



Change in HbA1c and Weight after **Healthy Grocery Delivery and Low-Carb Education** among People with Type 2 Diabetes and Food Insecurity

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Disclosures:

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Presentation Overview

1. Background
2. Objective
3. Methods
4. Results
5. Conclusions
6. Future Directions

Impact of Diabetes

Over **34 million** Americans are living with diabetes today.

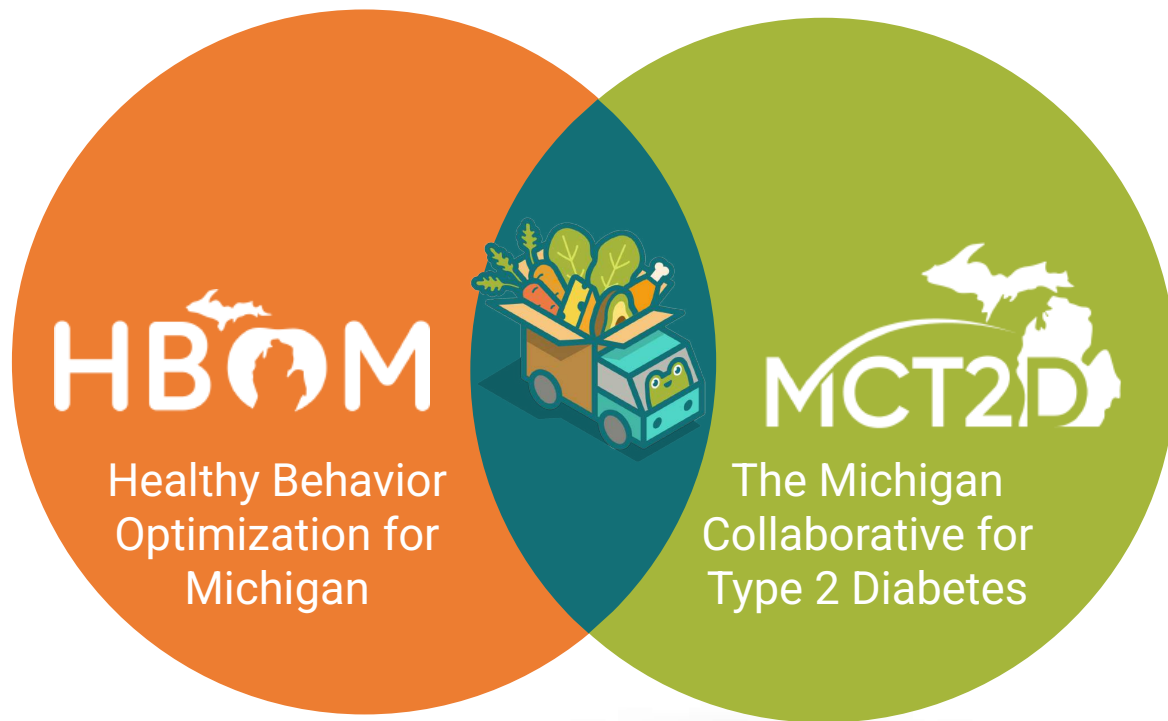
More than 1 in 9

Or 11.5% of adults in Michigan have diabetes (~912,794 adults)



Approx. 239,000 Michiganders **have diabetes but don't know it**

Over 2.7 million people in Michigan have prediabetes **but have not yet been diagnosed**



CQI Partners: HBOM & MCT2D

<https://hbomich.org/>
<https://mct2d.org/>

Lifestyle & diet modification is the first line treatment for T2D

Unmet social needs like *food insecurity* are barriers

Food insecurity negatively affects diet quality, diabetes self-management skills, glycemic control, micro- and macrovascular complications and health care utilization.



