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Informing & Developing Systematic Interventions for Diabetes Prevention

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Disclosures

I have no relevant financial relationships with commercial interests.

I will not be discussing non-FDA approved uses of any drugs.

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Outline

- Prediabetes prevalence and treatment guidelines
- Cohort study on prediabetes care management
- Barriers & facilitators to prediabetes care
- Systematic intervention for diabetes prevention

Current State of Prediabetes

Table 3. Estimated number, percentage, and awareness of prediabetes[a] among adults aged 18 years or older, United States, 2017–2020 and 2019

Characteristic	Prediabetes,[a] 2019 estimates Number in millions (95% CI)	Prediabetes,[a] 2017–2020 estimates Percentage (95% CI)	Prediabetes awareness,[b] 2017–2020 estimates Percentage (95% CI)
Total	96.0 (90.5–102.0)	38.0 (35.7–40.3)	19.0 (15.0–23.7)
Age group			
18–44	32.2 (27.7–36.8)	27.8 (24.0–32.0)	13.8 (9.8–18.9)
45–64	37.4 (35.0–39.9)	44.8 (41.7–47.9)	20.6 (14.3–28.9)
≥65	26.4 (24.1–28.7)	48.8 (44.3–53.2)	23.0 (16.9–30.4)
Sex			
Men	52.3 (48.0–56.6)	41.9 (38.4–45.6)	17.4 (13.4–22.2)
Women	43.7 (39.8–47.6)	34.3 (31.2–37.5)	20.9 (15.5–27.5)
Race-ethnicity			
White, non-Hispanic	62.4 (57.4–67.4)	38.7 (35.5–41.9)	17.3 (11.8–24.7)
Black, non-Hispanic	12.4 (11.4–13.5)	39.2 (35.8–42.6)	21.9 (18.0–26.5)
Asian, non-Hispanic	6.0 (5.3–6.8)	37.3 (32.6–42.3)	30.1 (21.0–41.1)
Hispanic	14.3 (13.0–15.6)	34.5 (31.3–37.7)	20.9 (15.3–27.9)

Centers for Disease Prevention & Control. National Diabetes Statistics Reports, 2022

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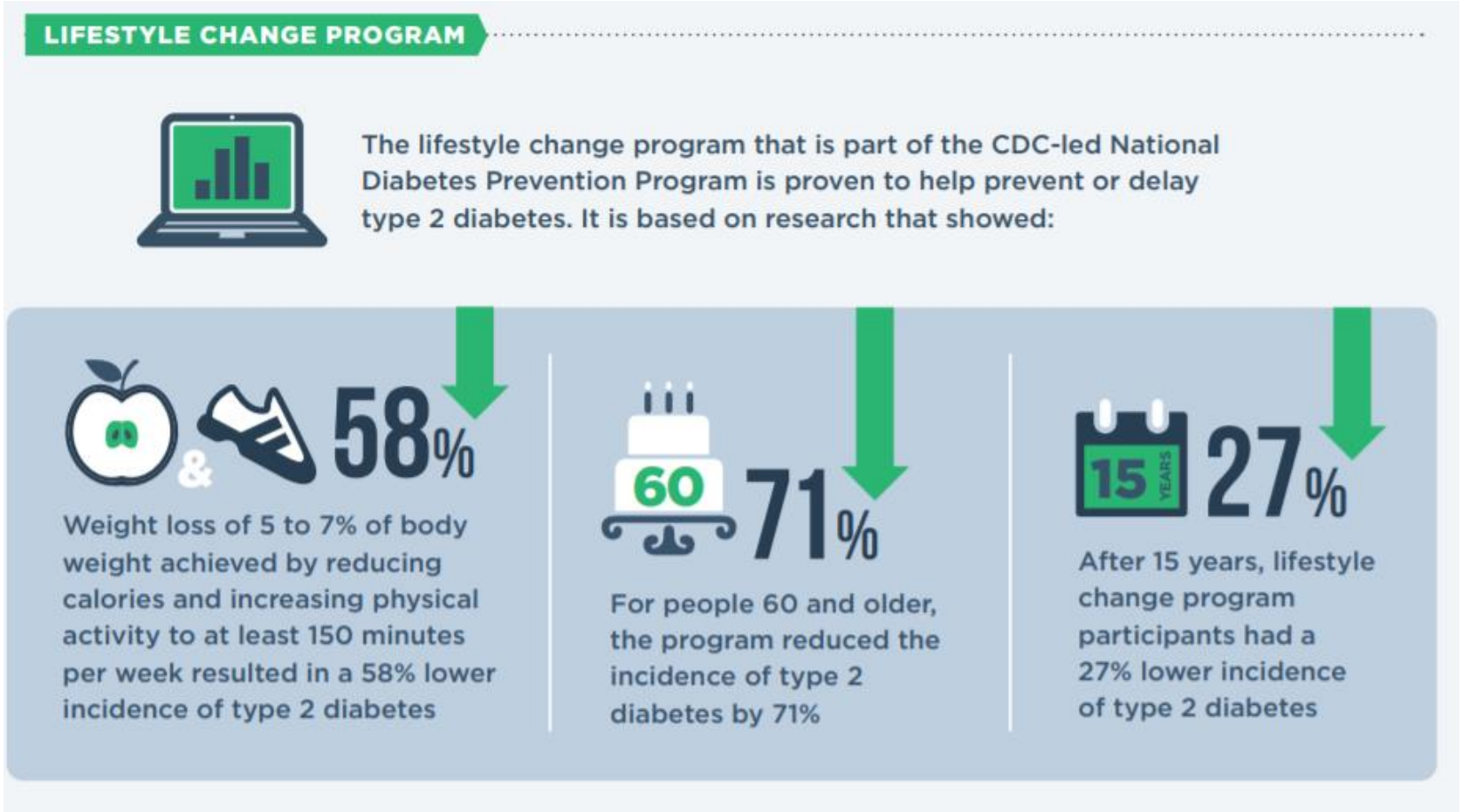
Diabetes Prevention Program Works!



Centers for Disease Prevention & Control

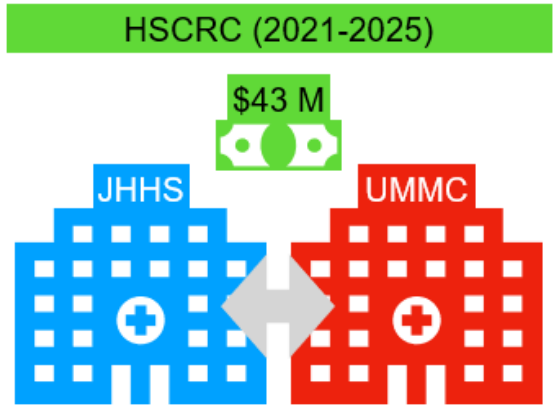
Guidelines on Diabetes Prevention (ADA)

- Referral to intensive lifestyle behavior change program consistent w/ DPP to achieve & maintain 7% body weight loss & 150 min/wk of moderate-intensity physical activity (A)
- Metformin can be considered, especially those with BMI ≥35, age 25-59 yrs, prior GDM, higher fasting plasma glucose (≥110 mg/dL), higher A1c (≥6%) (A)
- At least annual lab monitoring for development of diabetes (E)
- Variety of eating patterns can be considered to prevent diabetes in people with prediabetes (B)
- Screen and treat for modifiable risk factors for cardiovascular disease (B)

American Diabetes Association Standards of Medical Care, 2023

Diabetes Prevention & Education at Johns Hopkins

Diabetes Prevention and Education Program (DPEP)



Infrastructure-building for delivery of two (2) programs:

National Diabetes Prevention Program (CDC)

