



A Collaborative Network of Effectiveness Studies of
Population-Targeted Policies for Diabetes Prevention and
Control

Does a Disease-Specific Health Insurance Plan Lead to Better Health Outcomes?

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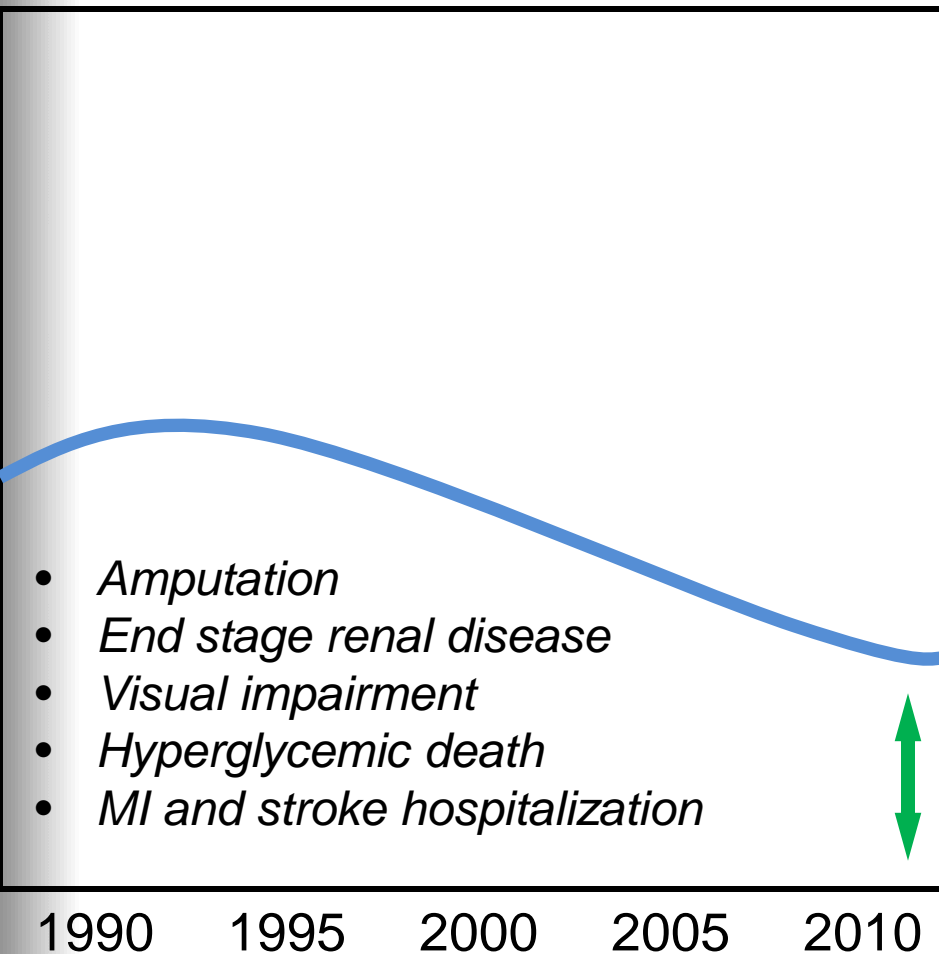
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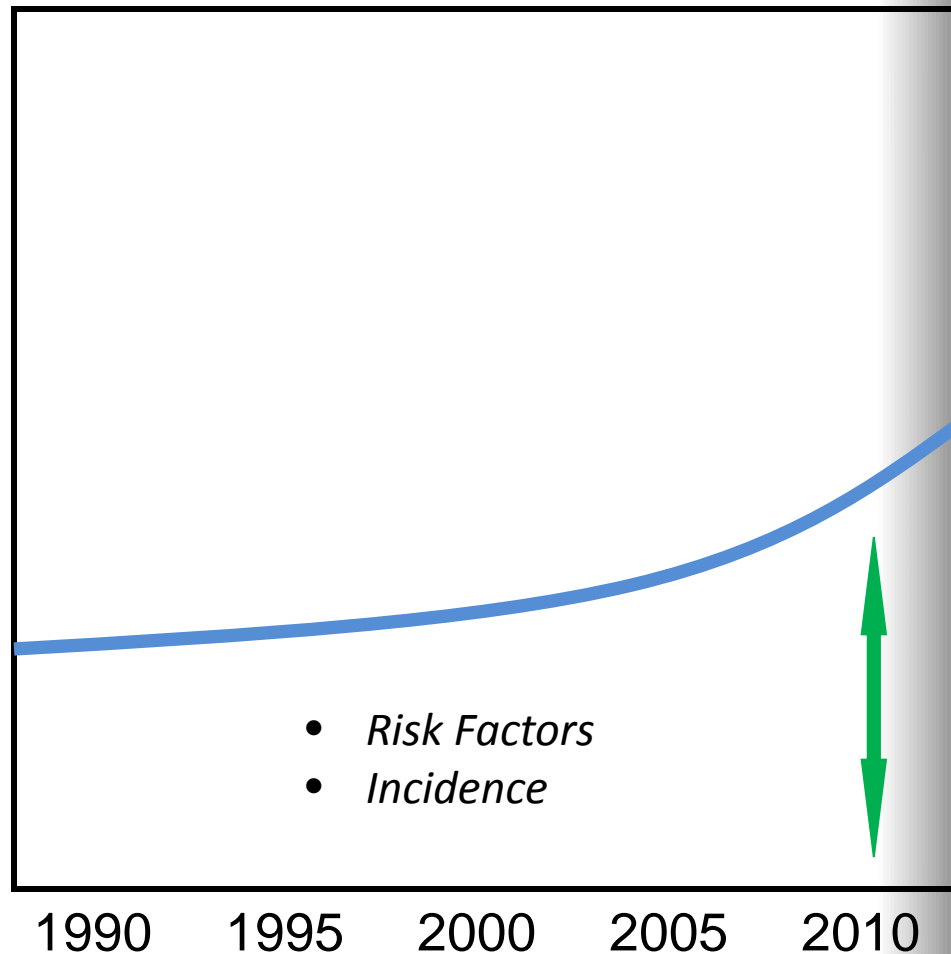
Disclosure

