



Dietary Quality, Food Security and Glycemic Control among Adult Diabetic Population in the US

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Disclosures

No relevant commercial relationships to disclose



Learning Objectives

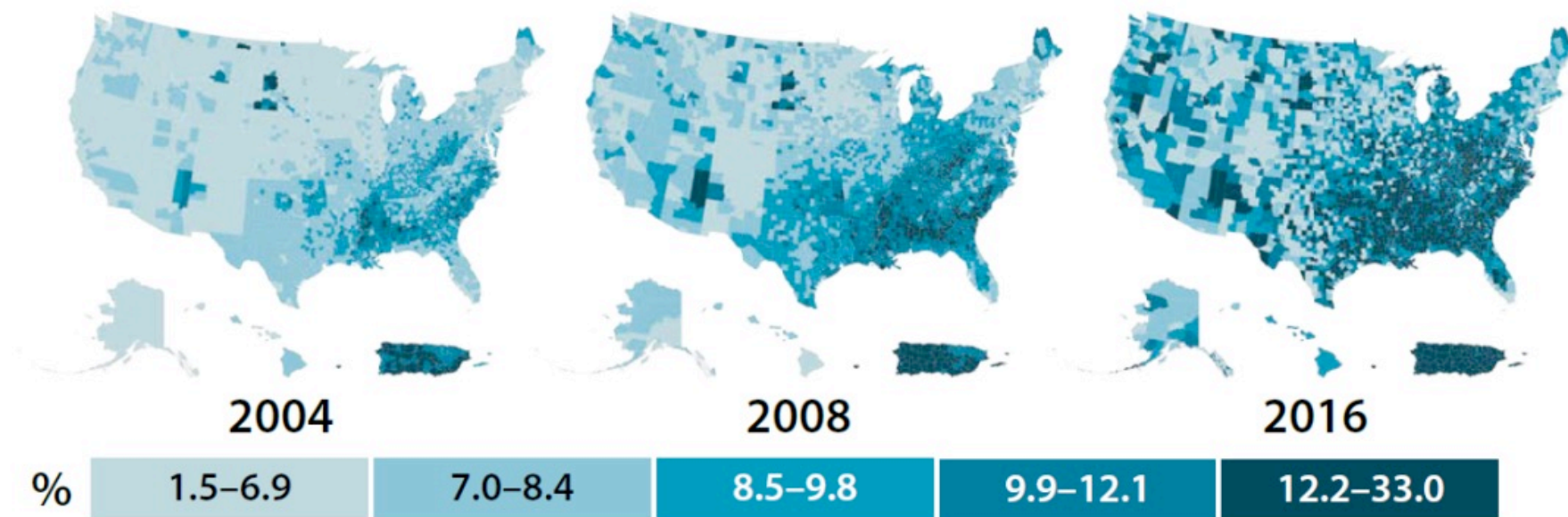
At the end of this session, participants should be able to:

- 1) Understand the association between food quality and glycemic control among adult population with Type 2 diabetes
- 2) Understand the contribution of food insecurity and poor food quality to glycemic control among adult population with Type 2 diabetes



Diabetes is a Public Health Crisis

- Over 34 million (13%) American adults are currently living with diabetes mellitus
- Type 2 diabetes is the 7th leading cause of death in the United States



Control of Diabetes Mellitus

- When left uncontrolled, diabetes can lead to complications and mortality.
- Lifestyle factors and access to healthcare contribute to diabetes control

Diabetic complications are a direct result of hyperglycemia.

Research indicates that controlling glycemic levels can prevent and occasionally reverse complications

Multiple factors may contribute to the control of diabetes mellitus:

Quality of food

Food security

Physical activity

Access to health care



Diet is an Important Factor in Diabetes Control

- A good quality diet is one that is nutritionally adequate
- The American Diabetes Association recommends healthful eating patterns composed of a variety of nutrient-dense foods
- Unfortunately, the dietary quality of diabetic patients has remained sub-optimal over the past few decades



from Diabetes Food Hub



Food insecurity

Limited ability to reliably obtain safe and nutritionally adequate food

- Hinders ability to adhere to recommended dietary choices
- Food-insecure diabetic patients are more likely to have poor glycemic control
- The prevalence of food insecurity has doubled during the coronavirus (COVID-19) pandemic