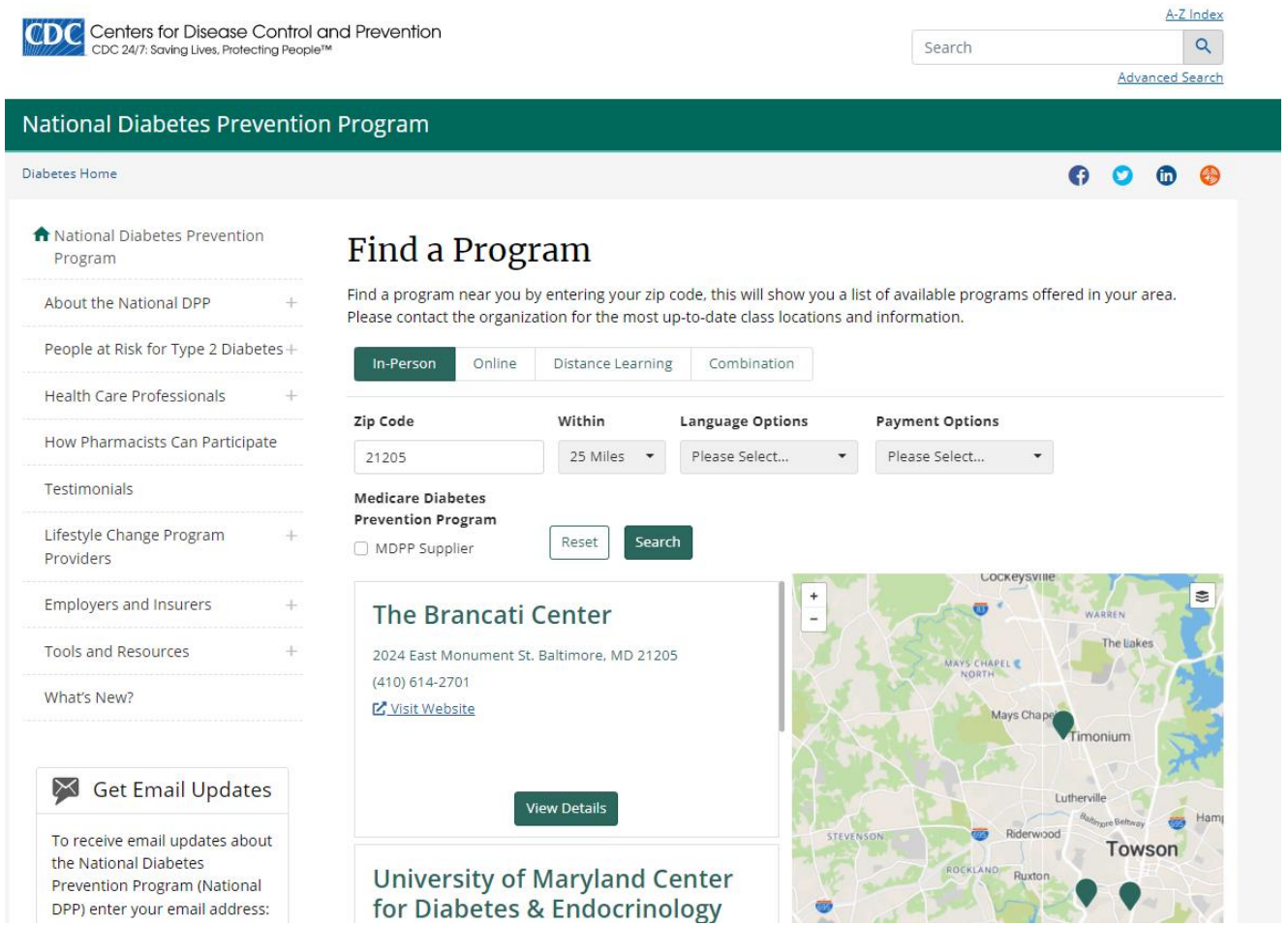
Diabetes Self-Management Training (ADA)

Wrap-around services

National Diabetes Prevention Program

- CDC-recognized structured lifestyle change program
  - Targets 5-7% weight loss and 150 min/wk of physical activity
- Eligibility: age ≥18 yrs + BMI ≥25kg/m² or ≥23kg/m² if Asian + labs consistent with prediabetes or prior gestational diabetes
- In-person or online
- One year duration (weekly for 6 months then 1-2 times/month for 6 months)
- Insurance coverage: Medicare, Medicaid (in some states), some private insurers

DPPs Nationally & Locally



https://www.cdc.gov/diabetes/prevention/find-a-program.html

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Informing Systematic Interventions for Diabetes Prevention

Diabetes Prevention in Primary Care: PCP Surveys

- Regional and national survey of primary care providers (PCPs) demonstrated gaps in knowledge about diabetes prevention and underutilization of Diabetes Prevention Programs

Table 2 Reported Knowledge, Practices, and Perceptions of Barriers/Interventions for Prediabetes

	N (%)
Knowledge of recommendations for management of prediabetes	
Initial management approach*	
Refer to diabetes prevention lifestyle change program	88 (29.7)
Counseling on diet changes and physical activity	209 (70.1)
Refer to nutritionist	50 (16.8)
Discuss starting metformin	53 (17.8)
Refer to bariatric surgery	9 (3.0)
150 min/week of physical activity	120 (41.0)
7% body weight loss	22 (7.6)
Practice behaviors	
Initial management approach*	
Refer to diabetes prevention lifestyle change program	107 (35.9)
Counseling on diet changes and physical activity	276 (92.6)
Refer to nutritionist	123 (41.3)
Discuss starting metformin	128 (43.0)
Refer to bariatric surgery	30 (10.1)

Tseng E et al. Survey of primary care providers' knowledge of screening, diagnosing and managing prediabetes. J Gen Intern Med. 2017.
Tseng E et al. National survey of primary care physicians' knowledge, practices and perceptions of prediabetes. J Gen Intern Med. 2019.

Diabetes Prevention Practices in Primary Care: NHANES Data

- Metformin use <1% among adults with prediabetes using NHANES data from 2005-2012

Table 3—Percentage of individuals with prediabetes reporting metformin use by criteria for metformin use

Risk factors for prediabetes	*n**	*N*†	% (SE) on metformin‡
Prediabetes by IFG, IGT, HbA_{1c}, or self-report	91	7,652	0.8 (0.008)
Prediabetes based on IGT alone	1	285	0.8 (0.008)
Prediabetes based on IFG alone	0	1,577	0
Prediabetes based on HbA_{1c} 5.7–6.4% alone	18	3,065	0.6 (0.002)
Prediabetes based on HbA_{1c} 6.0–6.4% alone	13	1,411	0.9 (0.003)
Self-reported prediabetes alone	0	0	0
BMI ≥35 kg/m^2	33	1,316	1.9 (0.005)
IFG and IGT + risk factor§	0	0	0
IGT + risk factor‖	1	190	1.1 (0.1)
IFG + risk factor‖	0	1,178	0
HbA_{1c} 5.7–6.4% + risk factor‖	13	2,101	0.7 (0.002)
Self-reported prediabetes + risk factor‖	0	0	0
IFG and IGT + risk factor‖ + HbA_{1c} 6.0–6.4%	0	179	0

IFG, impaired fasting glucose; IGT, impaired glucose tolerance. *Represents unweighted *n* for those treated with metformin. †Represents unweighted *n* for those treated or not treated with metformin. ‡Represents weighted percentage. §2007 guidelines risk factors: age <60 years, BMI ≥35 kg/m^2, family history of diabetes, elevated triglycerides, low HDL cholesterol, hypertension, or HbA_{1c} ≥6%. We defined elevated triglycerides as ≥150 mg/dL and low HDL cholesterol as <40 mg/dL based on Adult Treatment Panel III guidelines (30). ‖2017 guidelines risk factors: age <60 years, BMI ≥35 kg/m^2, or history of gestational diabetes mellitus (not available in this data set) and rising HbA_{1c} despite lifestyle intervention (not available in this data set).