No conflicts of interest to disclose

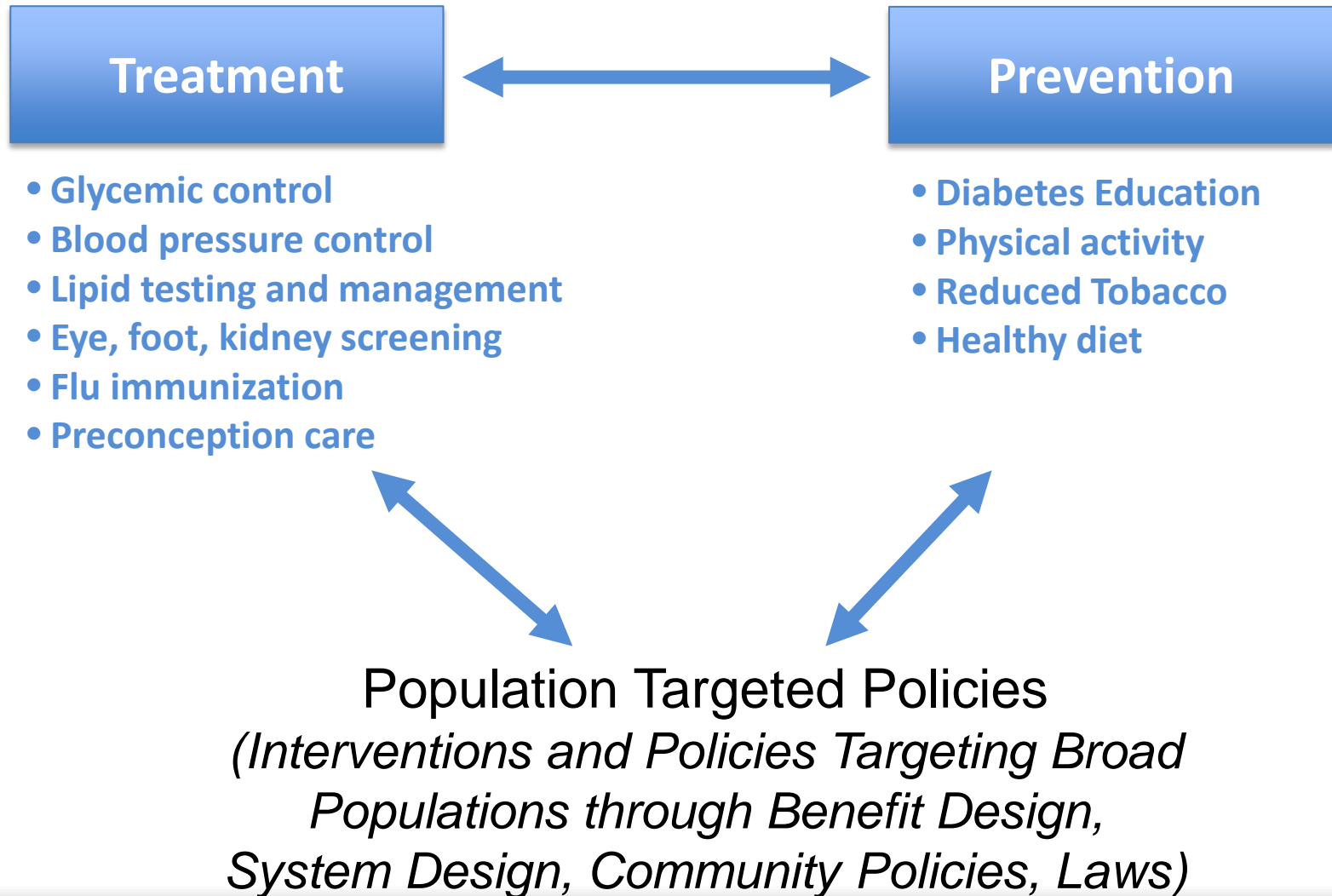
Excess Risk of Complications in the Diabetic Population