Lower carbohydrate diets aid glycemic control and can lead to T2D remission

A low carbohydrate diet is generally defined as
50-130g of carbs per day

BENEFITS OF A LOW CARB LIFESTYLE



WEIGHT LOSS



**REDUCED BLOOD
PRESSURE**



**REDUCED HUNGER
& CRAVINGS**

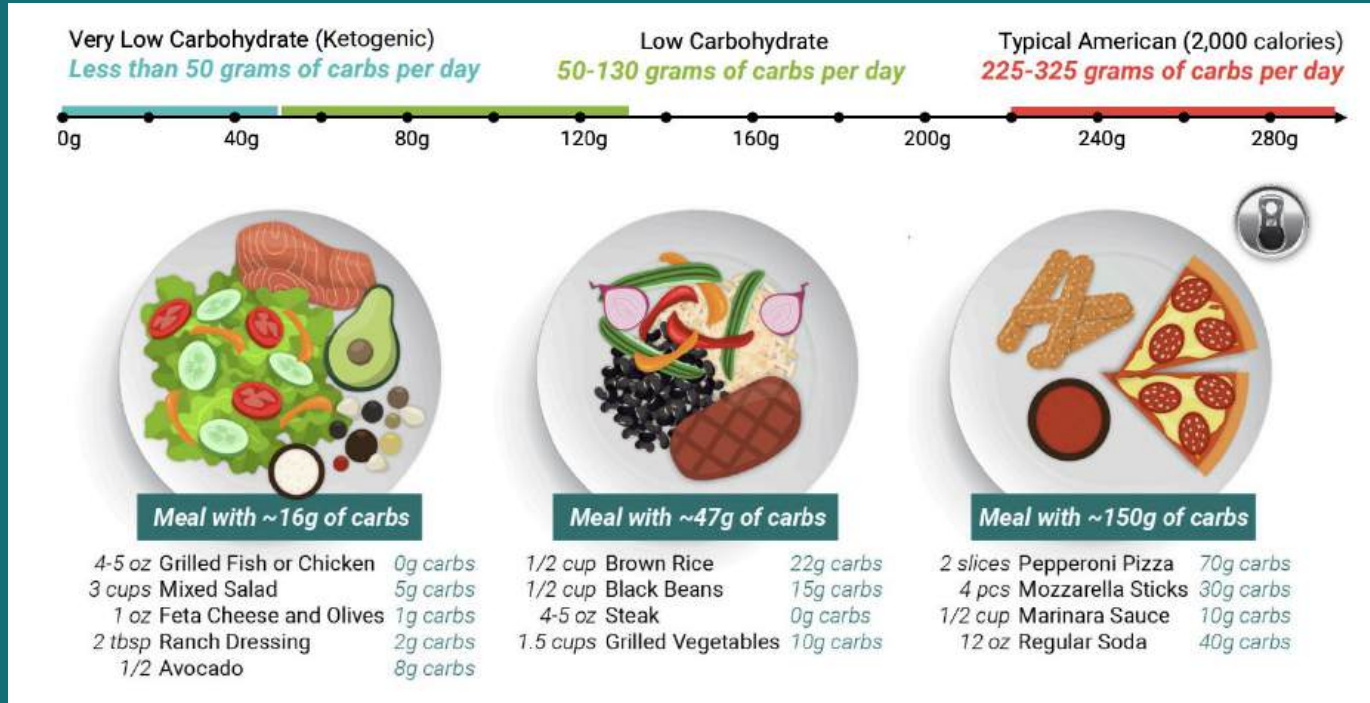


**BLOOD SUGAR
CONTROL**



**INCREASED
ENERGY**

Lower carbohydrate diets aid glycemic control and can lead to T2D remission



Objective

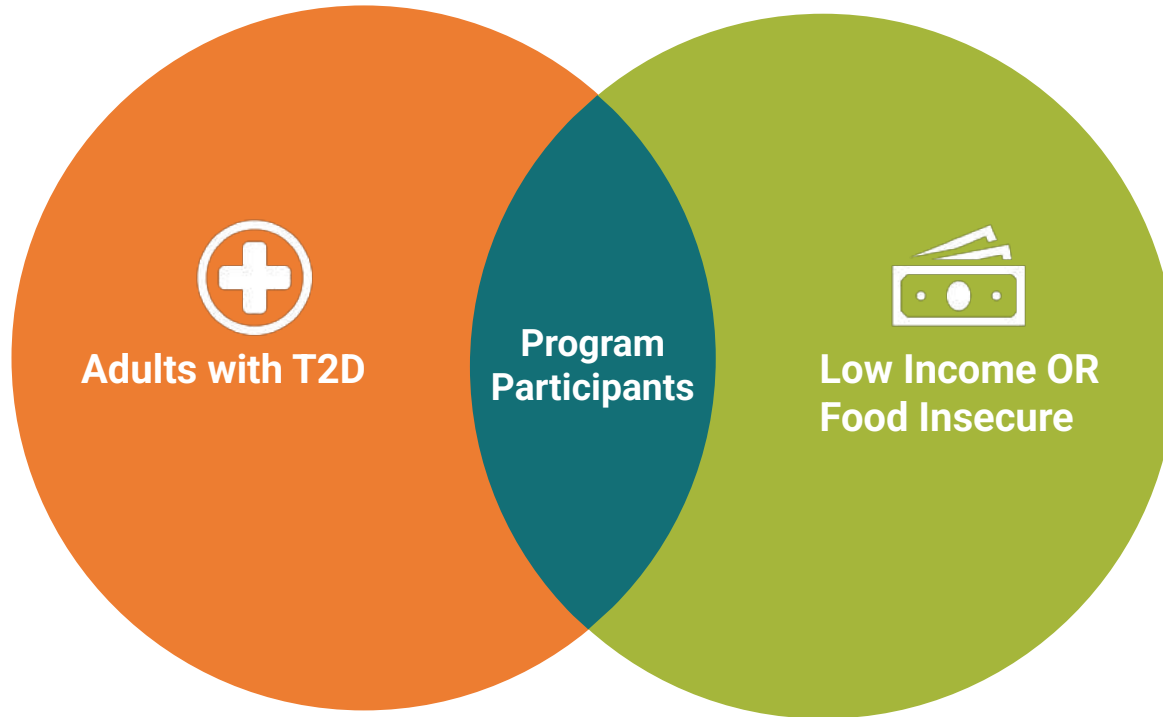
To evaluate a quality improvement program to **support patients with T2D and low income to adopt a healthier lower carbohydrate diet.**



Methods: Patient Population

Michigan state-wide patient cohort

21 practices participating in the Michigan Collaborative for Type 2 Diabetes





3 Months of Healthy Choice Allowance

\$240 of total food
credits (\$80 per
month)



12 Weeks of Education and Support

Via website, email,
and print

Methods: Program Overview

Education Materials: Print, Digital, & Video

BUILDING YOUR PLATE

Follow the 4-step process to create delicious low carb meals

STEP 1: Pick a Protein

Choose a high-quality protein source like chicken, fish, seafood, beef, eggs, or soy.

STEP 2: Add Non-Starchy Vegetables (half your plate)

Fill half your plate with non-starchy vegetables like salad greens, broccoli, or Brussels sprouts.

STEP 3: Add Some Fats (pick one or two)

Add some fats from oil, sauces, or full-fat dairy like cheese, butter or sour cream.

STEP 4: Add 1-2 Servings of Complex Carbs

Include 1-2 servings of high-quality carbs like starchy vegetables, fruits, legumes/lentils or whole grains.



10 inch Dinner Plate

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STEP 1: Pick a Protein (Continued)

How much protein should I have?

Protein plays an essential role in maintaining the proper functioning of your body. It is a major component of every cell in the body. Protein is necessary for muscle growth and repair, and the maintenance of healthy skin, hair, nails, and other organs.

We recommend starting out with 4-5oz of protein (like chicken, fish, meat, or tofu) for your meals. As a rule of thumb, 4 oz is slightly bigger than the size of your palm and the thickness of a deck of cards. You can also use your dinner plate (10in) as a guide in which case your protein source would take up a little over 1/4 of the plate.

Using your hand as a portion guide



1 portion of protein = your palm



1 portion of vegetables = your fist



1 portion of carbs = your cupped hand



1 portion of fats = your thumb

The amount of protein that is right for you may vary and you may notice you need more or less depending on the day and activity level.

Feeling hungry? Try this!

Increase the amount of protein, non-starchy vegetables, OR fats in your meal.