Tseng et al, Metformin Use for Prediabetes among U.S. Adults, 2005-2012. Diabetes Care. 2017 Jul;40(7):887-893

Clinical Care Among Individuals with Prediabetes: Retrospective Cohort Study

Tseng E, et al. Clinical care among individuals with prediabetes in primary care: a retrospective cohort study. J Gen Intern Med. 2022 Dec;37(16):4112-4119

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Objectives

- Describe the care management activities of patients with prediabetes
- Determine what patient factors are associated with these prediabetes care management activities
- Describe the incidence of diabetes after diagnosis of prediabetes and whether PCP treatment practices and patient factors are associated with progression to diabetes

Methods

- Data: linked claims and EHR dataset for patients participating under 3 Hopkins Health Care insurance plans from 2/2016-2/2021
- Cohort: age 18+ with at least 2 outpatient primary care encounters
- Inclusion: lab diagnosed prediabetes (HbA1c 5.7-6.4% or fasting glucose 100-125mg/dL), one claim in 12m prior to and 12m after cohort entry date
- Exclusion: prior diagnosis of diabetes (SUPREME-DM definition), history of pregnancy in prior 6m, or recent steroid use in prior 30 days
- Cohort entry date (CED) = date of first lab consistent with prediabetes

Outcomes

- Primary Outcome: prediabetes care management activities
  - Using EHR data: PCP visits, PCP visits coded w/ ICD-10 code for prediabetes, glycemic test orders and results, nutrition referrals and visits
  - Using claims data: nutrition visits, metformin fills
- Secondary Outcome: development of diabetes
  - Using EHR and claims data
  - SUPREME-DM definition: ≥1 inpatient ICD code for diabetes or ≥2 of the following (outpatient ICD code for diabetes, labs in diabetes range, or diabetes medication fill)

Raebel MA, et al. Validating Type 1 and Type 2 Diabetes Mellitus in the Mini-Sentinel Distributed Database Using the Surveillance, Prevention, and Management of Diabetes Mellitus (SUPREMEDM) Datalink. MINI-SENTINEL METHODS. 2016 April.

Statistical Analysis

- Primary/Secondary Objectives: prediabetes care management activities and associated factors
  - Tabulated occurrence of each activity within 3, 6, and 12m after CED (dichotomized as any or none)
  - Tested strength of association between baseline characteristics and activities using bivariate logistic regression and multiple logistic regression with clinic as fixed effect

Statistical Analysis

- Tertiary Objective: development of diabetes
  - Described patients who developed diabetes within 3, 6, and 12m after CED
  - Tested strength of association between baseline characteristics and development of diabetes using bivariate logistic regression
  - Evaluated independent predictors of diabetes using multiple logistic regression with clinic as fixed effect

Results: Baseline Characteristics (n=3888)

	Mean (SD) or *n*(%)
Age (years)	62.7 (14.6)
18–26 years	57 (1.5)
27–44 years	465 (12.0)
45–64 years	1253 (32.2)
65–74 years	1349 (34.7)
75+ years	764 (19.7)
Female sex	2544 (65.4)
Race	
White	2140 (55.0)
Black	1341 (34.5)
Asian	156 (4.0)
Other/multiracial	218 (5.6)
Unknown	33 (0.9)
Hispanic ethnicity	117 (3.0)
Insurance plan	
Commercial	901 (23.2)
Medicare	1950 (50.2)
Medicaid	491 (12.6)
Other*	546 (14.0)
BMI (kg/m^2)†	30.0 (7.6)
BMI (kg/m^2)	
< 25	778 (25.9)
25–29	959 (31.9)
30–34	629 (21.0)
35–39	324 (10.8)
≥ 40	313 (10.4)
Fasting plasma glucose (mg/dL)	98.4 (11.3)
Fasting plasma glucose 100–109 mg/dL	850 (84.8)
Fasting plasma glucose 110–125 mg/dL	153 (15.3)
HbA1c, %	6.0 (0.2)
HbA1c 5.7–5.9%	1860 (53.2)
HbA1c 6–6.4%	1639 (46.8)

Results: Prediabetes Care Management Activities

Outcome	Within 3 months, *n* (%)	Within 6 months, *n* (%)	Within 12 months, *n* (%)
PCP practices			
≥ 1 PCP visit coded with ICD diagnosis of prediabetes	147 (3.8)	262 (6.7)	405 (10.4)
≥ 1 visit coded with ICD diagnosis of prediabetes among those with ≥ 1 PCP visit	147 (8.5)	262 (10.5)	405 (13.0)
≥ 1 glycemic test ordered	797 (20.5)	1578 (40.6)	2463 (63.4)
≥ 1 referral to nutrition†	8 (0.2)	19 (0.5)	37 (1.0)
≥ 1 metformin prescription†‡	77 (2.0)	126 (3.2)	211 (5.4)
Patient behaviors			
≥ 1 PCP visit	1739 (44.7)	2493 (64.1)	3105 (79.9)
≥ 1 glycemic test completed†	447 (11.5)	1091 (28.1)	1957 (50.3)
≥ 1 glycemic test completed among those with test ordered	438 (55.0)	1080 (68.4)	1950 (79.2)
≥ 1 nutrition visit completed§	15 (0.4)	25 (0.6)	39 (1.0)
≥ 1 nutrition visit completed (claims)*	16 (0.4)	27 (0.7)	41 (1.1)
≥ 1 nutrition visit completed among those with referral placed	4 (50.0)	13 (68.4)	28 (75.7)
≥ 1 metformin fill (claims)*	121 (3.1)	148 (3.8)	189 (4.9)
≥ 1 metformin fill (claims)* among those with prescription	55 (71.4)	89 (70.6)	161 (76.3)

**EHR data used unless otherwise noted. n refers to the number of unique individuals who had at least one occurrence of each activity*
†American Medical Association proposed quality measures for prediabetes (2019)
‡Some portion of these patients may have been started on metformin for diabetes prevention or once they developed diabetes
§More patients had a nutrition visit than had a referral since a referral is not required by all insurances

Results: Factors Associated with Prediabetes Care

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	Eligible patients *n*	ICD diagnosis of prediabetes at PCP visit *n*(%)	Glycemic test completed *n*(%)	Metformin prescription *n*(%)	Nutrition visit completed *n*(%)
Sex					
Female (ref)	2544	250 (9.8)	1269 (49.9)	128 (5.0)	27 (1.1)
Male	1344	155 (11.5)	688 (51.2)	83 (6.2)	12 (0.9)
Age					
18–26 years (ref)	57	7 (12.3)	14 (24.6)	1 (1.8)	0
27–44 years	465	49 (10.5)	170 (36.6)	19 (4.1)	3 (0.7)
45–64 years	1253	127 (10.1)	631 (50.4)*	71 (5.7)	15 (1.2)
65–74 years	1349	140 (10.4)	744 (55.2)*	78 (5.8)	16 (1.2)
75+ years	764	82 (10.7)	398 (52.1)*	42 (5.5)	5 (0.7)
Race					
White (ref)	2140	208 (9.7)	1057 (49.4)	91 (4.3)	15 (0.7)
Black	1341	146 (10.9)	686 (51.2)	89 (6.6)*	23 (1.7)*
Asian	156	25 (16.0)*	86 (55.1)	12 (7.7)*	1 (0.7)
Other/multiracial	218	25 (11.5)	111 (50.9)	16 (7.3)*	0
Unknown	33	1 (3.0)	17 (51.5)	3 (9.1)	0
Hispanic ethnicity (ref)	117	6 (5.1.)	62 (53.0)	9 (7.7)	0
Not Hispanic or unknown	3771	399 (10.6)	1895 (50.3)	202 (5.4)	39 (1.0)
Insurance					
Commercial (ref)	901	94 (10.4)	432 (48.0)	58 (6.4)	6 (0.7)
Medicare	1950	201 (10.3)	1055 (54.1)*	112 (5.7)	21 (1.1)
Medicaid	491	50 (10.2)	225 (45.8)	14 (2.9)*	6 (1.2)
Other	546	60 (11.0)	245 (44.9)	27 (5.0)	6 (1.1)
HbA1c 5.7–5.9% or FPG 100–109 mg/dL (ref)	2109	214 (10.2)	927 (44.0)	97 (4.6)	16 (0.8)
HbA1c 6.0–6.4% or FPG 110–125 mg/dL	1779	191 (10.8)	1030 (57.9)*	114 (6.4)*	23 (1.3)
BMI (kg/m^2)					
< 25 (ref)	778	52 (6.7)	400 (52.7)	20 (2.6)	5 (0.6)
25–29	959	114 (11.9)*	502 (52.4)	42 (4.4)*	6 (0.6)
30–34	629	98 (15.6)*	313 (49.8)	43 (6.8)*	8 (1.3)
35–39	324	57 (17.6)*	176 (54.3)	37 (11.4)*	3 (0.9)
≥ 40	313	58 (18.5)*	165 (52.7)	45 (14.4)*	10 (3.2)*