Risk of Diabetes in the General Population



Science Base Underlying Classic Levers in the Public Health Response to Diabetes



Overarching Objectives for Natural Experiments for Translation in Diabetes (NEXT-D)

Develop a multi-center research network to test effectiveness of population-targeted health policies on diabetes prevention, control and health inequalities

Provide policy makers with a clear prioritization of policy level “best practices” that can be implemented by health plans, communities, legislatures or governments

NEXT-D Network Participants

- **Harvard** – Impact of High Deductible Health Plans on diabetes care
- **Northwestern** – Evaluation of the DPP YMCA Program
- **St. Lukes / Columbia** – Evaluation of an enhanced EHR
- **Kaiser Permanente** – Evaluation of a series of health plan care management approaches
- **UCLA** – Evaluation of the Diabetes Health Plan

Diabetes Health Plan (DHP)

- Enhanced benefit design for patients with diabetes or pre-diabetes
 - Decreased out of pocket costs for medications and preventive care
 - Health Promotion
 - Compliance features
 - Can be customized by the employer group
- Available for purchase from UHC since 2009
 - Unique opportunity to conduct a rigorous evaluation of this real world intervention

Feature	DHP	Standard Plan
Primary Care Visit Copays	\$0	\$20
Rx Copays	\$0	\$5-15
Lab Tests	Covered	Covered



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PREVENTING CHRONIC DISEASE

PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY

SPECIAL TOPIC

Volume 10 — January 31, 2013

Evaluation of the Diabetes Health Plan to Improve Diabetes Care and Prevention

O. Kenrik Duru, MD, MSHS; Carol M. Mangione, MD, MSPH; Charles Chan, MS; Abigail Keckhafer, MBA, MPH; Lindsay Kimbro, MPP; K. Anya Kirvan, RN, MS; Norman Turk, MS; Robert Luchs, MS; Jinnan Li, MPH; Susan Ettner, PhD