Protein: add an ounce of a high-quality protein like chicken, tofu, fish, or beef

Non-starchy vegetables: add an extra helping of your favorite non-starchy vegetables

Fats: add some nuts/seeds, a few slices of avocado, or some dairy like cheese, sour cream, or Greek yogurt

Adapted from Precision Nutrition

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STEP 2: Add Non-Starchy Vegetables (Continued)

Non-starchy Vegetables: Leafy Greens

1 Serving = 1 cup raw or 1/2 cup cooked

<5g Carb

Arugula
Chicory
Kale
Endive
Lettuce
Spinach
Romaine
Watercress
Radicchio

Non-starchy Vegetables: Other (Continued)

1 Serving = 1 cup raw or 1/2 cup cooked

5g Carb

Cucumber
Daikon
Eggplant
Fennel
Gourd
Green beans and wax beans
Green onions/scallion/chives
Greens (mustard/collard/turnip)
Hearts of palm
Jicama
Kohlrabi
Leeks
Mushrooms
Okra
Nopales
Onions/shallots
Pea pods/pea shoots
Peppers (all varieties)
Radishes
Rutabaga
Seaweed
Snap peas/snow peas
Swiss chard
Tomatoes
Turnips
Water chestnuts
Zucchini

Non-starchy Vegetables: Other

1 Serving = 1 cup raw or 1/2 cup cooked

5g Carb

Artichoke
Asparagus
Baby corn
Bamboo shoot
Bean sprouts
Bok choy
Broccoli and Chinese broccoli, broccoli
Brussel sprouts
Cabbage/purple cabbage/napa cabbage
Cauliflower
Celery
Chayote

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Education Materials: Print, Digital, & Video

7-DAY SAMPLE MEAL PLAN

An example low carb meal plan (50-130g carbohydrates/day)

Are you wondering what to eat on a low carbohydrate lifestyle? Look no further! Here is a sample 7-day meal plan to get you started. Breakfast, lunch, and dinner meals are listed below with total carbohydrate estimates. Add a low-carbohydrate snack, as needed, using the recommended snack list.

SUNDAY		
Breakfast	Lunch	Dinner
3 egg omelet with ½ cup diced vegetables (peppers, onion, mushroom, tomatoes), and 1oz shredded cheese 1 slice whole wheat bread or 1 cup mixed berries	Wrap sandwich (8 inch low carb wrap, 4-5oz turkey, cheese, spinach, tomato, and onion). Add mustard, pickles, mayo, and seasoning as desired Optional: add 1oz nuts for crunch or avocado	2 cups spaghetti squash* topped with ½ cup low carb tomato sauce, 4-5oz ground beef, and 1 cup sautéed non-starchy vegetables Optional: add grated Parmesan *Note: Can also use high-protein, low carbohydrate pasta
Total carbs: 20-25g	Total carbs: 25-30g	Total carbs: 40g
MONDAY		
Breakfast	Lunch	Dinner
½ cup plain Greek yogurt topped with 1oz mixed berries, 1 cup berries or 1 piece fruit (1 small apple, plum, kiwi, 1 cup cantaloupe)	2-3 cups mixed greens topped with 4-5oz tuna or other canned fish, ½ cup chickpeas, diced cucumber, tomato, onion, pickles, olives, avocado, and feta or shredded cheese Serve with 2 tbsp ranch dressing or lemon and olive oil vinaigrette	Chicken Alfredo (whole grain fettuccine with 4-5oz chicken, ½ cup chickpeas, 2oz (dried) whole grain fettuccine) Serve with side salad (dressing full-fat or olive oil and vinegar)
Total carbs: 25g	Total carbs: 25g	Total carbs: 50g
TUESDAY		
Breakfast	Lunch	Dinner
Baked avocado cups (cut avocado in half, add 1 egg to center of each half, then bake at 425 degrees for 15-20 min) 1 piece of fruit (1 small apple, plum, kiwi, 1 cup cantaloupe, 1 cup berries)	Lettuce wraps (2-3 large lettuce leaves topped with 4-5 oz turkey or chicken, 2 tbsp hummus, diced tomato, onion, and 1oz pumpkin seeds)	2 cups lentil soup (brown lentils, onions, garlic, diced carrots, zucchini, celery, mushrooms) Chia pudding (mix 1 small chia seeds, ½ cup coconut cream, and a dash of stevia. Let sit overnight) You can make these in batches!
Total carbs: 30g	Total carbs: 20g	Total carbs: 43g

UNDERSTANDING NUTRITION LABELS

Learn how to read nutrition labels on packaged foods

Serving Size: Always check the serving size to see the portion it reflects. The nutrient amounts shown on the label all refer to the size of one serving.

In this example, one serving is 1 cup (55g).

Total Carbohydrate: The sum of all carbohydrates in one serving of a product including starch, sugars, and dietary fiber. All, except dietary fiber, will play a role in raising blood sugar and insulin levels.

This example has 21g of total carbohydrates in one serving.

Dietary fiber: Fiber is an important part of a low carbohydrate lifestyle because it helps you feel full, keeps blood sugar levels steady, and your gut healthy. A well-balanced low carbohydrate lifestyle will include foods high in dietary fiber such as leafy greens, broccoli, cauliflower, peppers, nuts, and seeds.

This example has 2g of dietary fiber in one serving.

Total sugars: Sugars are part of total carbohydrate and include sugars naturally present in food, like fruit or milk, as well as sugars that have been added to a food, like sweetened beverages and desserts. Regardless of the source, all sugars are absorbed into the bloodstream and raise insulin levels. These should be limited in a low carbohydrate lifestyle.

This example has 8g of total sugars in one serving.

Protein: Protein helps you feel full and satisfied. Check the label to see how many grams of protein is in a serving of a product. A good source of protein will have at least 7-8g per serving.

This example has 10g of protein in one serving.