BMI body mass index, FPG fasting plasma glucose, HbA1c hemoglobin A1c
**p < 0.05 generated from logistic regression analysis comparing to reference group*

Results: Factors Associated with Incident Diabetes (n=249)

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Table 5 Predictors of Development of Diabetes Within 12 Months in a Multiple Logistic Regression Model Stratified by Baseline Glycemic Level

Variable	Baseline HbA1c 6.0–6.4% or FPG 110–125 mg/dL	Baseline HbA1c 5.7–5.9% or FPG 100–109 mg/dL	All baseline HbA1c and glucose levels
	Odds ratio (95% CI)		
Age	1.00 (0.98–1.02)	**0.98 (0.96–0.99) p=0.03**	0.99 (0.98–1.01)
Female vs. male	0.74 (0.49–1.13)	0.86 (0.51–1.45)	0.79 (0.57–1.09)
Asian vs. White	1.27 (0.43–3.78)	2.34 (0.77–7.09)	1.73 (0.80–3.76)
Black vs. White	1.55 (0.99–2.43)	1.26 (0.75–2.15)	**1.44 (1.02–2.04) p=0.04**
Other vs. White	0.60 (0.18–2.01)	1.20 (0.41–3.50)	0.83 (0.38–1.85)
BMI (per 1 kg/m^2)	**1.04 (1.02–1.07) p<0.001**	**1.05 (1.02–1.08) p<0.001**	**1.05 (1.03–1.06) p<0.001**
Care utilization prior to CED†			
Quartile 2 vs. 1	**0.55 (0.32–0.97) p=0.04**	0.67 (0.34–1.32)	**0.57 (0.37–0.88) p=0.01**
Quartile 3 vs. 1	0.70 (0.41–1.20)	1.10 (0.59–2.06)	0.82 (0.55–1.23)
Quartile 4 vs. 1	0.65 (0.38–1.13)	0.51 (0.25–1.04)	**0.55 (0.36–0.85) p=0.006**
Medicare vs. commercial	0.91 (0.50–1.67)	2.02 (0.97–4.19)	1.33 (0.83–2.11)
Medicaid vs. commercial	0.90 (0.41–1.95)	0.78 (0.31–1.97)	0.86 (0.48–1.54)
Other vs. commercial	0.62 (0.28–1.37)	1.49 (0.62–3.57)	0.91 (0.51–1.63)

BMI body mass index, CED cohort entry date, FPG fasting plasma glucose, HbA1c hemoglobin A1c
**Fixed-effects model with clinic as a fixed effect. Displayed variables were included in the model together*
†Care utilization defined as sum of hospitalizations and outpatient visits in 12 months prior to CED

Conclusions

- Few patients received a coded diagnosis of prediabetes, were referred to a nutritionist, or prescribed metformin in 12m after meeting cohort criteria, similar to prior studies although our rates of nutrition referral were lower
- Consistent with prior research, patients with higher baseline glycemic levels or higher BMI were more likely to receive prediabetes care. They were also more likely to develop diabetes within 12 months.
- Black patients were 1.4 times more likely to develop diabetes compared to White patients

Strengths

- Diverse population
- Newer data (2016-2021) and use of both EHR and claims data
- Examined type of insurance to see if prediabetes care differed by insurance
- Examined development of diabetes which adds to limited data on risk of progression to diabetes among different racial/ethnic groups in the U.S.

Limitations

- Single health system
- 5-year study period overlapped with COVID-19 pandemic so outcome rates may be lower than usual
- Lack of data on insurance enrollment dates
- Included both prevalent and incident prediabetes but baseline characteristics were similar in both groups
- Model included clinic as a fixed effect but did not examine other clinic-level predictors
- DPPs exist at our institution but referral order was not implemented till 2020 and program had limited capacity during study period

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Implications/Future Directions

- Since the underdiagnosis and undertreatment of prediabetes is evident, future research is needed to understand whether clinical decision support tools in the EHR can help improve prediabetes care in primary care settings and reduce diabetes incidence
- Continuing education on diabetes prevention guidelines is needed
- Expanding our analysis to other health systems and patients from underserved populations

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Engaging Payors & PCPs in Improving Diabetes Prevention

Tseng E, et al. Engaging payors and primary care physicians together in improving diabetes prevention. J Gen Intern Med. 2022 Sept 20. DOI: 10.1007/s11606-022-07788-8

Objective

- Through interviews of PCPs and payors, understand barriers to DPP uptake that exist and intersect at different levels (patients, PCPs and payors) to inform strategies to improve diabetes prevention in primary care settings

Methods

- Design: During May 2020-October 2021, we conducted remote, semi-structured interviews (30-60 min) with PCPs and payors
- Participants: PCPs from primary care practices affiliated with Johns Hopkins Health System. Payors from regional commercial, Medicare and Medicaid plans
- Approach:
  - Standardized interview guide focused on barriers, facilitators and potential intervention components
  - Interviews recorded using Zoom and professionally transcribed
- Analysis: Two reviewers double-coded transcripts using framework analytic approach

Results

N=16 PCPs from 13 primary care clinics & n=7 payor leaders representing 6 insurance plans

PCP reported patient-level barriers	PCP barriers	PCP & payor barriers
• Lack of programs and insurance coverage of resources to address nutrition and exercise • Inadequate resources to address social determinants of health that impact diabetes prevention	• Low PCP knowledge about DPPs and misperceptions of insurance coverage of DPPs • Inadequate clinical staff to address diabetes prevention	• Absence of prediabetes quality measures • Inadequate engagement of PCPs and patients by payors

Results

PCP reported patient-level barriers
• Lack of programs and insurance coverage of resources to address nutrition and exercise

PCP: *Standard primary care has found significant challenges with getting patients into lifestyle modification programs […] I think that created a learned helplessness […]* ***So I think rarely do providers think about DPPs or even nutrition referrals unless patients specifically asked, simply because typically it's been challenging to get the access to those***

Payor: *We connect members with dietitians and diabetic educators. We also have – within our own care management strategies [..]* ***toolkits and clinical pathways that we use to meet members where they are. So, they are evidence-based strategies and/or questions or areas of opportunities that we've customized****.*

Results

PCP barriers

- Low PCP knowledge about DPPs and misperceptions of insurance coverage of DPPs

Payor: *There's no good way to get the physician to say, this is what's available to this member under this account under the [Commercial] plan and you can refer them to this virtual diabetes clinic. That would be the ideal pathway if the person had a physician to go through the physician, but* ***from a data perspective, it's really challenging to get that level of granularity about coverage, benefits and programs***

PCP: *Nowadays is not just Medicare. It's Medicare, Medicare Maryland Primary Care Program, [and] Medicare Advantage plan […]* ***What happens is you refer somebody to the program (DPP), you get 10 messages trying to clarify if they can go***

Results

PCP & payor barriers
• Absence of prediabetes quality measures

PCP: *There are real dollars being attached to getting certain reports and hitting certain targets, and not only does it matter for our patients and their well-being, but it* ***matters for our financial health and the resources we can bring in***

Payor: *If there is some kind of requirement by the state to report on our prediabetic members, let's say –[…] some kind of HEDIS measures or reportable thing, because* ***once we start reporting on it – we pay attention to it. We start measuring it, and that's how we get more serious about how we address it and how we prevent it***

Conclusions/Implications

- Identified important perceived patient-, PCP-, and payor-level barriers to engaging in diabetes prevention
- Strategic priorities proposed based on findings:
  - Improve transparency of coverage benefits and changes
  - Increase coverage of lifestyle change resources for people unable to participate in DPPs
  - Data reporting and outreach by payors to PCPs
  - Continuing education efforts for clinicians from a systems-level
  - Review and endorsement of prediabetes quality measures

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Implementation & Evaluation of A Systematic Intervention for Diabetes Prevention

Study ongoing

Objectives

Design, implement and evaluate a systematic intervention for diabetes prevention, comparing intervention and control clinics