1. DHP and the Transition to Diabetes

2. Use of Metformin in Diabetes Prevention

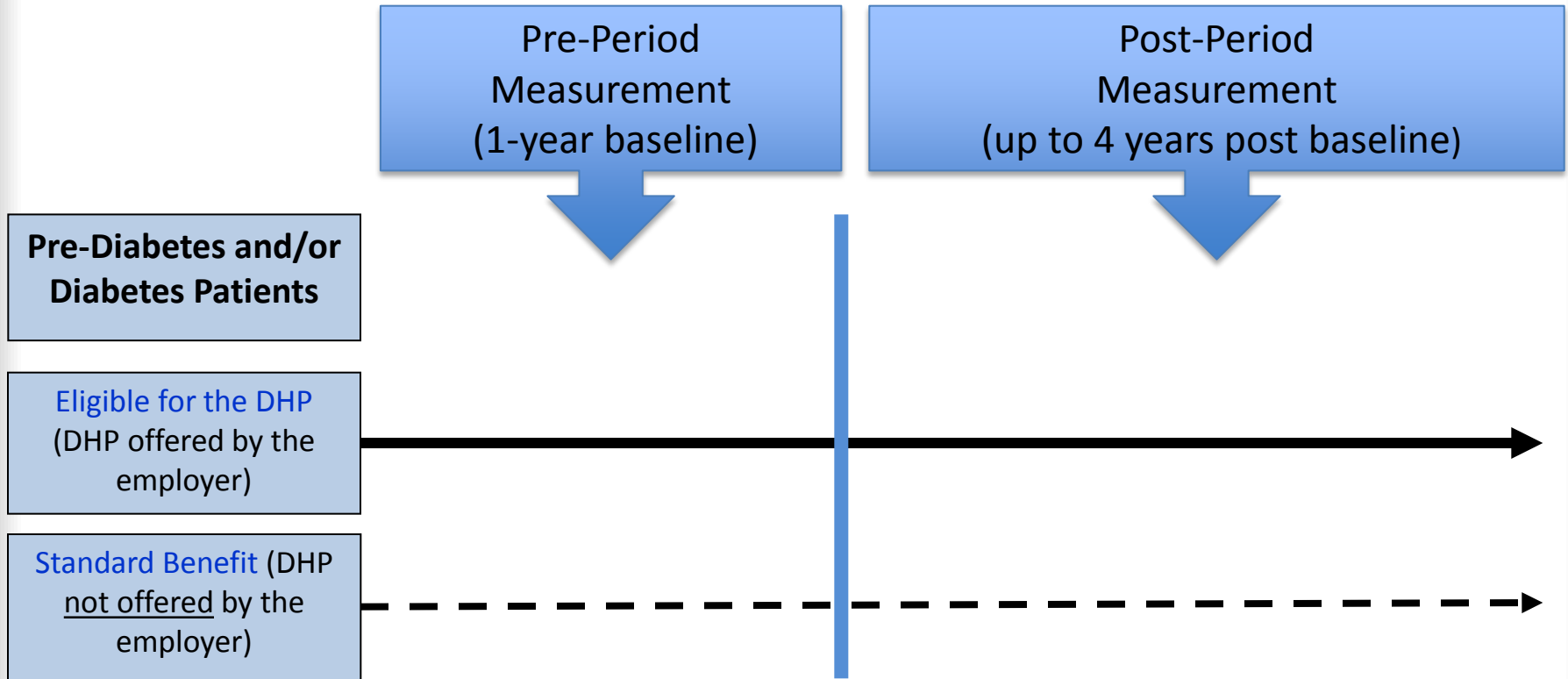
3. DHP and Medication Adherence

4. DHP and ER/Inpatient Utilization

Prevention

Treatment

Quasi-Experimental Study Design



We included all patients eligible for the DHP in all analyses, in order to approximate the impact in a “real-world” situation, with varying and incomplete take-up of the plan

Most of our models used the employer as the unit of analysis, and we used employer-level propensity score methods to facilitate the most appropriate comparisons

DHP and the Transition to Diabetes

Manuscript under review

2015 Oral Presentations

American Diabetes Association (ADA)

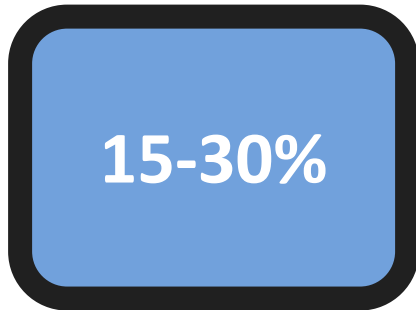
NIH Science of Dissemination & Implementation

Abstracts

**Results from NEXT-D: Does a Disease Specific Health Plan
Reduce Incident Diabetes Development among a National
Sample of Working-Age Adults with Prediabetes?**