Food insecurity is Preventable



Objective

Examine the relationship between dietary quality and glycemic control and whether this association is modified by food insecurity among adults living with Type 2 Diabetes



Methods-Sample Population

- Analysis of secondary data from the National Health and Nutrition Survey (NHANES) years 2011-2016
- Cross-sectional survey using multistage cluster sample
- Representative sample of the non-institutionalized US population
- NHANES Includes data from questionnaire, examination, laboratory, and food intake
- Our analysis included participants aged 20 years and older with diabetes mellitus, based on self-report of doctor diagnosed of diabetes or HbA1c levels
- The analytical sample is 1,526 adult subjects with diabetes mellitus



Methods-Main Variables

- Dependent variable: **Diabetes control**, based on HbA1c
 - <7%=excellent
 - 7%-<8%=good
 - 8%-<9%=fair
 - =>9%=poor
- Main independent variables: **diet quality and food security**

1) **Diet quality**: measured using “Healthy Eating Index (HEI)”

- Based on 2 days of 24-hour recall
- The score of the HEI estimates how well the diet aligns with recommendations of the Dietary Guidelines for Americans
- Categories: Good quality diet (80-100); Needs Improvement (60-<80); poor quality diet (<60)



Methods - Food Security Questions

2) Food security: Based on 10 questions about having to skip meals and access to balanced meals

- I worried whether my food would run out before I got money to buy more.
- The food that I bought just didn't last, and I didn't have enough money to get more food.
- I couldn't afford to eat balanced meals.
- Did you ever cut the size of your meals or skip meals because there wasn't enough money for food?
- How often did this happen?
- In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?
- Were you ever hungry but didn't eat because there wasn't enough money for food?
- Did you lose weight because there was not enough money for food?
- Did you ever not eat for a whole day because there wasn't enough money for food?
- How often did this happen?

Food security status is categorized based on the number of affirmative responses as:

- Full security = 0;
- Marginal security = 1-2;
- Low security = 3-5;
- Very low security = 6-10



Methods- Other Independent Variables

- Demographics: Age, gender, race/ethnicity, education, marital status, and federal poverty level
- Health insurance and have regular source of care
- Diabetes treatment
- Ever visited diabetes specialist
- Body mass index (BMI)
- Smoking status
- Alcohol consumption
- Physical activity
- Comorbidities – Number of comorbidities [HTN, CVD, CKD, liver disease, depression]