- To understand if PCP practices in managing patients with prediabetes differ between baseline and implementation periods, comparing intervention and control clinics
  - Hypothesis: Patients in intervention clinic will have higher rates of prediabetes care (primary outcome) than patients in control clinic, comparing baseline and implementation periods
- To understand if there are factors associated with patients receiving higher rates of prediabetes care
  - Hypothesis: Patients with higher BMI and baseline glycemic level will be more likely to receive prediabetes care regardless of intervention assignment but rates will be higher in the intervention clinic

Systematic Intervention

HEALTH SYSTEM

Prioritizing diabetes prevention across the health system

CLINICIANS

Engaging clinicians through education, creating a standardized treatment algorithm and building clinical decision support tools

PATIENTS

Engaging patients through education and shared decision-making

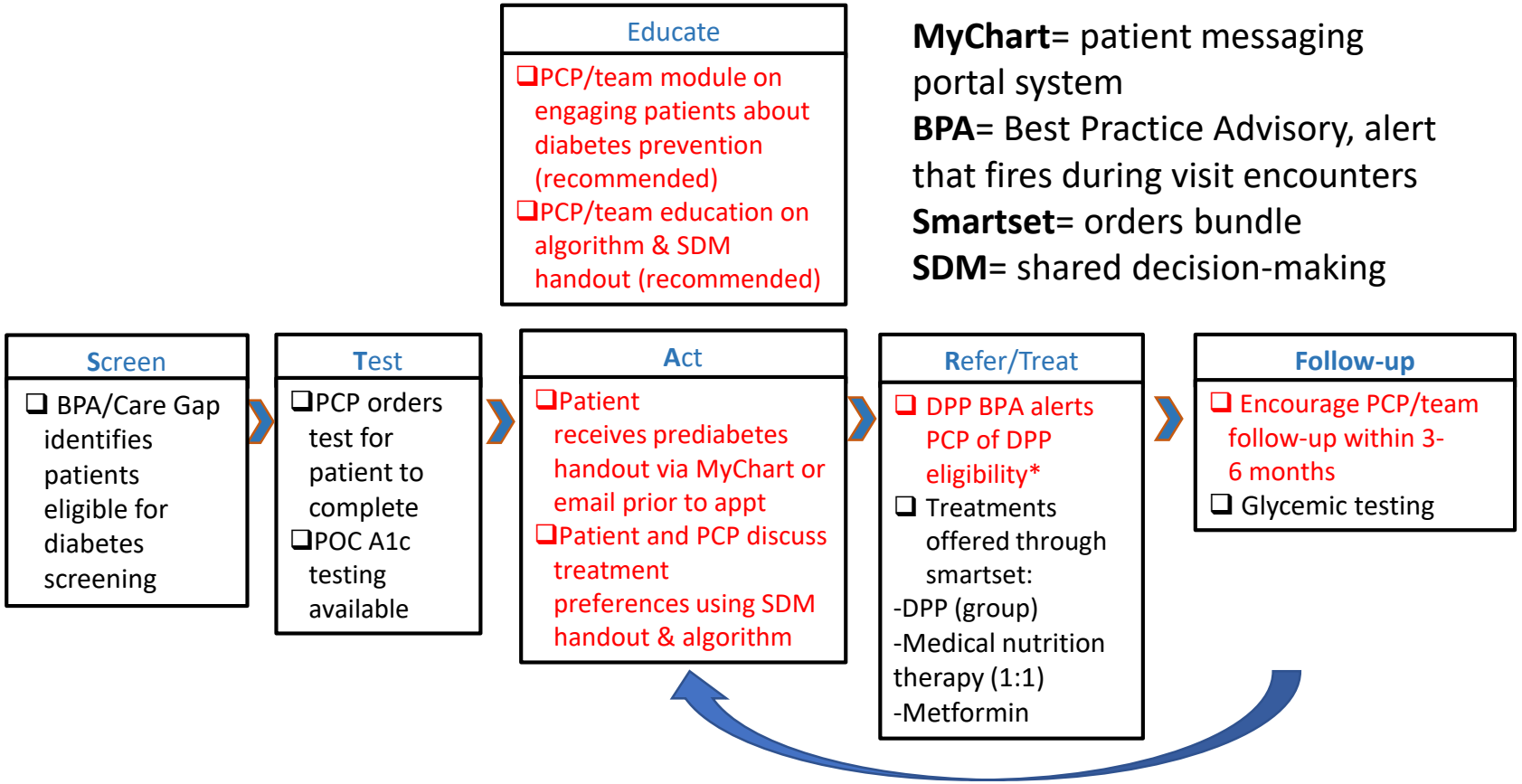
CLINICAL DECISION SUPPORT

Building tools for patients and clinicians to enhance education and promote evidence-based treatment

Intervention & Participants

- Intervention: START Diabetes Prevention Clinical Pathway (next slide)
- Intervention period: 12 months (May 2022- May 2023)
- Sites: academically affiliated clinics located outside of Baltimore; intervention and control clinics with similar patient demographics (~1200 patients with prediabetes seen yearly in each clinic)
- Participants:
  - Adult patients presenting for routine PCP visit
  - Have prediabetes or h/o prediabetes

START Diabetes Prevention Clinical Pathway

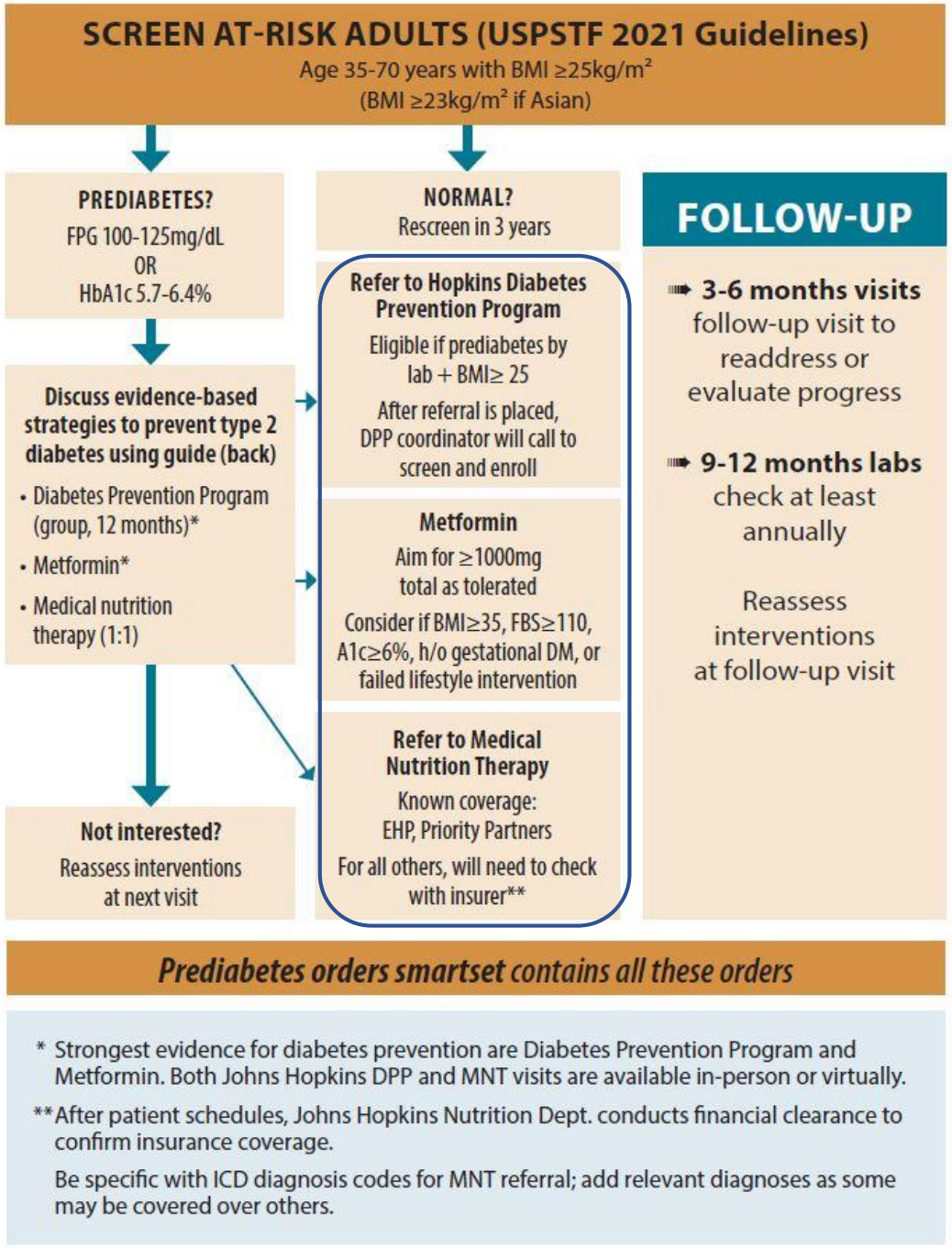


MyChart= patient messaging portal system
BPA= Best Practice Advisory, alert that fires during visit encounters
Smartset= orders bundle
SDM= shared decision-making