Nutrition Facts

10 servings per container

Serving size 1 cup (55g)

Amount per serving

Calories 165

% Daily Value*

Total Fat 1.5g

Saturated Fat 0.5g

Trans Fat 0g

Polysaturated Fat 0.5g

Monounsaturated Fat 0.5g

Cholesterol 0mg

Sodium 180mg

Fluoride 0g

Total Carbohydrate 21g

Dietary Fiber 2g

Soluble Fiber <1g

Insoluble Fiber 1g

Total Sugars 8g

Includes 6g Added Sugars

Protein 10g

Vitamin D 3mcg (80IU)

Calcium 70mg

Iron 3mg

Potassium 140mg

Vitamin C 10mg

Thiamin 0.3mg

Niacin 3mg

Vitamin B₆ 0.4mg

Biotin 5mcg

Vitamin E 6mg

Phosphorus 112mg

Iodine 15mcg

Zinc 7mg

Manganese 0.3mg

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Calories per gram:

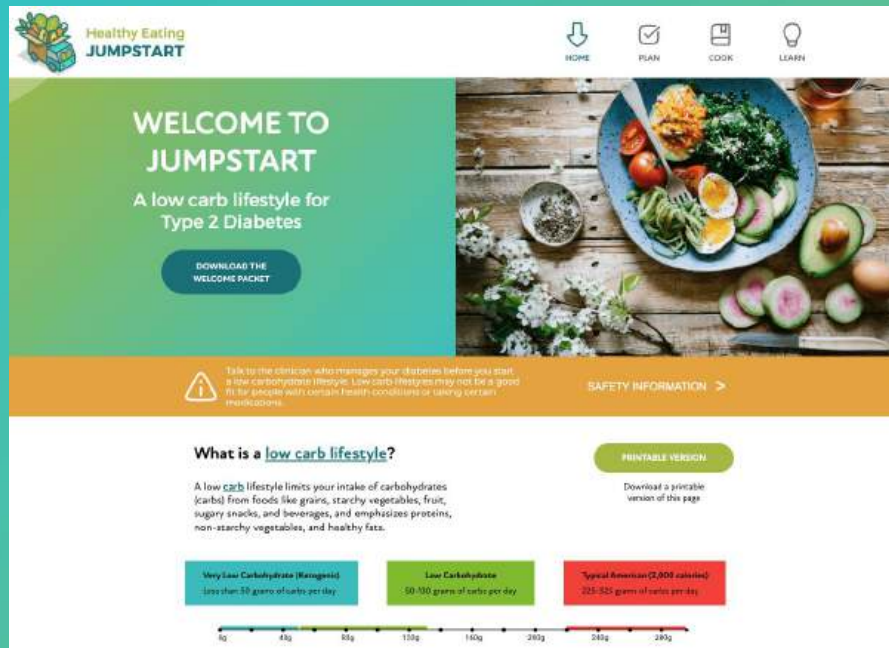
Fat 10 - Carbohydrate 4 - Protein 3

LOW CARB GROCERY SHOPPING LIST

Stock your fridge and pantry with low carb foods

Meats & Meat Alternatives	Dairy	Fats & Oils
Beef (ground, steaks, ribs, or roast)	(No added sugars or starches)	Avocado/Avocado oil
Chicken/Turkey	Butter	Coconut oil
Duck	Cheeses (full-fat - all types)	Ghee/Lard
Lamb	Cottage cheese	Olives/Olive oil
Pork (ground, chops, ribs, or roast)	Cream cheese	Schwartz (chicken fat)
Veal	Eggs	Sesame oil
Goat	Cream (heavy or whipping)	Vegetable oil
Venison or other game	Ricotta	Nut oils
Tempeh with no starches added	Sour cream	
Tofu with no starches added	Yogurt (unsweetened Greek)	
Deli counter	Canned or packaged meats & seafood	
(No added sugars or starches)	(No added sugars or starches)	
Bacon	Beef jerky or sticks	
Chorizo	Ham	
Corned beef	Pork ribs or chicharrones	
Egg salad	Anchovies	
Hot dogs	Crab	
Luncheon meats of all types	Salmon	
Pastrami	Sardines	
Pepperoni	Tuna	
Salami		
Sausage		
Beverages	Seafood	
Club soda	Crab	Octopus
Coffee	Fish of all types	Oysters
Tea	Lobster	Scallops
Unsweetened flavored seltzers	Mussels	Shrimp
		Squid

Education Materials: Print, Digital, & Video



The screenshot shows the 'Healthy Eating JUMPSTART' website. The header includes a logo and navigation links: HOME, PLAN, COOK, and LEARN. The main content area features a large image of a healthy meal with a bowl of salad, a hard-boiled egg, and sliced cucumbers. Text on the left reads 'WELCOME TO JUMPSTART' and 'A low carb lifestyle for Type 2 Diabetes'. A button says 'DOWNLOAD THE WELCOME PACKET'. Below this is a 'SAFETY INFORMATION' section with a warning icon and text: 'Talk to the clinician who manages your diabetes before you start a low carbohydrate lifestyle. Low carb lifestyles may not be a good fit for people with certain health conditions or taking certain medications.' The bottom section is titled 'What is a low carb lifestyle?' and includes a 'PRINTABLE VERSION' button. A horizontal bar at the bottom shows carbohydrate intake levels: 'Very Low Carbohydrate (Ketogenic)' (less than 50 grams of carbs per day), 'Low Carbohydrate' (50-100 grams of carbs per day), and 'Typical American (2,000 calories)' (225-325 grams of carbs per day).

Healthy Eating JUMPSTART

HOME PLAN COOK LEARN

WELCOME TO JUMPSTART

A low carb lifestyle for Type 2 Diabetes

DOWNLOAD THE WELCOME PACKET

SAFETY INFORMATION

Talk to the clinician who manages your diabetes before you start a low carbohydrate lifestyle. Low carb lifestyles may not be a good fit for people with certain health conditions or taking certain medications.

What is a low carb lifestyle?

A low carb lifestyle limits your intake of carbohydrates (carbs) from foods like grains, starchy vegetables, fruit, sugary snacks, and beverages, and emphasizes proteins, non-starchy vegetables, and healthy fats.