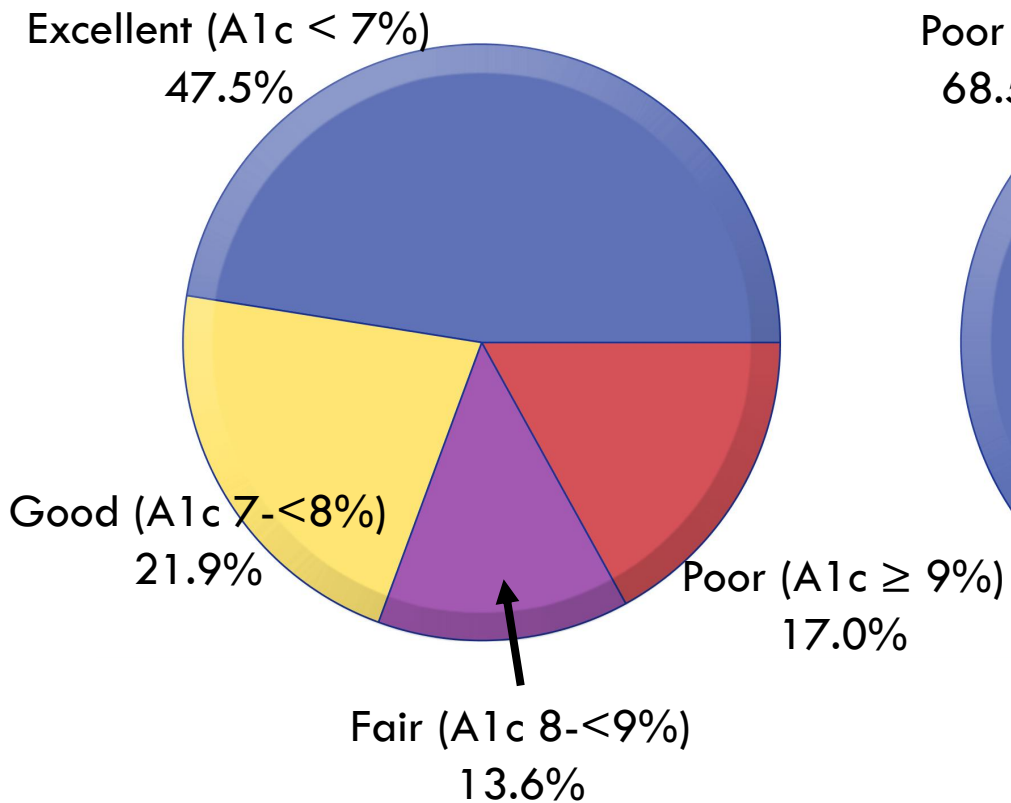
Methods-Statistical Analysis

- Analysis of data accounting for the design and sample weight provided by NCHS
- Descriptive statistics: unweighted number and weighted percent
- Bivariate statistics using Chi Square: examine the variation of the diabetes control by the independent variables
- Multinomial regression
 - Investigate the association between diabetes control, diet quality, and food security
 - Adjust for potential confounding variables
 - Presented as adjusted odds ratio (AOR) and 95% confidence interval
 - P-value of <0.05 is considered statistically significant