1 in 3 US adults has prediabetes

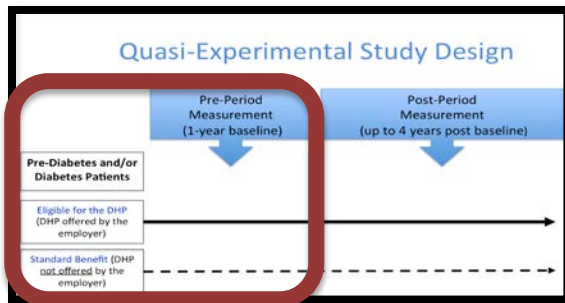


Percentage of adults who will transition to diabetes in 5 years

-
- Prediabetes = important public health concern
 - Diabetes prevention = critical goal to help improve public health and well-being

DHP and the Transition to Diabetes

- Retrospective, intent-to-treat analysis using a 4 year continuous study window



Group	Pre-period	1 Year Post	2 Years Post	3 Years Post
DHP	12 months pre-DHP	12 months post-DHP	24 months post-DHP	36 months post-DHP
Control	2010	2011	2012	2013

- Employer-level propensity model to identify comparable controls
 - Included employer size, salary, age, % female, race/ethnicity, % chronic condition, % prediabetes, region, % high deductible, generosity of benefit, and a health plan risk score

DHP and the Transition to Diabetes

- Primary outcome = diabetes diagnosis over 3-year follow-up among those with prediabetes
- Primary predictor = DHP employer group
- We used multiple imputation for missing demographic and lab data

Diagnostic Criteria	Prediabetes
ICD codes	≥ 2 790.2x from inpatient or outpatient
Lab data	A1c 5.7-6.4% OR FPG 100-125 mg/dL OR 2 hour OGTT 140-199 mg/dL

	Diabetes
ICD codes	250.xx from inpatient or outpatient
Lab data	A1c $\geq 6.5\%$ OR FPG ≥ 126 mg/dL OR 2 hour OGTT ≥ 200 mg/dL
Rx claims	≥ 1 Rx for insulin or oral glycemic agent (other than metformin)

Selected Baseline Characteristics	DHP N=1,538 From 9 Employer Groups	Control N=10,427 From 105 Employer Groups	P Value
Female	54%	44%	<.001
Age	51 (8.7)	50 (8.8)	<.001
Race/ethnicity			<.001
White	72%	71%	
Hispanic	15%	16%	
AA	10%	7%	
Asian	2%	5%	
Other	<1%	<1%	
Education			<.001
HS or Less	38%	31%	
Some College	55%	52%	
Bachelors or Above	7%	17%	
Income			<.001
Under 30K	6%	5%	
30-49K	24%	18%	
50-74K	29%	30%	
≥79K	41%	47%	

No significant differences in baseline A1c, obesity and mental health diagnoses

Main Results

Baseline Characteristic		Predicted Probability	Absolute Difference	P-value
DHP Status	Non-DHP	.367		
	DHP	.291	-7.6%	<.001

Adjusted for the following variables: gender, age, race/ethnicity, education, income, baseline prediabetes severity, baseline lab count (A1c/FPG/OGTT), obesity, and mental health comorbidity

Adjusted Results with Imputation

Selected Baseline Characteristic		Predicted Probability	Absolute Difference from Reference	P-value
Age	19-34*	.288		
	35-44	.325	+3.7%	.084
	45-54	.367	+7.9%	<.001
	55-62	.375	+8.7%	<.001
Baseline Prediabetes Severity	Low* (A1c 5.7-5.9% OR FPG 100-109 mg/dL)	.288		
	High (A1c 6.0-6.4%OR FPG 110-125 mg/dL)	.504	+21.6%	<.001
	ICD-9/OGTT	.358	+7.0%	.313
ICD-9 Obesity	No*	.348		
	Yes	.474	+12.6%	<.001

*=Reference. Baseline labs: ≥ 1 associated with significant decrease in predicted probability compared to baseline prediabetes diagnosis with ICD. The following variables were non-significant: gender, race/ethnicity, education, income, and mental health comorbidity.