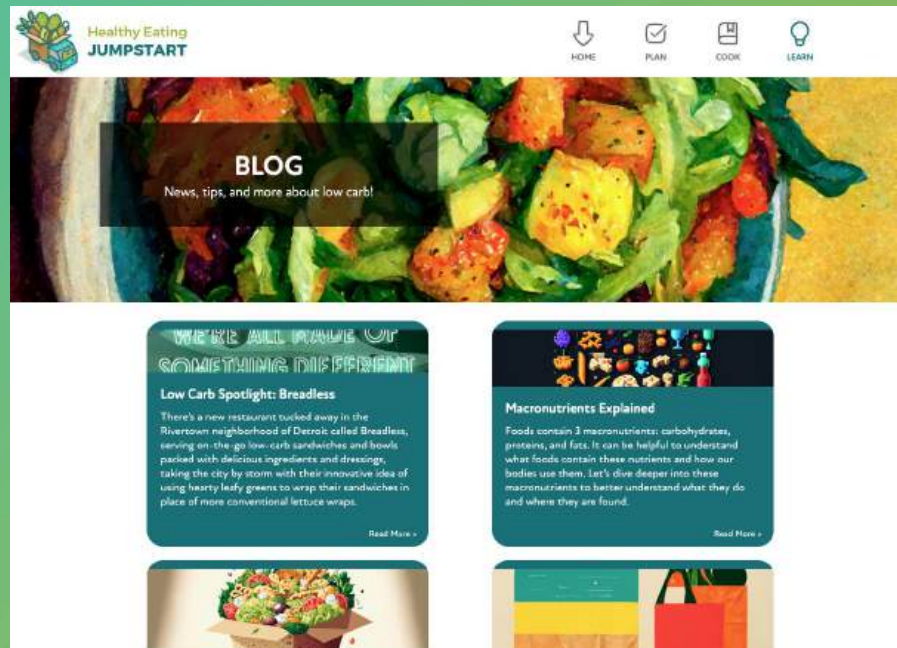
PRINTABLE VERSION

Download a printable version of this page

Very Low Carbohydrate (Ketogenic)
less than 50 grams of carbs per day

Low Carbohydrate
50-100 grams of carbs per day

Typical American (2,000 calories)
225-325 grams of carbs per day



The screenshot shows the 'Healthy Eating JUMPSTART' website blog page. The header includes a logo and navigation links: HOME, PLAN, COOK, and LEARN. The main content area features a large image of a healthy meal with a bowl of salad, a hard-boiled egg, and sliced cucumbers. Text on the left reads 'WELCOME TO JUMPSTART' and 'A low carb lifestyle for Type 2 Diabetes'. A button says 'DOWNLOAD THE WELCOME PACKET'. Below this is a 'SAFETY INFORMATION' section with a warning icon and text: 'Talk to the clinician who manages your diabetes before you start a low carbohydrate lifestyle. Low carb lifestyles may not be a good fit for people with certain health conditions or taking certain medications.' The bottom section is titled 'What is a low carb lifestyle?' and includes a 'PRINTABLE VERSION' button. A horizontal bar at the bottom shows carbohydrate intake levels: 'Very Low Carbohydrate (Ketogenic)' (less than 50 grams of carbs per day), 'Low Carbohydrate' (50-100 grams of carbs per day), and 'Typical American (2,000 calories)' (225-325 grams of carbs per day).

Healthy Eating JUMPSTART

HOME PLAN COOK LEARN

BLOG

News, tips, and more about low carb!

WE'RE ALL MADE OF SOMETHING DIFFERENT

Low Carb Spotlight: Breadless

There's a new restaurant tucked away in the Rivertown neighborhood of Detroit called Breadless, serving on-the-go low-carb sandwiches and bowls packed with delicious ingredients and dressings, taking the city by storm with their innovative idea of using hearty leafy greens to wrap their sandwiches in place of more conventional lettuce wraps.

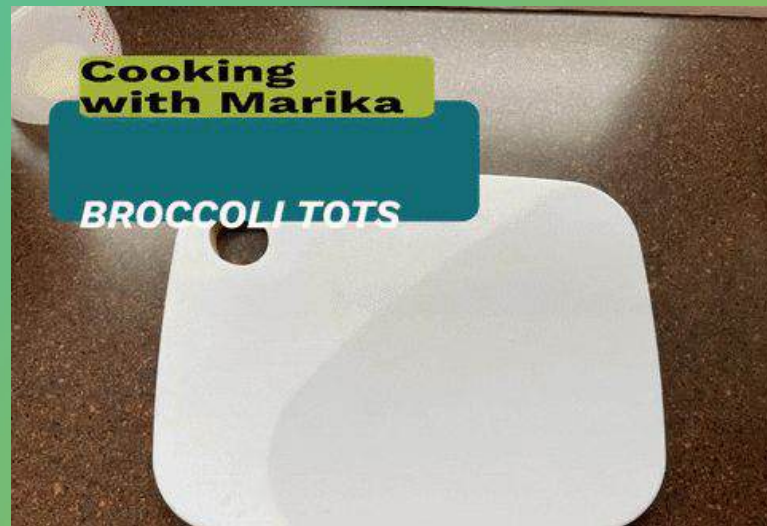
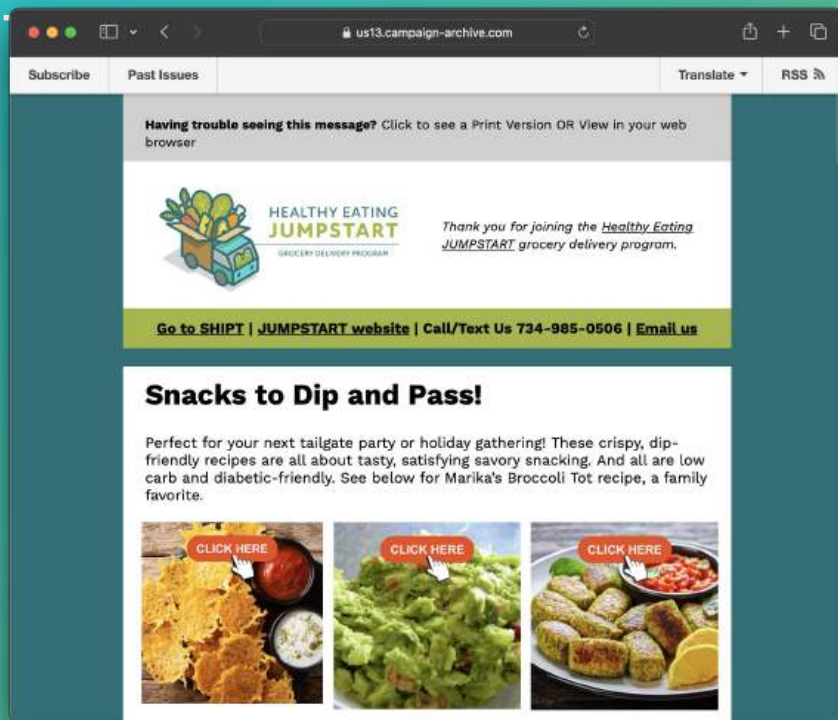
[Read More](#)

Macronutrients Explained

Foods contain 3 macronutrients: carbohydrates, proteins, and fats. It can be helpful to understand what foods contain these nutrients and how our bodies use them. Let's dive deeper into these macronutrients to better understand what they do and where they are found.