Control clinic does not have intervention components highlighted in red

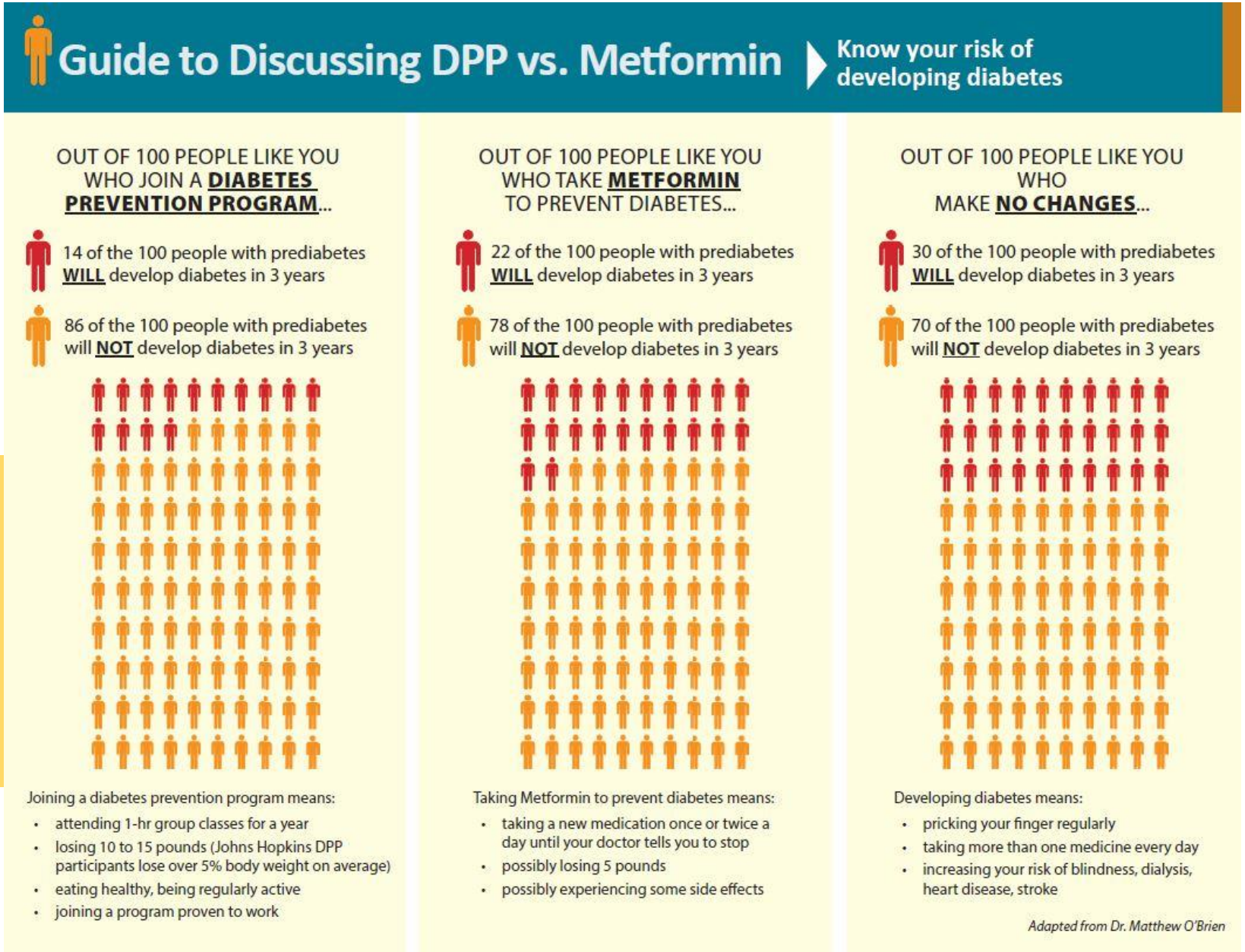
START Diabetes Prevention Strategy

Treatment algorithm based on evidence-based guidelines



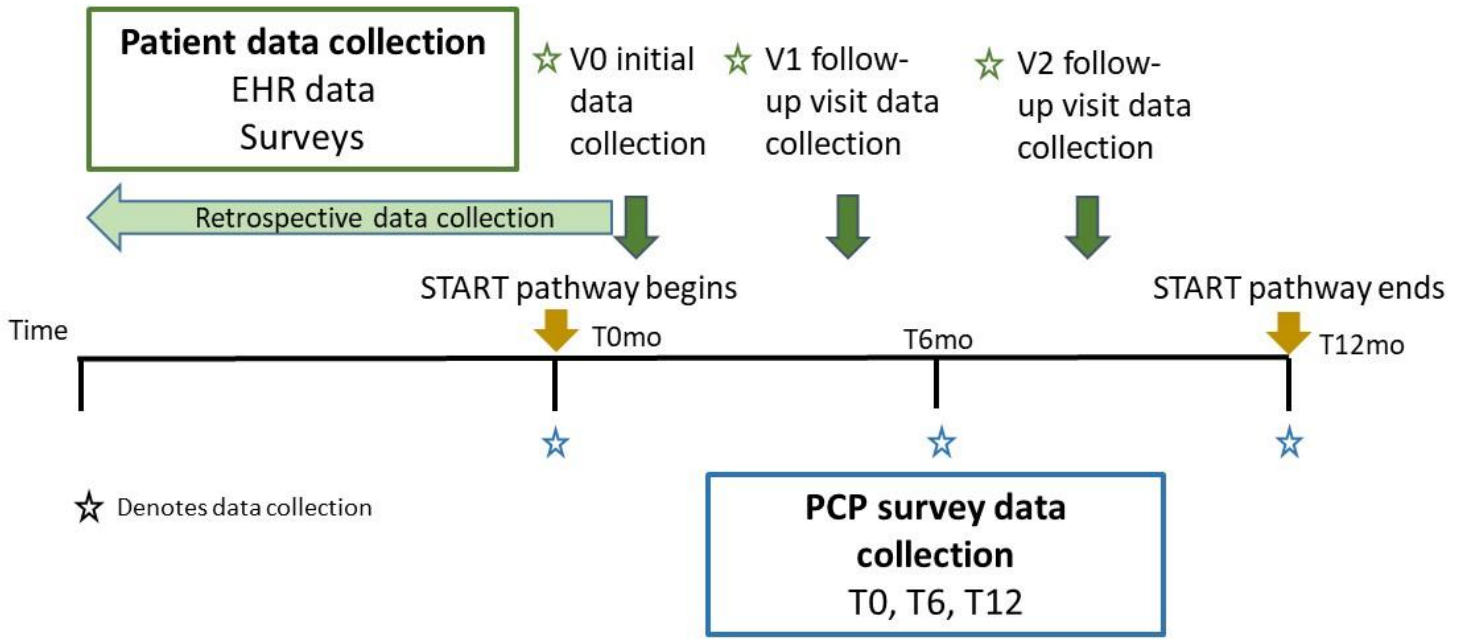
Decision Aid

Use a prediabetes decision aid to discuss treatment options with patients



Data Collection

- Patient REDCap surveys sent via email after each PCP visit
- Patient Epic data from primary care clinical database
- PCP REDCap surveys sent via email at baseline, 6 months, and 12 months