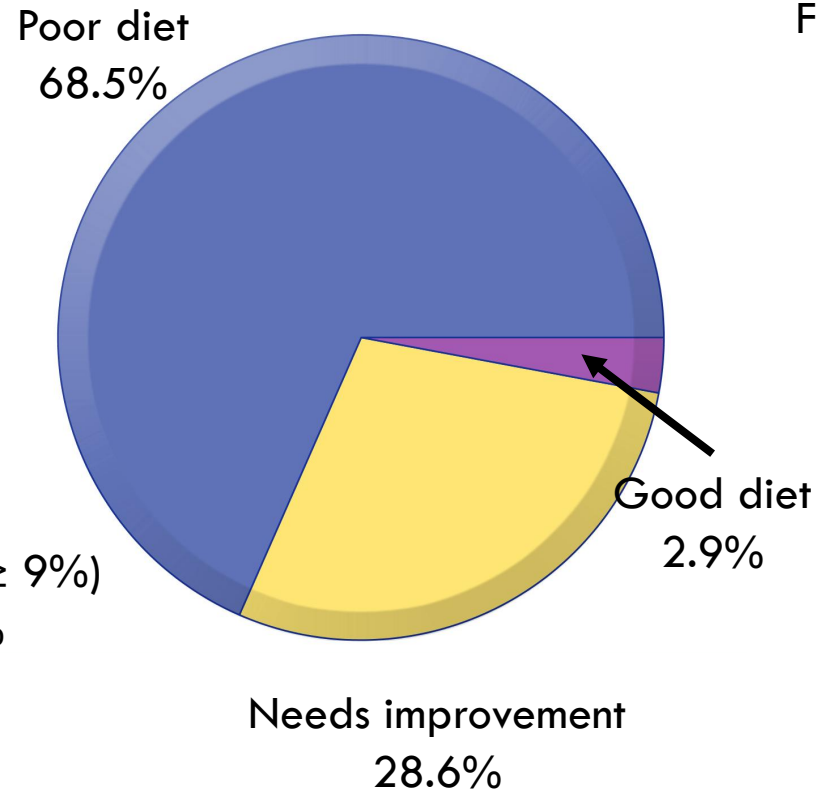


Results-Main variables

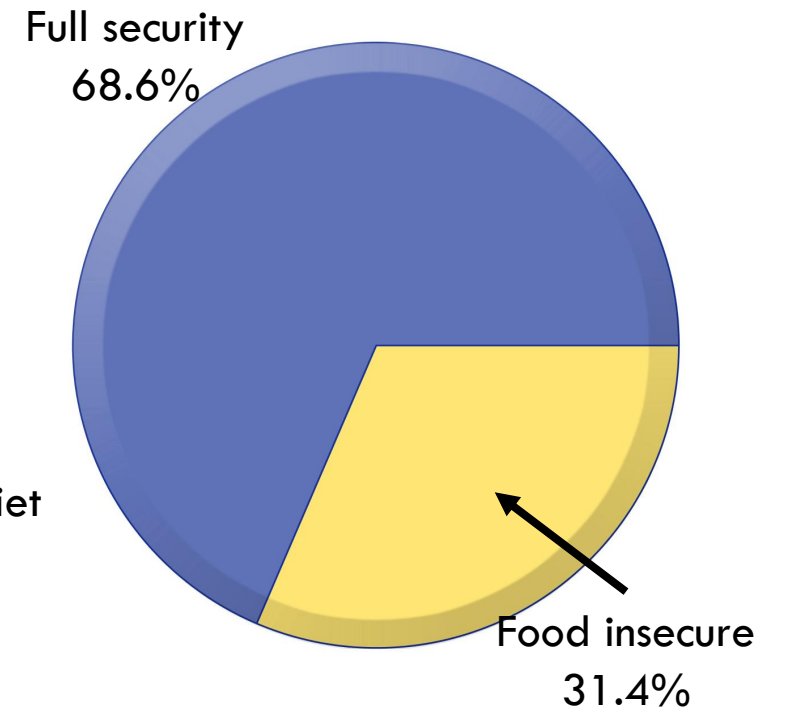
Diabetes control



Healthy eating index



Food security



Results-Sample Characteristics

	Number (%)
Race/ethnicity	
Non-Hispanic White	528 (62.5)
Hispanic	422 (15.3)
Non-Hispanic Black	408 (14.0)
Other	168 (8.2)
Age group (Year)	
18-39	108 (7.6)
40-59	553 (41.4)
60-85	865 (51.1)
Sex	
Male	783 (51.6)
Female	743 (48.4)
Relationship status	
Single	603 (35.4)
Partnered	923 (64.6)

	Number (%)
Education level	
Less Than High School	441 (20.4)