[Read More](#)

Education Materials: Print, Digital, & Video



Methods: Data Collection and Analysis

- Program was implemented for 3 months with data collection for 12 months after program completion
- Medical records obtained for 18-month period
 - 6 months prior to enrollment - 12 months after
- HbA1c and weight abstracted from medical records
- Participants categorized by baseline HbA1c control (uncontrolled: $\geq 7\%$ HbA1c) and GLP-1 RA use (no use: < 30 days use 12-month evaluation period)



Methods: Data Collection and Analysis

- Baseline values assigned as closest to enrollment date up to 21-days after enrollment
- Additional data categorized in 3-month increments (evaluation quarters)
 - Latest value used when multiple available
- Change from baseline assessed with signed-rank tests ($\alpha=0.05$, two-tailed)
 - HbA1c stratification by baseline control
 - Weight stratification by GLP-1 RA use

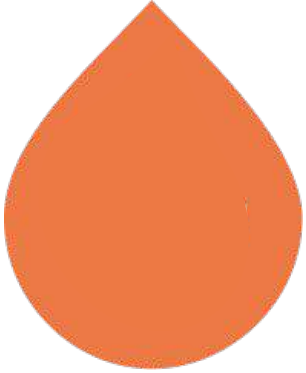
HbA1c change
Weight change



Results: Demographics (n=83)

	Mean (SD) or N (%)
Age (range: 18-86)	56.6 (13.5)
Gender	
Female	57 (72.2)
Male	22 (27.8)
Race	
White	70 (88.6)
Black	4 (5.1)
Native American	1 (1.3)
Other	2 (2.5)
Mixed Race	1 (1.3)
Hispanic	
Yes	3 (3.8)
No	74 (93.7)
Education Level	
High school graduate or less	35 (44.8)
Some college or technical school	25 (31.6)
Associate's or technical degree	8 (10.1)
Bachelor's degree or higher	11 (13.9)

Results: Demographics



Average HbA1c = 7.6 (std=2.0)

- 42 (53%) uncontrolled
- 37 (47%) controlled



Average BMI = 38.2 (std=8.8)

- 3 (4%) normal BMI
- 15 (19%) overweight BMI
- 61 (77%) obese BMI

Results: Healthy Choice Allowance Use

100%

of participants
successfully placed
orders through Shipt

On average,
participants
spent \$221 of
their \$240
(92%) Healthy
Choice
Allowance.

92%

Overall HbA1c reduction at 6+ months

Full Cohort

-0.42%

± 1.43 (p=0.02, n=68)



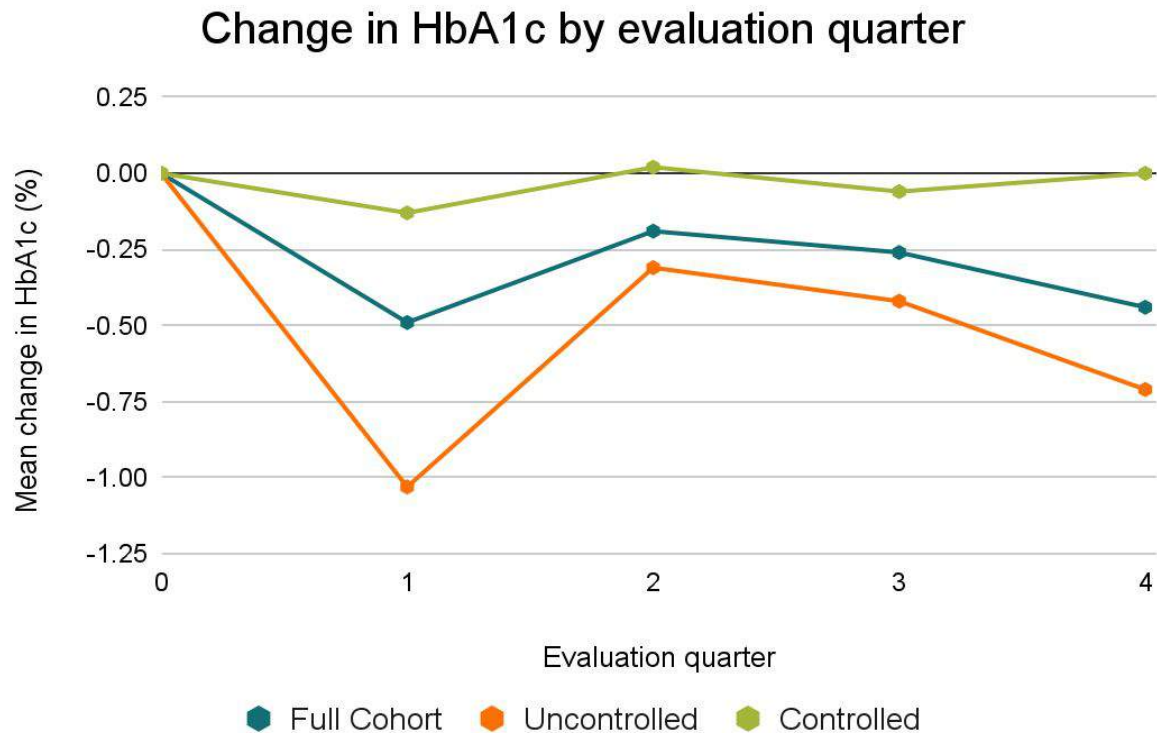
Uncontrolled

At Baseline

-0.67%

± 1.76 (p=0.04, n=38)

Results: Impact on HbA1c (n=74)



Overall weight reduction at 6+ months

Full Cohort

-1.7%

± 4.36 ($p < 0.01$, $n = 66$)