Outcomes

Primary	Secondary
• Referred to DPP within 30 days of visit • Referred to MNT within 30 days of visit • Prescribed metformin within 30 days of visit • Prediabetes diagnosis code at PCP visit	• DPP enrollment within 120 days • Attended MNT visit within 30 days of visit • PCP visit within 6 months from initial visit • Repeat A1c testing within 12 months • Weight loss ≥5%

Outcomes

Adoption	PCP Outcomes	Patient Outcomes
• PCP completion of CME module on diabetes prevention • MyChart messages read by patients	• Acceptability • Actionability • Adoption of intervention components	• Satisfaction with PCP discussion about prediabetes • Confidence & motivation to manage prediabetes • Engagement in lifestyle changes to address prediabetes

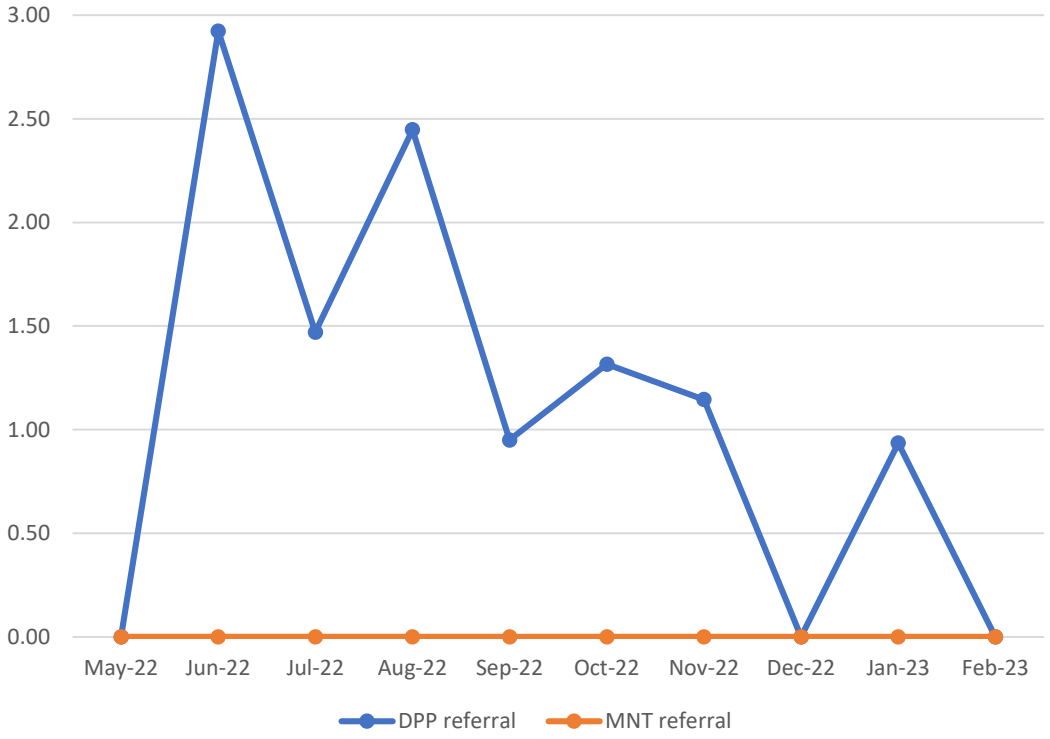
Analysis Plan

- Study Population Inclusion/Exclusion:
  - Adults age 18 and older, on prediabetes registry, last A1c <6.5% at time of initial PCP visit
  - Completed ≥1 PCP visit during 12-month intervention period and ≥1 PCP visit in 12-month baseline period.
- Descriptive analysis: baseline characteristics of patients, comparing intervention and control clinics
- Interrupted time series analysis: evaluate differences in trend of primary outcomes in baseline and implementation periods, comparing intervention and control clinics
- Multiple logistic regression analysis: determine the importance of hypothesized predictors of these primary outcomes adjusting for age, race, and baseline A1c