Conclusions

- Our analysis showed the risk of progression from prediabetes to diabetes was significantly lower for those in DHP employer groups
- Benefit designs that reduce cost sharing for preventive care, lifestyle modifications and metformin for those with prediabetes may prevent or delay diabetes onset

Metformin Use for Diabetes Prevention

ORIGINAL RESEARCH

Annals of Internal Medicine

Metformin Prescription for Insured Adults With Prediabetes From 2010 to 2012

A Retrospective Cohort Study

Tannaz Moin, MD, MBA, MSHS; Jinnan Li, MPH; O. Kenrik Duru, MD, MSHS; Susan Ettner, PhD; Norman Turk, MS; Abigail Keckhafer, MBA, MPH; Sam Ho, MD; and Carol M. Mangione, MD, MSPH

Metformin Use For Diabetes Prevention

- 2002: the Diabetes Prevention Program (DPP) study showed that both metformin and lifestyle interventions can delay or prevent incident diabetes
- 2008: ADA diabetes care guidelines added the use of metformin to prevent diabetes
- Long term safety, tolerability and cost-effectiveness have been demonstrated
- Little was known about uptake and translation in the “real world”

Specific Aims

- Characterize rates of metformin use among insured, working age adults with prediabetes
- Test the association between patient characteristics and predicted probability of metformin use among those with prediabetes

Methods

- A retrospective analysis of administrative claims between 2009-2012
- Patients with prediabetes diagnosis in 2010

Diagnostic Criteria	Prediabetes
ICD codes	≥2 790.2x from inpatient or outpatient
Lab data	A1c 5.7-6.4% OR FPG 100-125 mg/dL OR 2 hour OGTT 140-199 mg/dL

- Excluded patients with polycystic ovarian syndrome, diabetes, gestational diabetes

Published Results for All Groups (DHP + Control)

- Data from 17,352 working age, insured adults with pre-diabetes

Rate of Metformin Use	Patients with Prediabetes N=17352
Any Metformin Prescription Between in 2010-2012	3.7% (n=647)

Results

- Overall rate of any metformin use across a pooled sample was only 3.7% over 3 years
- Among the 647 patients with any metformin Rx, we examined the predicted probabilities of use over 3-year study window

Predicted Probability of Metformin Prescription		
<u>Gender</u>		
Male*	2.8%	
Female	4.8%	<0.001
<u>BMI>30 kg/m²</u>		
No*	3.5%	
Yes	6.6%	<0.001
<u>Race</u>		
White*	3.8%	
Hispanic	3.8%	0.94
Black	2.9%	0.06
Asian	3.2%	0.36
Other	8.2%	0.089
<u>Co-morbidities</u>		
0*	2.8%	
1	3.4%	0.119
2	4.2%	0.001
≥3	4.9%	<0.001

*Reference group. Other covariates included age, household income, and education level.

Conclusions

- Metformin is rarely used in the management of prediabetes, despite a strong evidence from RCTs supporting its use for over 10 years
 - Barriers may include lack of FDA approval for this indication
- Women, obese individuals and those with a higher number of comorbidities are more likely to use metformin

DHP and Medication Adherence

Adherence to Metformin, Statins, and ACE/ARBs Within the Diabetes Health Plan (DHP)

O. Kenrik Duru, MD, MSHS¹, Norman Turk, MS¹, Susan L. Ettner, PhD^{1,2}, Romain Neugebauer, PhD³, Tannaz Moin, MD, MBA, MSHS^{4,5}, Jinnan Li, MPH¹, Lindsay Kimbro, MPP¹, Charles Chan, MS⁶, Robert H. Luchs, MS⁶, Abigail M. Keckhafer, MBA, MPH⁶, Anya Kirvan, RN, MS⁶, Sam Ho, MD⁶, and Carol M. Mangione, MD, MSPH^{1,2}

Duru OK, Turk N, Ettner SL, et al. J Gen Intern Med. 2015;30(11):1645-50

Why Medication Adherence among Patients with Diabetes is Critically Important

- Glycemic control
 - Decrease in A1c (e.g., 8%→7%) reduces microvascular complications by 25%
- Blood pressure control
 - 10-point drop in SBP reduces diabetes complications by ~ 24% over 8 years, but this benefit disappears if BP control not maintained
- Lipid control
 - Use of statins reduces CVD complications in patients with diabetes who have existing CHD or additional risk factors

UKPDS 33, Lancet 1998; UKPDS 38, BMJ 1998; Holman et. al., NEJM 2008;
Emdin et. al, JAMA 2015; Colhoun et. al., Lancet 2004.