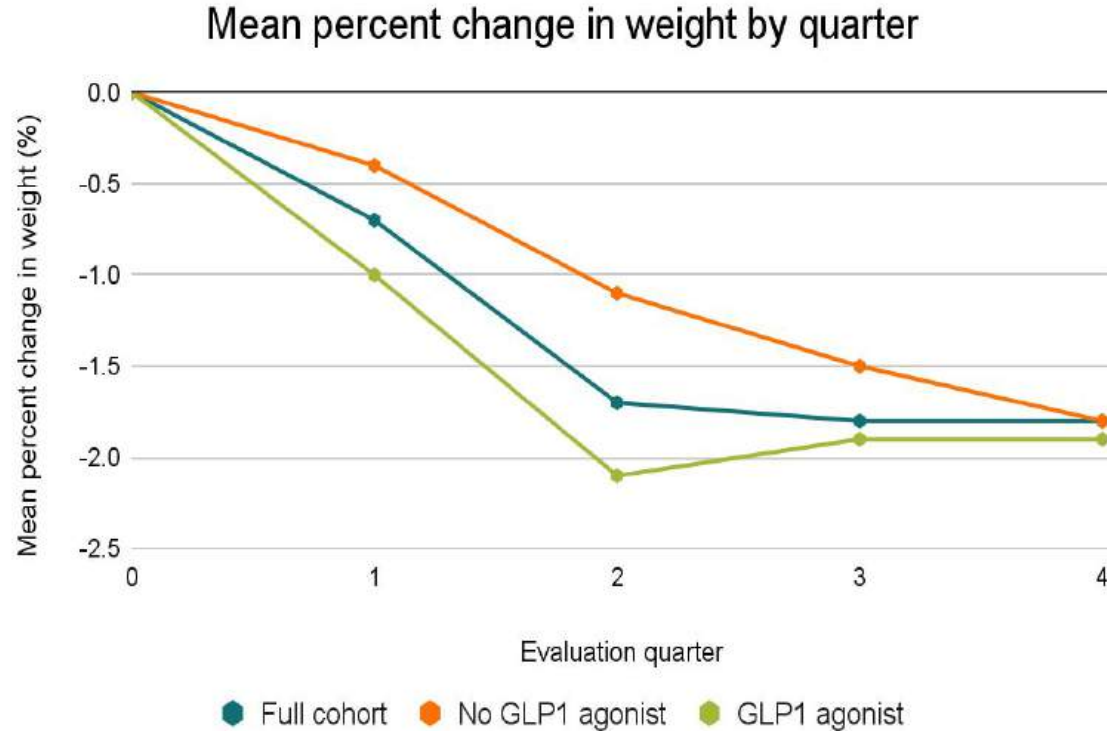


No GLP-1 RA

-1.09%

± 4.37 ($p = 0.28$, $n = 29$)

Results: Impact on Weight (n=73)



Conclusions

- HbA1c and weight both show marginal improvement greater than 6-months after program enrollment
- Jumpstarting dietary change among patients with T2D and food insecurity may creating lasting impact



Future Directions

- **Large-scale study** to more rigorously adjust for covariates and confounding variables
- Conduct programmatic **cost-benefit analysis**
 - Implementation costs vs. potential healthcare savings
- Implementation of this program into clinical practice where appropriate



Questions?

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<https://jumpstart.mct2d.org/>

References

1. American Diabetes Association. The Burden of Diabetes in Michigan. https://diabetes.org/sites/default/files/2021-11/ADV_2021_State_Fact_sheets_Michigan_rev.pdf. Accessed September 12, 2023.
2. Seligman HK, Jacobs EA, López A, Tschann J, Fernandez A. Food insecurity and glycemic control among low-income patients with type 2 diabetes. *Diabetes Care*. Feb 2012;35(2):233-8
3. Hill-Briggs F, Adler NE, Berkowitz SA, et al. Social Determinants of Health and Diabetes: A Scientific Review. *Diabetes Care*. 2020;44(1):258-279. doi:10.2337/dci20-0053
4. Berkowitz SA, Karter AJ, Corbie-Smith G, et al. Food Insecurity, Food "Deserts," and Glycemic Control in Patients With Diabetes: A Longitudinal Analysis. *Diabetes Care*. Jun 2018;41(6):1188-1195. doi:10.2337/dc17-1981
5. Morales ME, Berkowitz SA. The Relationship between Food Insecurity, Dietary Patterns, and Obesity. *Curr Nutr Rep*. Mar 2016;5(1):54-60. doi:10.1007/s13668-016-0153-y
6. Goldenberg JZ, Day A, Brinkworth GD, et al. Efficacy and safety of low and very low carbohydrate diets for type 2 diabetes remission: systematic review and meta-analysis of published and unpublished randomized trial data. *BMJ*. Jan 13 2021;372:m4743. doi:10.1136/bmj.m4743
7. Snorgaard O, Poulsen GM, Andersen HK, Astrup A. Systematic review and meta-analysis of dietary carbohydrate restriction in patients with type 2 diabetes. *BMJ Open Diabetes Res Care*. 2017;5(1):e000354. doi:10.1136/bmjdr-2016-000354
8. Feinman RD, Pogozelski WK, Astrup A, et al. Dietary carbohydrate restriction as the first approach in diabetes management: Critical review and evidence base. *Nutrition*. 2015/01/01/ 2015;31(1):1-13. doi:10.1016/j.nut.2014.06.011
9. Unwin D, Unwin J, Crocombe D, Delon C, Guess N, Wong C. Renal function in patients following a low carbohydrate diet for type 2 diabetes: a review of the literature and analysis of routine clinical data from a primary care service over 7 years. *Current Opinion in Endocrinology, Diabetes and Obesity*. 2021;28(5)

Methods: Program Timeline

JUMPSTART Patient Timeline



Shipt Healthy Choice Allowance (HCA)

HCA Categories

Allowed

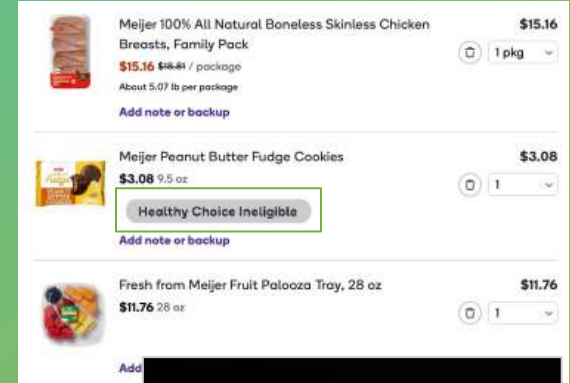
- Produce
- Meat & Seafood
- Dairy
- Deli
- Breakfast
- Pantry
- Household Supplies
- Personal Care / Wellness