High school diploma (including GED)	354 (24.1)
More Than High School	731 (55.6)
Federal poverty Level (%)	
< 100	387 (18.0)
100-200	450 (23.7)
>200	689 (58.3)
Has health insurance	
Yes	1297 (87.5)
No	229 (12.5)
Where go for health care	
Doctor office	1399 (92.9)
Emergency Department	39 (1.8)
No regular place	88 (5.3)



Results-Sample Characteristics (Cont.)

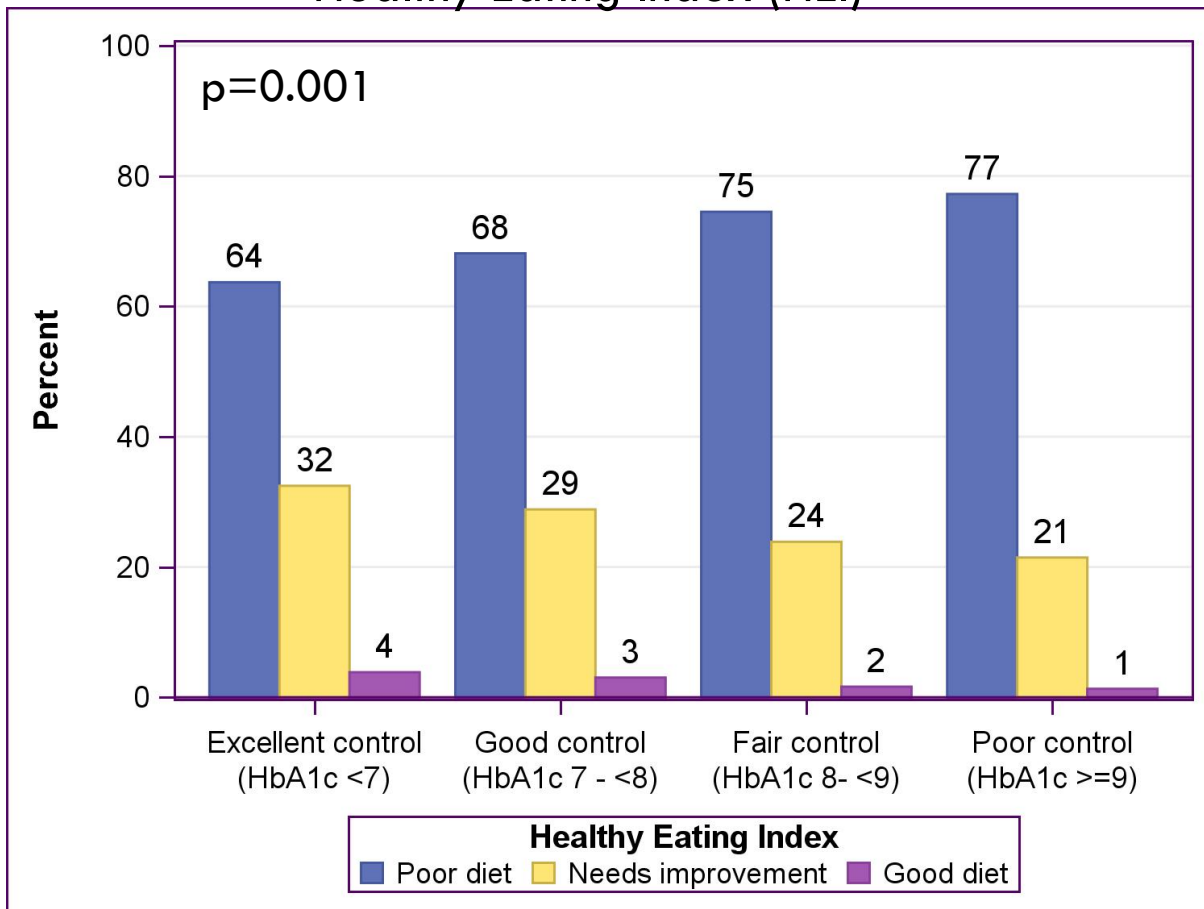
	Number (%)
Takes diabetes medication	
No	344 (21.3)
Yes	1182 (78.7)
Last time saw a diabetes specialist	
Never	577 (36.2)
Ever	949 (63.8)

