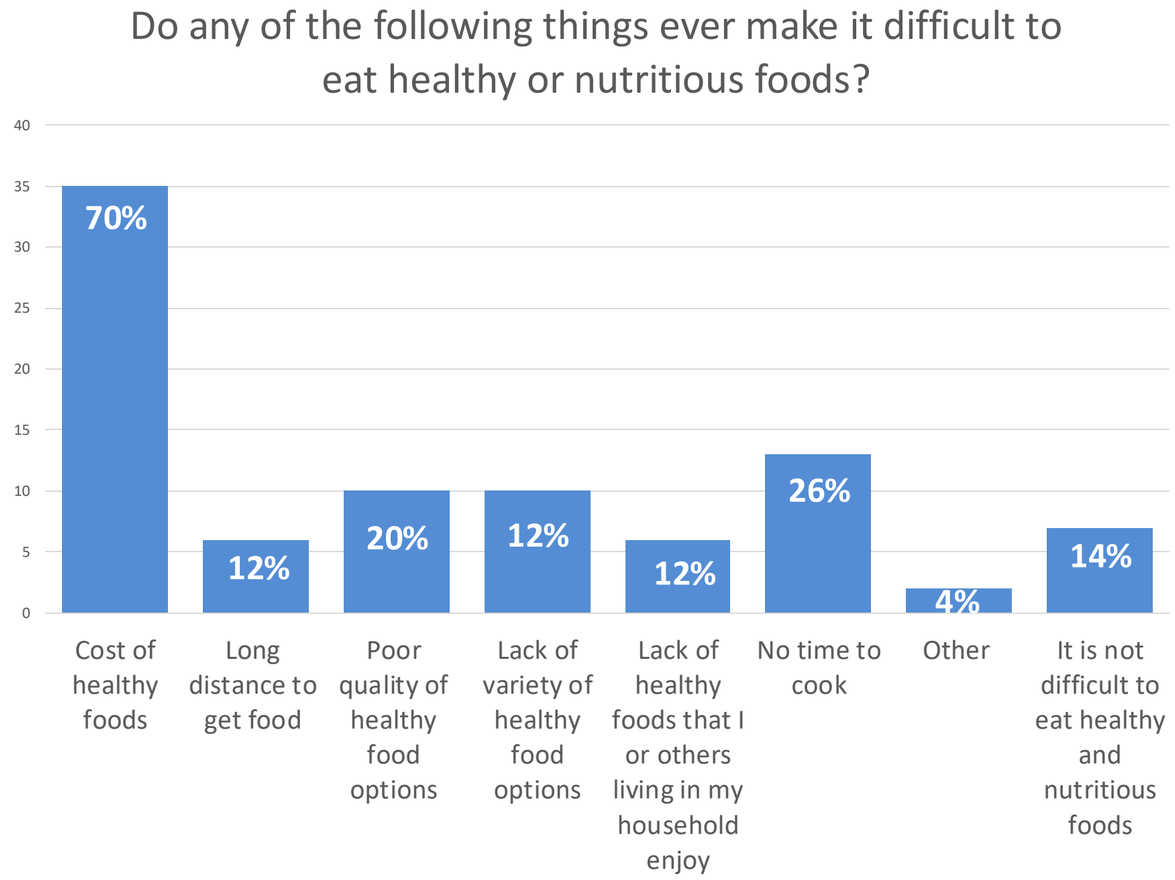
Food Security



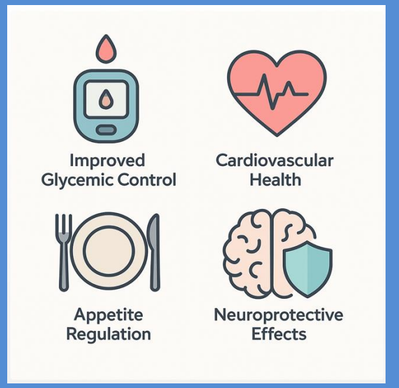
PREMLIMINARY FINDINGS FROM INTERVIEWS

A1c Facilitators- Common Themes

GLP-1 RA

Continuous Glucose Monitor (CGM)

Self-Determination



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A1c Facilitators-Common Themes

GLP-1 RA: "Game Changer"

"The **Ozempic**'s what changed everything for me...I started out at 12.7. And I go every three months for a checkup. And it's just came down a little bit by little bit. But, I think I was stuck at, like, a 10 'til I got on that Ozempic. And then the next time I went in it was, like, an eight. And this last time I went in was, like, a 6.7." (Participant 24)

"...My A1C is down, and it stays down. I've lost weight. ...it [**Mounjaro**] doesn't make me feel bad when I take it...it's helped me—it's probably changed my life on the diabetes part..."

(Participant 24)

A1c Facilitators-Common Themes

CGM: "Empowering Personal Success"

"I started the sensor, I want to say back in like around January or February. It's been a God send. Just being ...able to see what my sugar is, not having to worry about the pen pricks. It's helped me because now I know how my medicine does, like when it works best to take it 'cause .... one of my insulins, they say 30 minutes before meals, but I found, I need to do it at least an hour before meals to prevent the big spikes."