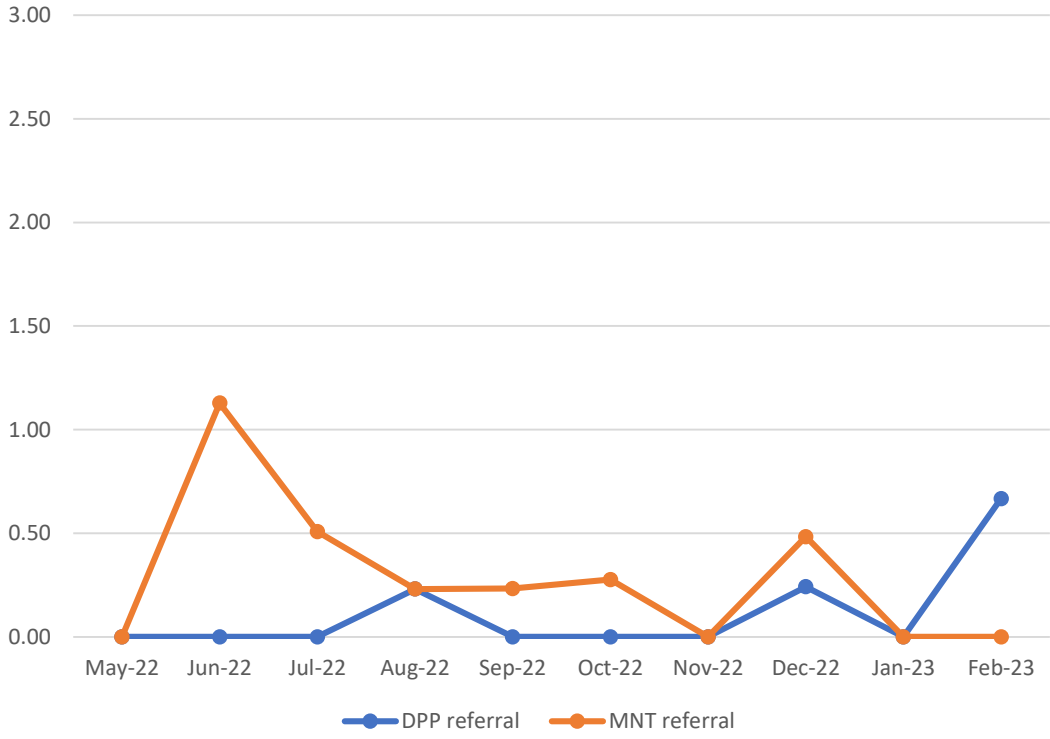
Preliminary Results: Referrals

DPP and MNT referrals per **50 eligible PCP visits**

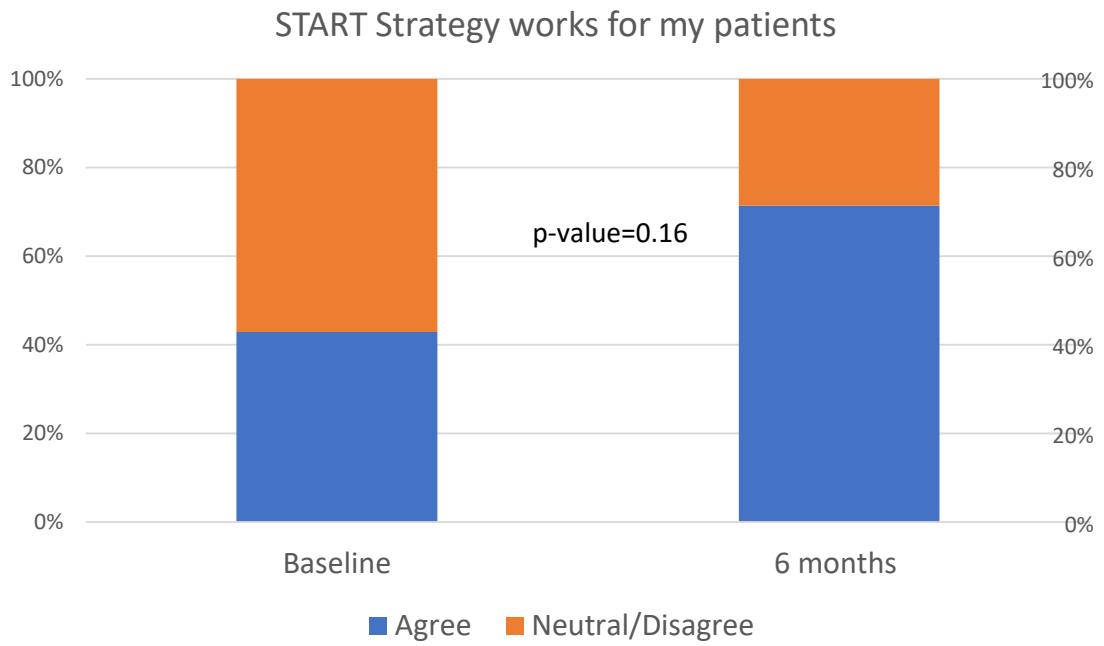
Intervention clinic

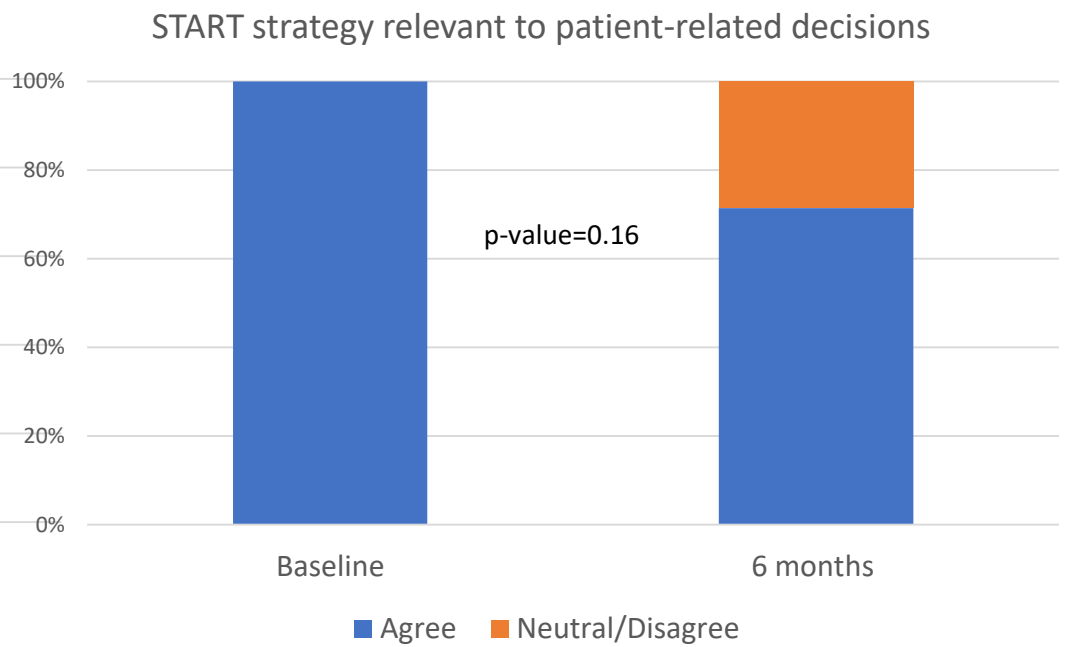


Control clinic



Preliminary Results:
PCP Survey in Intervention Clinic





Response rate at baseline 9/16 (56%)
Response rate at 6 months 13/18 (72%). N=2 PCPs joined clinic.

P-value is for McNemar test for paired data between baseline and 6 months (n=7).
Unpaired data not included

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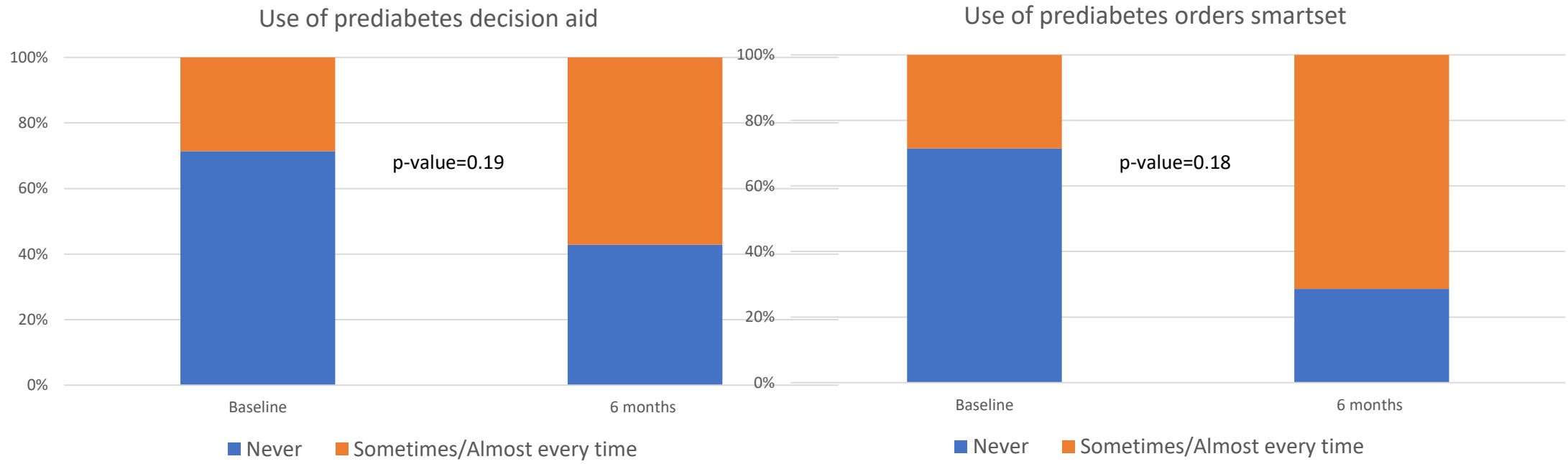

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Preliminary Results: Patient Survey

Mean weekly response rate:
5-31%
(mean=13%)

	Intervention clinic (n=192)		Control clinic (n= 154)	
	Yes	No	Yes	No
Have prediabetes?	128 (67)	64 (33)	98 (64)	56 (36)
Receive prediabetes handout prior to visit?	75 (39)	115 (61)	NA	NA
If yes, was it helpful?	63 (88)	9 (12)	NA	NA
Discuss prediabetes with PCP at recent visit?	122 (64)	69 (36)	71 (46)	82 (54)

Patients surveyed after each routine PCP visit. If ≥1 survey completed, only initial survey result included here. This was collected from 5/30/22-3/1/23

Preliminary Results: Patient Survey

	Intervention clinic (n=120)					Control clinic (n=70)				
	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly disagree	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
Understood what doctor was telling me about prediabetes	92 (76)	25 (21)	3 (2)	0	1 (1)	44 (63)	21 (30)	4 (6)	0	1 (1)
Felt my opinion was valued when talking about prediabetes	95 (79)	16 (13)	9 (7)	0	1 (1)	47 (68)	16 (23)	4 (6)	1 (1)	1 (1)
Discussed options and ways to address prediabetes	78 (64)	28 (23)	13 (11)	1 (1)	1 (1)	40 (57)	19 (27)	9 (13)	1 (1)	1 (1)
Felt my doctor's concern about prediabetes	88 (73)	21 (18)	10 (8)	0	1(0)	43 (61)	21 (30)	5 (7)	0	1 (1)

Patients surveyed after each routine PCP visit. If ≥1 survey completed, only initial survey result included here

Challenges

- IRB approval
- Epic access and challenges with sending patient materials via MyChart
- Setting up longitudinal data collection in REDCap
- PCP engagement & feedback
- Unable to utilize other clinical staff in intervention
- Patient survey response rate has been low despite calls and reminders

Future Directions

- Expand systematic intervention across health system and to other populations including underserved patients
- R03 grant (pending funding) to develop prediabetes digital patient activation tool
- Evaluate effectiveness of clinical decision support tools for diabetes prevention
- Understand if lower intensity interventions for prediabetes are effective

Acknowledgments

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- BEAD/PC-COE

Clinical

- GSS SOM General Internal Medicine Clinic
- GSS JHCP Internal Medicine

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SCHOOL of MEDICINE

Thank You!

Questions? Please email me at etseng3@jhmi.edu!

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