	Number (%)
Physical activity	
Active	972 (63.5)
Inactive	554 (36.5)
Alcohol consumption (avg # drinks/day)	
Never	822 (47.6)
One or less than day	605 (45.9)
More than one per day	99 (6.5)
Smoking status	
Never smoker	769 (48.1)
Former smoker (quit at least 2 months ago)	255 (16.9)
Current smoker	502 (35.0)
Body Mass Index (BMI)	
Normal weight	195 (10.9)
Overweight	414 (25.4)
Obese	917 (63.7)

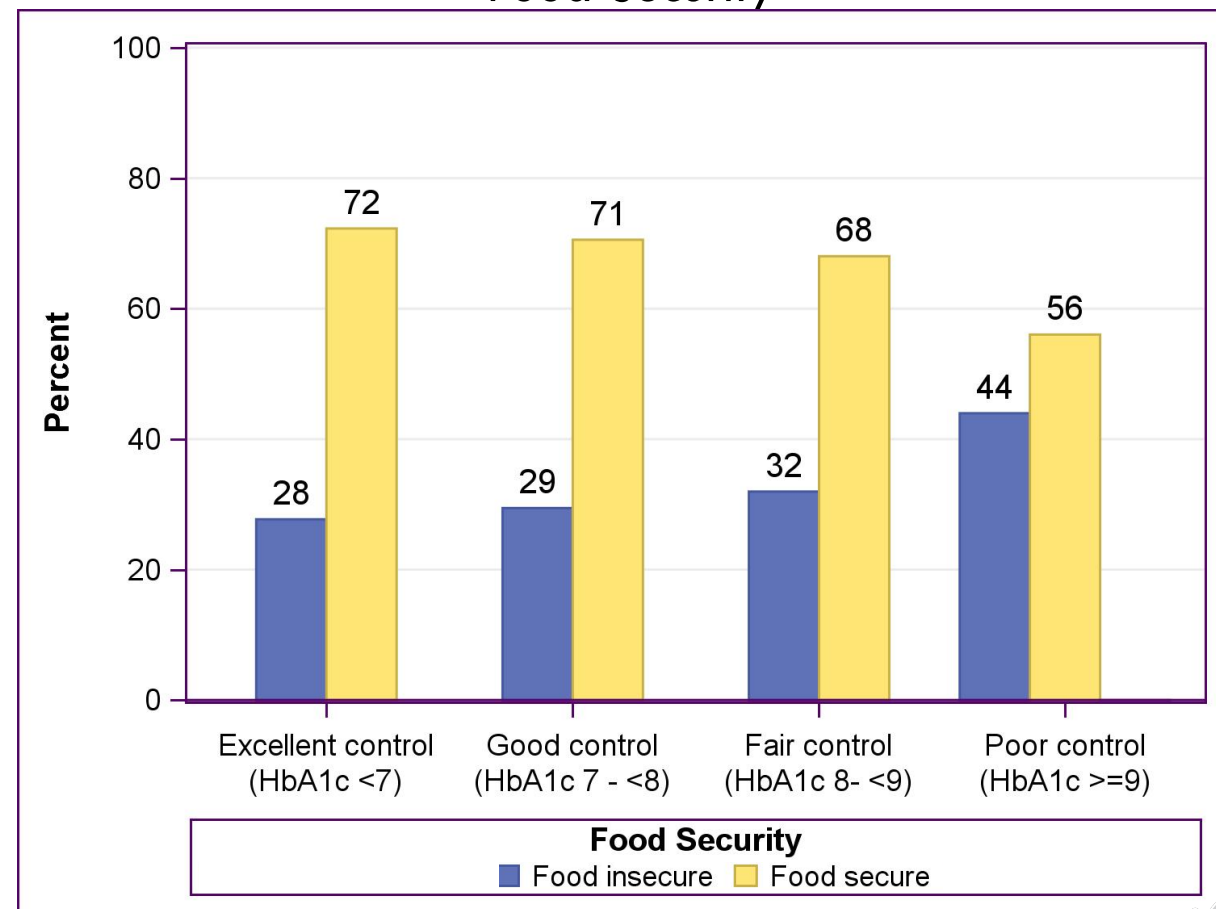


Results-Diabetes Control by HEI and Food Security

Healthy Eating Index (HEI)



Food Security



Results-Multinomial Regression

Adjusted Odds Ratio and 95% Confidence Interval

Ref = Excellent control (HbA1c < 7)	Good control (HbA1c 7 - <8)		Fair control (HbA1c 8- <9)		Poor control (HbA1c >=9)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Food Security Level						
Full security	Reference		Reference		Reference	
Food insecure	1.71 [0.22 - 13.1]	0.60	6.77 [1.05 - 43.8]	0.045	1.16 [0.12 - 11.1]	0.90
Healthy Eating Index						
Good diet	Reference		Reference		Reference	
Needs improvement	1.42 [0.36 - 5.58]	0.62	3.39 [0.79 - 14.5]	0.10	2.29 [0.70 - 7.52]	0.17
Poor diet	1.50 [0.38 - 5.95]	0.57	4.38 [1.12 - 17.1]	0.03	3.03 [0.98 - 9.36]	0.05

*Model adjusted for race/ethnicity, age, gender, education, relationship status, income, health insurance, regular care, medication, whether has seen a diabetes specialist, physical activity, smoking status, alcohol use, BMI, # of chronic conditions



Results- Multinomial Regression (Cont.)

Ref = Excellent control (HbA1c < 7)	Good control (HbA1c 7 - <8)		Fair control (HbA1c 8- <9)		Poor control (HbA1c >=9)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Interaction						
Food secure X Good diet	Reference		Reference		Reference	
Food insecure X Good diet	1.71 [0.22 - 13.1]	0.60	6.77 [1.05 - 43.8]	0.04	1.16 [0.12 - 11.1]	0.90
Food secure X Diet needs improvement	1.42 [0.36 - 5.58]	0.62	3.39 [0.79 - 14.5]	0.10	2.29 [0.70 - 7.52]	0.17
Food insecure X Diet needs improvement	1.29 [0.32 - 5.15]	0.72	2.95 [0.63 - 13.7]	0.17	1.59 [0.42 - 5.99]	0.49
Food secure X Poor diet	1.50 [0.38 - 5.95]	0.57	4.38 [1.12 - 17.1]	0.03	3.03 [0.98 - 9.36]	0.05
Food insecure X Poor diet	1.72 [0.46 - 6.38]	0.42	5.32 [1.24 - 22.9]	0.03	4.89 [1.57 - 15.2]	0.01

*Model adjusted for race/ethnicity, age, gender, education, relationship status, income, health insurance, regular care, medication, whether has seen a diabetes specialist, physical activity, smoking status, alcohol use, BMI, # of chronic conditions



Results-Multinomial Regression (Cont.)