(Participant 16)

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A1c Facilitators-Common Themes

CGM: "Empowering Personal Success"

"That Dexcom 7....I should do commercial for ‘em ’cause it’s like having a school teacher, like right there, all the time, telling you what you’re doin’ wrong and what you’re doin’ right. And the other thing is prior to getting that, when I would start feeling weird with my blood sugar, I thought I was crashing, so I would eat more. And so now, with this Dexcom, I can see that when that’s happening, I’m actually going high, so it’s interesting." (Participant 24)

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A1c Facilitators-Common Themes

Self-Determination

"But waking up to havin' a child that relies on you is my number one reason ... why I wanted to get a handle on... my sugar, on my A1C, on just feeling better in general, because she needs me. So having her as my inspiration...I want her to have her mom is my number one reason." (Participant 66)

"I've had two people, at least, in my family on dialysis, and I don't wanna be on dialysis. So I try to take my medicine, you know... so, I don't...end up on dialysis." (Participant 17)

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A1c Barriers-Common Themes

The Silent Struggle:

Stress

Work Life Balance

Family Caregiver

Other Health Challenges

A1c Barriers-Common Themes

Stress-Work Life Balance

"...definitely stress...I've had a lot of stuff happen too, ... like I said, you just eating... you know, stress relief, I guess." (Participant 18)

"...balancing everything is difficult at times. It can be very stressful. obviously, work can be stressful, and I do some pretty stressful work." (Participant 25)

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A1c Barriers-Common Themes

Stress- Family Caregiver

"Since my kids have came into my life, I have not been putting my health first...you know, when they're sick, I don't even worry about me; I'm worried about them. So, I do think...I've struggled there. ...Stress, like I said, I have a very stressful job... and then come home and sometimes stress with them too, getting everything done, homework, baths and bed." (Participant 18)

"... My elderly mother lives with me. I try to take care of her too. And it can be stressful at times and working two jobs, but I try to take a deep breath, count to 10, you know, this is fine. So I make it work." (Participant 79)

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A1c Barriers-Common Themes

Stress- Other Health Challenges

"Definite changes in stress since the [panic] attack... I'm a stressed mess, I am. My entire life has been affected" (Participant 38)

"Stress, I think that went up a lot higher because I didn't know yet that I had cancer... and then I got my diagnosis a couple months later that I had stage three, and they thought it was just stress, really, at that time, before I got my diagnosis...There was a lot really going on in that timeframe." (Participant 15)

Medication Taking Facilitator-Common Themes

Trusting Provider Relationship

Organizational Systems

No Cost Medication

Medication Taking Facilitators-Common Themes

Trusting Provider Relationship

"I respect her, and I know she's looking out for my best interest, so I have faith in her. If this is what I'm supposed to do, then I do it" (Participant 38)

"It made it easier to take my medicine...for the relationship to get...to where I was more trusting to a person that I didn't see but once a month or...every three months or whatever" (Participant 99)

Medication Taking Facilitators-Common Themes

Organizational Systems

"I take a lot of meds and I usually have a little pill—Monday, Tuesday, Wednesday, little pill box that I put them in... I've got morning meds, I've got night medicine and they're different. So I normally have to carry a lot of the little box for mornings and I've got a little box for...night medication" (Participant 14)

"I have a planner, a medication planner, that I set up through the week...I try to do it on Sundays." (Participant 12)

Medication Taking Facilitators-Common Themes

No Cost Medication

"I feel like it takes a community. It takes medicine not to be so expensive for the ones who don't have the income, the research or the insurance to come together... There's a lotta people that aren't fortunate, and if I wasn't fortunate enough to have insurance or even be native, could I afford the medicine to keep me on track?" (Participant 66)

"I feel like the ease of how we get stuff done around here, with my experience, works. Like I don't know, …I've never struggled with havin' to worry about gettin'... my medication. I know that's a big thing for some people. And if I didn't have Choctaw Nation it would be for me to" (Participant 96)

Medication Taking Barriers-Common Themes

Medication Side Effects

Taking too Many Medications

Forgetting

Medication Taking Barriers-Common Themes

Medication Side Effects

"I took a medicine called, glipizide and those caused huge rashes on my body, angry, hurt rashes." (Participant 25)

"...they did used to have me on the Metformin too, but it made me sick. It made me have stomach problems..." (Participant 67)

"Ozempic was not a good fit for me. It made me so, so sick. I couldn't eat. I couldn't hold down water. Like, it was bad. I couldn't eat solid food. I was literally having to eat, like, mashed potatoes and soup and drink those Boost drinks..." (Participant 15)

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Medication Taking Barriers-Common Themes

Taking too Many Medications

"I’m just real curious for what I can do to drop my number [of medications] down and if not, then I’ll take the medicine the rest of my life. But I would just like to get off of it." (Participant 37)

"I don't like takin' as many medicines as I do. I know that one of 'em has made me sun sensitive... and ultimately, I realize that diabetes is somethin' you wanna be in control of 'cause my dad died so young, but I don't like takin' as many medicines as I do." (Participant 25)

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Medication Taking Barriers-Common Themes

Forgetting

"...The most significant challenge I would have in takin' the medication is a very busy schedule, and you forget because you're...kinda like the Mad Hatter in Alice in Wonderland, that, I'm late, I'm late, I'm late...you're hurryin' into the next thing so fast you forgot to do the last thing, which would be taking the pill" (Participant 12)

"...it's part of my routine... I just do it, right...but if when something happens or I get particularly interested in a video game or a TV show, ...I might forget at night ...on the weekends I might... forget until sometimes noon or one o'clock..." (Participant 14)

Next Steps

- Complete analysis for aim 2
- Finish analysis for aim 3
- Based on findings explore other reasons (therapeutic inertia) why despite good medication adherence, A1c levels are higher than recommended in guidelines

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References

Contact Information

Lisa Scarton, PhD, RN, FAAN
Associate Professor
University of Florida
lscarton@ufl.edu

Tarah Nelson, PhD, FNP-C
Postdoctoral Associate
University of Florida
ruca@ufl.edu