Specific Aim

Determine the effect of employer purchase of the DHP on adherence to several classes of medications, including:

- 1) metformin, 2) statins, and 3) ACE/ARBs

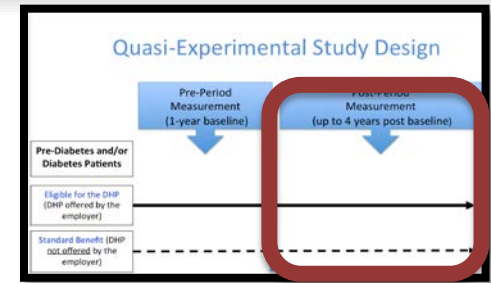
Why an Employer-Level Analysis?

- Policy level implications = employers decide whether to purchase the DHP and offer it to their employees
- Analogue to an “intent-to-treat” design

Methods

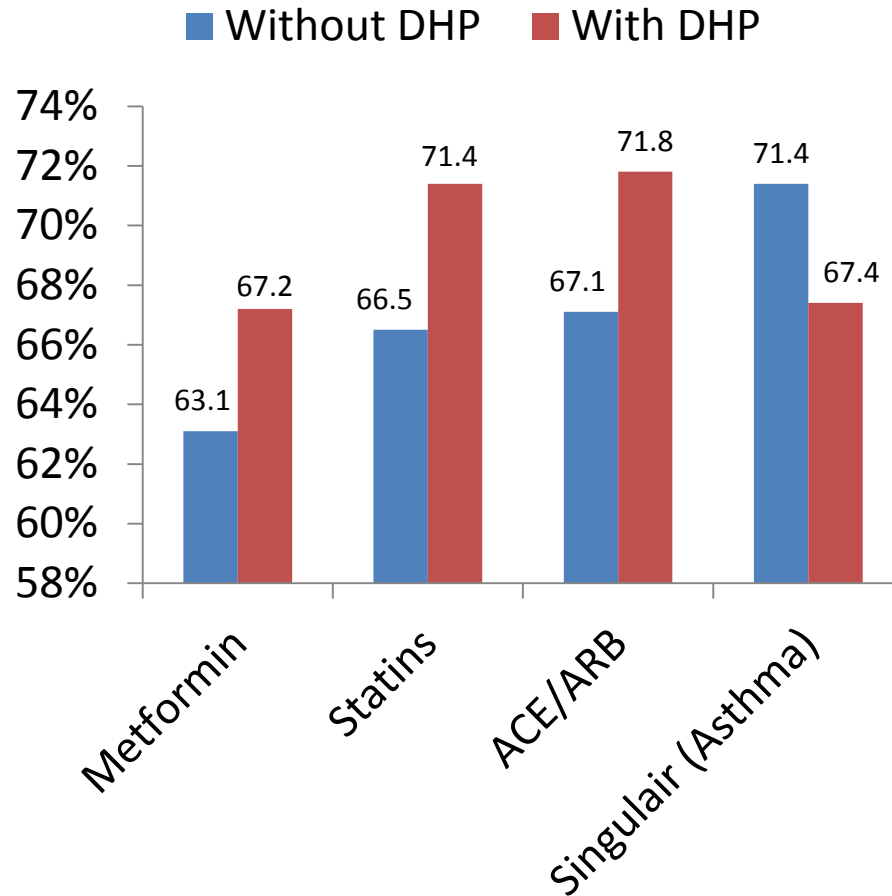
- Employer-level propensity model to identify control employer groups most comparable to DHP employer groups
- Claims-based measure (Proportion of Days' Covered/PDC) to assess employer-level adherence among all diabetes patients over 9 month period
- Inverse probability weighting to determine Average Treatment Effect on the Treated (ATET)

Methods



- Average Effect of the Treatment on the Treated (ATET)
 - Difference in predicted adherence among employer groups who purchased the DHP and the predicted rates had they not purchased the DHP
 - Treatment = employer group purchasing DHP
 - Difference = predicted rates with purchase of DHP compared to predicted rates had those same groups not purchased the DHP

Adherence to Metformin, Statins, and ACE/ARBs Within the DHP



Change in adherence significant for ONLY the 3 DHP-covered medications (all $p < 0.02$)