Ref = Excellent control (HbA1c < 7)	Good control (HbA1c 7 - <8)		Fair control (HbA1c 8- <9)		Poor control (HbA1c >=9)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Race/ethnicity						
Non-Hispanic white	Reference		Reference		Reference	
Hispanic	1.62 [1.00 - 2.61]	0.05	1.70 [0.99 - 2.93]	0.05	2.92 [1.95 - 4.39]	<0.01
Non-Hispanic Black	1.48 [0.98 - 2.23]	0.06	1.21 [0.77 - 1.89]	0.42	1.88 [1.18 - 2.98]	0.01
Other	1.53 [0.89 - 2.65]	0.13	1.14 [0.49 - 2.66]	0.77	1.48 [0.79 - 2.79]	0.23
Where goes for health care						
Doctor's office, clinic	Reference		Reference		Reference	
No regular place	0.93 [0.36 - 2.39]	0.88	1.72 [0.51 - 5.82]	0.39	4.08 [1.91 - 8.74]	<0.01
ER	2.79 [1.00 - 7.84]	0.05	2.00 [0.53 - 7.49]	0.30	2.31 [0.61 - 8.78]	0.22

*Model adjusted for race/ethnicity, age, gender, education, relationship status, income, health insurance, regular care, medication, whether has seen a diabetes specialist, physical activity, smoking status, alcohol use, BMI, # of chronic conditions



Strengths and limitations

Strengths

- We investigated how both diet quality and food security together contribute to diabetes control, rather than focusing on just one of these factors. This is important because these two factors can be intertwined.
- Based on a nationally representative sample, so reflective of diabetic patients throughout the country

Limitations

- Cross-sectional, so we cannot determine causality
- Diet and food security are based on self-report, so some possibility for recall bias
- Limited sample size for some combinations of factors, such as those that include "good diet"



Take Home Points

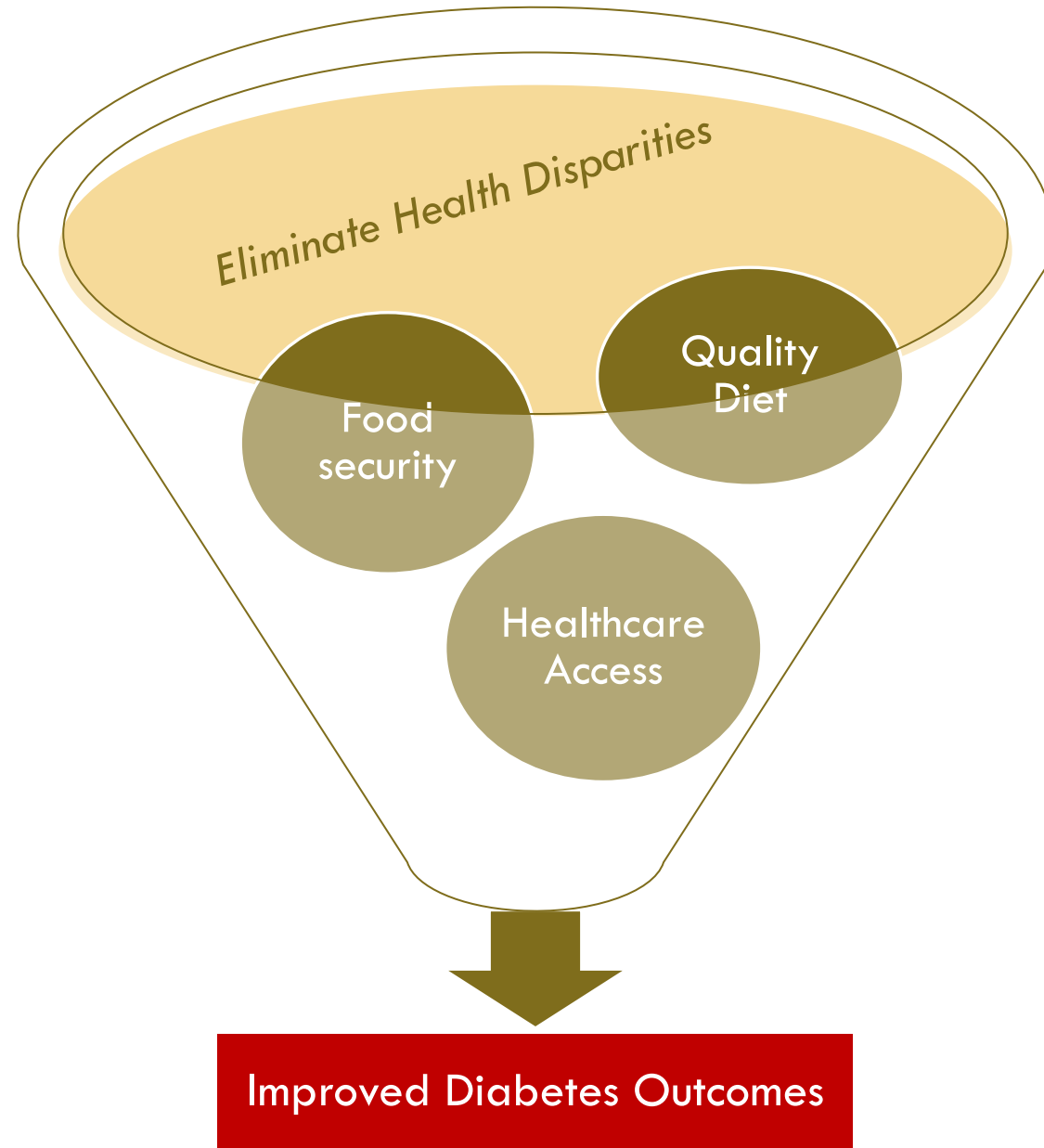
- 1. Poor quality diet** was associated with having HbA1c 8-<9%
 - ❖ Food Secure and Food Insecure
- 2. Food insecurity** was associated with having HbA1c 8-<9%
 - ❖ Good quality diet and Poor quality diet
- 3. Food insecurity AND Poor quality diet** was associated with having **HbA1c =>9%**