Not Allowed

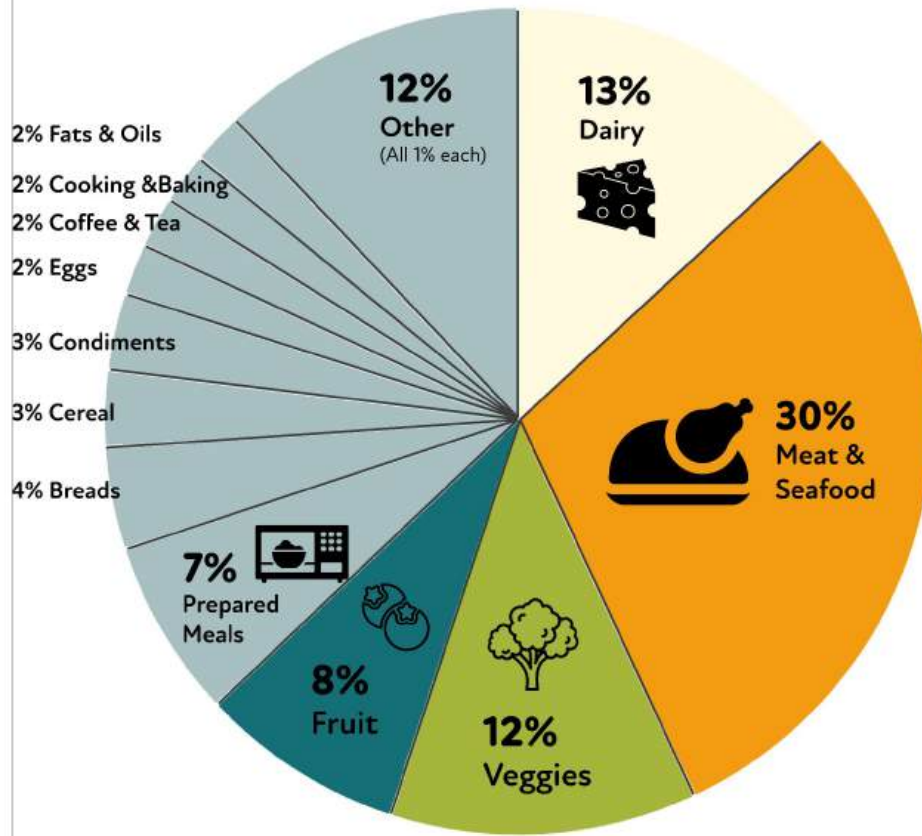
- Baby & Toddler
- Toys
- Entertainment
- Electronics
- Beauty
- Home Goods
- Pets
- Other

Restricted

- **Beverages:** No Soft Drinks
- **Frozen:** No Ice Cream & Dessert
- **Snacking:** No Chips, Candy & Chocolate, Cookies and Snack Cakes

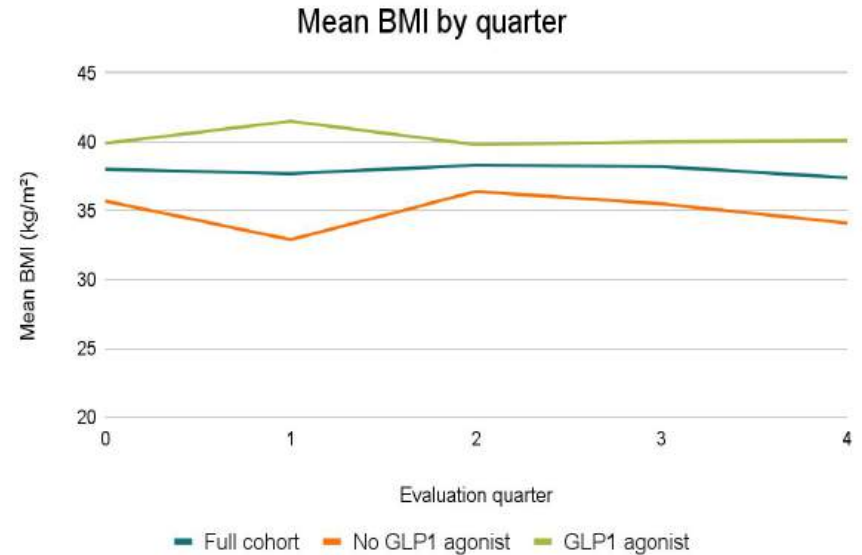
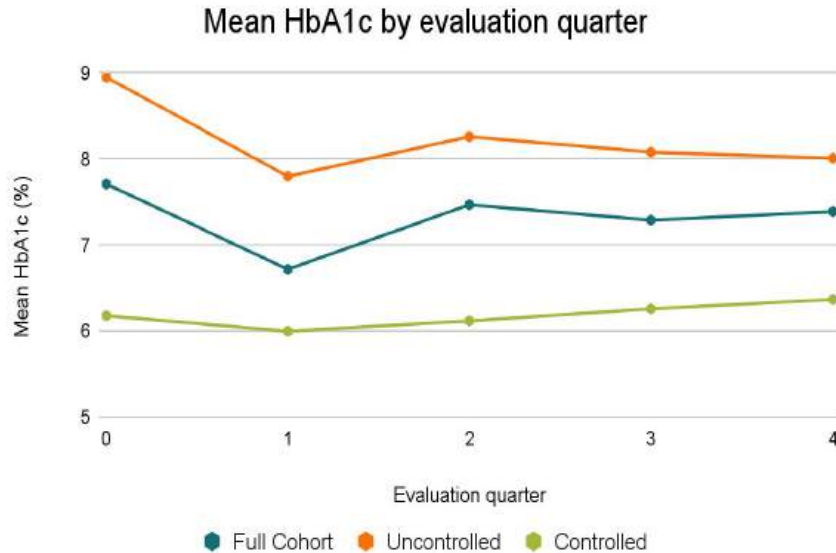


Results: Healthy Choice Allowance Use



"It made you have to think about **what kinds of foods would be covered** or acceptable so **it made you think** about putting more natural and sustainable things into your body than other foods"

Results: Absolute change in HbA1c



Results: Medication Utilization