Conclusion

- We found differences of 4-5 percentage points in medication adherence at the employer-level, attributable to DHP purchase
- The combination of free and reduced cost medications as provided in the DHP may be a promising approach to improve adherence among patients with diabetes

DHP and Emergency Room (ER)/Inpatient Utilization

Manuscript under review

Oral presentation - 2014 ADA and DNI

MEETING ABSTRACT

Open Access

The association of a diabetes-specific health plan with ER and inpatient hospital utilization: a natural experiment for translation in diabetes (NEXT-D)

Tannaz Moin^{1,2,*}, W Neil Steers³, Susan L Ettner^{3,4}, O Kenrik Duru³, Norman Turk³, Romain Neugebauer⁵, Charles Chan⁶, Robert H Luchs⁶, Sam Ho⁶, Carol M Mangione^{3,4}

*From 7th Annual Conference on the Science of Dissemination and Implementation in Health
North Bethesda, MD, USA. 8-9 December 2014*

- Why focus on ER and hospital utilization?
 - About 26% of all hospital days and 12% of all emergency room (ER) visits are incurred by patients with diabetes

Specific Aim

Compare annual adjusted rates of ER and hospital use for employers who purchased the DHP with rates for those same employers had they not purchased the DHP

Methods

- Employer-level propensity score match
- Examined data from 3 continuous years
 - All employees 19-63 years of age with DM or pre-diabetes (ICD codes, labs or Rx claims)
 - Outcome variables of interest: proportion of employees with any ER visit or hospitalization
- Again, we used inverse probability weighting to determine Average Treatment Effect on the Treated (ATET)

Inverse Probability Weighted Differences in Mean Rates of Any ER Use for DHP Employers

Time	Predicted ER Use Without DHP	Predicted ER Use <u>With</u> DHP	Absolute Difference	Relative Difference	P value
1-year post	18.9%	16.5%	-2.4 percentage points	13% Reduction	0.012
2-years post	18.9%	17.1%	-1.8 percentage points	10% Reduction	0.046

Weighted for the following employer-level variables in a propensity model: Mean employee age, % female, race/ethnicity (% white, % Hispanic, % African American, % Asian, % other race), % with diabetes or pre-diabetes, mean income, UHC estimated medical cost risk score, geographic region, number of employees, % of employees with a high deductible health plan, overall generosity of benefit, % with chronic comorbidities, baseline utilization measure.

Inverse Probability Weighted Differences in Mean Rates of Any Inpatient Hospital Use for DHP Employers

Time	Predicted Hospital Use Without DHP	Predicted Hospital Use <u>With</u> DHP	Absolute Difference	Relative Difference	P value
1-year post	10.3%	10.0%	-0.3 percentage points	3% Reduction	0.737
2-years post	10.9%	10.7%	-0.2 percentage points	2% Reduction	0.803

Weighted for the following employer-level variables in a propensity model: Mean employee age, % female, race/ethnicity (% white, % Hispanic, % African American, % Asian, % other race), % with diabetes or pre-diabetes, mean income, UHC estimated medical cost risk score, geographic region, number of employees, % of employees with a high deductible health plan, overall generosity of benefit, % with chronic co-morbidities, baseline utilization measure.

Summary

- Our analysis showed a statistically significant reduction in the adjusted mean rates of any ER utilization at 1 and 2 years post-DHP
- We found no evidence of any significant impact of DHP on inpatient hospital utilization at 1 and 2 years post-DHP

Summary of DHP Evaluation

- The Diabetes Health Plan is associated with improvements in several outcomes
 - Patients with prediabetes show decreased progression to diabetes
 - Patients with diabetes have better adherence to treatment
 - Lower use of ER services

Summary of DHP Evaluation

- However, measures such as the very low use of metformin for diabetes prevention indicate room for improvement
- Results from this project have directly influenced policy within UnitedHealthcare, such as:
 - Enrollment strategies
 - Efforts to incentivize the use of metformin in diabetes prevention

Implications

- Condition-specific health plans may enable focused care delivery & better results for high-risk populations
- More studies are needed to better understand impacts over longer-term
 - 10 year follow-up?
 - Cost analyses currently underway

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NExT^D

Natural Experiments for Translation in Diabetes Study



National Institute of
Diabetes and Digestive
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