Take Home Points

- ❖ Lack of access to regular health care were 4 times more likely to have HbA1c => 9%
- ❖ Hispanic and Non-Hispanic Black participants were 2-3 times more likely to have HbA1c => 9%





Implications

Encourage/educate about nutritionally healthy diets



Nutrition Toolkit

Proper nutrition promotes diabetes, cardiovascular disease settings with the knowledge order to promote optimal health

ACCESS TOOLKIT

Know resources in your community

The Feeding America Network
200 food banks and 60,000 food pantries and meal programs strong.

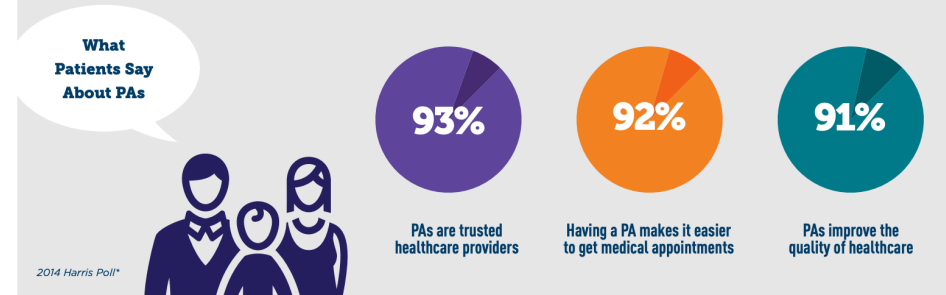
- Surplus Food
- Local Food Banks
- 60,000 Programs
- 1 in 7 Americans Served

Learn more about how Feeding America network food banks fight hunger in communities across America.

PAs are filling the gap



Optimal Team Practice
Provide quality care without burdensome administrative constraints.



Advocacy to eliminate health disparities



Acknowledgements



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References

1. Schwingshackl L, Chaimani A, Hoffmann G, Schwedhelm C, Boeing H. A network meta-analysis on the comparative efficacy of different dietary approaches on glycaemic control in patients with type 2 diabetes mellitus. *Eur J Epidemiol.* 2018;33(2):157-170. doi:10.1007/s10654-017-0352-x
2. Orr CJ, Keyserling TC, Ammerman AS, Berkowitz, SA. Diet quality trends among adults with diabetes by socioeconomic status in the U.S.: 1999-2014. *BMC Endocrine Disorders.* 2019;19(1):1-9
3. Flint KL, Davis GM, Umpierrez GE. Emerging trends and the clinical impact of food insecurity in patients with diabetes. *J Diabetes.* 2020;12(3):187-196. doi:10.1111/1753-0407.12992
4. Leddy AM, Weiser SD, Palar K, Seligman H. A conceptual model for understanding the rapid COVID-19-related increase in food insecurity and its impact on health and healthcare. *Am J Clin Nutr.* 2020;112(5):1162-1169. doi:10.1093/ajcn/nqaa226
5. Healthy Eating Index. <https://www.fns.usda.gov/resource/healthy-eating-index-hei>.

