Is Knowing Half the Battle? Behavioral Responses to Risk Information from the National Health Screening Program in Korea

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Introduction

- Health behavior is an important determinant for health, especially in industrialized countries (Cawley and Ruhm, 2012).
- World Health Organization (2009) identifies that the leading causes of mortality and morbidity in high income countries are modifiable risk factors.
  - Tobacco use, overweight and obesity, physical inactivity, high blood pressure, high blood glucose, high cholesterol, low fruit and vegetable intake, and alcohol use
- However, people often resist engaging in healthy behaviors.

Introduction

- The purpose of health screening is to detect diseases early and provide information on the risk of diseases.
  - For lifestyle diseases, the motivation for addressing the lack of risk information is that such knowledge would promote desirable health behaviors.
- In this paper, we study whether risk information can promote healthy behaviors, and thereby improve health status in the context of the large scale population-based screening program in Korea.

Introduction

Question: **Can risk information from health screening change behaviors and health outcomes?**

- Risk classification for many diseases vary discontinuously at cutoffs that are arbitrary.
  - Patients just below and just above a cutoff share otherwise similar characteristics

- Regression discontinuity (RD) design at these cutoffs.
  - **Running variables: fasting blood sugar, BMI, and LDL cholesterol**

Literature review

- Literature on how risk information or disease diagnosis affects health and health behaviors.

- Our study is closest to papers that employ a RD design based on diagnosis or risk classification thresholds.
  - Hypertension diagnosis in China (Zhao et al., 2013)
  - Very low birth weight classification for newborns (Almond et al., 2010)
  - Overweight classification in New York City public school students (Almond et al., 2016)

- Many papers use a suboptimal or no control group to estimate the relative behavior changes of patients after a disease diagnosis (e.g., Oster, 2015; Slade, 2012; Kersaw et al., 2004; Newsom et al., 2011).

Contribution of the paper

1. Implement quasi-experimental regression discontinuity design which allows us to control for confounding factors.
2. Provide evidence of the impact of screening on outcomes at a population level using administrative data.
3. Comprehensively study the impact of risk information by
   - multiple running variables
   - a wide range of outcome variables including biomarkers over multiple years

Summary of results

- We find evidence of weight loss around the high risk threshold for diabetes
  - where risk information is combined with prompting for a secondary examination and medical treatment.
- However, we do not find differences around other risk classification thresholds
  - where risk information is not combined with prompting for additional medical treatment.
- Our results suggest that that an important avenue for future research is to assess the extent to which further intervention increase the marginal benefit of risk classification information.

Outline

Outline

Institutional details

- The National Health Screening Program (NHSP) in Korea provides free general health screening every two years to the entire population aged 40 and over since 1995.
  - Consists of various tests for health screening including diabetes, obesity, and high cholesterol
  - Before screening, a survey is conducted of the screening participants' health-related behaviors
  - A screening report is sent to the household by regular mail within 2 weeks after screening
  - Secondary examination and counseling is offered to patients who are determined as high risk for diabetes (and hypertension)
  - Eligible once a year for blue-collar workers

Institutional details

- We use 2% random sample of the population from the National Health Insurance administrative data, which includes more than 350,000 baseline screening participants observed from 2009-2013.
- We focus on obesity (BMI, waist), diabetes (blood sugar), and hyperlipidemia (LDL cholesterol).
- We evaluate the impact of risk information on
  - Biomarkers: BMI, waist circumference, blood sugar, LDL cholesterol
  - Health-related behaviors: future screening participation, exercise, drinking, smoking
  - Disease-specific prescription medications

Institutional details

- Screening report consists of two pages

1. General test results: provides reference ranges for Normal A (Satisfactory) and Normal B (Warning)
2. Health traffic light report: visualizes the degree of risk with different colors for selected risk factors – low risk (green), medium risk (yellow) and high risk (red)

1st page

Results of Regular Medical Checkup (1st)

Name	XXXXX	Resident registration number	XXXXX
Date of examination	July 14, 2009	Health checkup institution	☑ Visit, ☐ On-site checkup

Test type / Section						Reference range	
Medical history	Diagnosis	N/A			External wound or Sequela	N/A	
	Medication	N/A					
Lifestyle					General status	Good	
Targeting diseases		Examination item	Examination result			Normal A (Satisfactory)	Normal B (Warning) (need preventive care, but no problem in health)
Measuring examination	Obesity	Height	**178**	cm			
		Weight	**75**	kg			
		Waist circumference	**84**	cm		Male: under 90 Female: under85	-
		Body Mass Index (BMI)	**23.6**	kg/m^2		18.5-24.9	-
	Optic acuity	Eyesight (left/right)	**1.2 / 1.2**				
	Auditory acuity	Hearing ability (left/right)	**Normal / Normal**				
	Hypertension	Blood pressure (Systolic/ diastolic)	**114 / 65**	mmHg		under 120 / under 80	120-139 / 80-89
Urine test	Kidney disease	Albuminuria	**Negative (-)**			Negative	Weak benign ±
Blood test	Anemia, etc.	Hemoglobin	**14.5**	g/dL		Male: 13-16.5 Female: 12-15.5	Male: 12-12.9 / 16.6-17.5 Female: 10-11.9 / 15.6-16.5
	Diabetes	Fasting blood sugar	**120**	mg/dL		under 100	100-125
	High cholesterol, Hypertension, Arteriosclerosis	Total Cholesterol	**152**	mg/dL		under 200	200-239
		HDL-Cholesterol	**52**	mg/dL		60 and over	40-59
		Triglyceride	**32**	mg/dL		under 100-150	150-199
		LDL-Cholesterol	**94**	mg/dL		under 100	100-159
	Chronic kidney disease	Creatinine	**0.8**	mg/dL		1.5 and below	-
		Glomerular filtration rate	**114**	mL/min		60 and over	-
	Liver disease	AST (SGOT)	**24**	U/L		40 and below	41-50
		ALT (SGPT)	**20**	U/L		35 and below	36-45
		Gamma-GTP	**30**	U/L		Male: 11-63 Female: 8-35	Male: 64-77 Female: 36-45
Radio-exam	TB, chest disease	Chest radiology examination	**Normal**			Normal, unactive	-
Prescription							

Determination	**Normal B: Diabetes**	Date of determination		July 18, 2009
		Examined Doctor	License number	XXXXX
			Name	XXXXX (signature)

※ If you are determined as hypertension or diabetes suspected within, it is recommended to take the 2nd medical checkup within **30 days** (until next January**)** from the date of this notification.

2nd page

Knowing your health risk factors

	Current Staus	Targeting Status	Health traffic light		
			Low-risk	Medium-risk	High-risk
Obesity (Weight/ Waist circumference)	Obese/ Abdominal obese (75kg/ 84cm)	Normal weight/ waist circum. (53-66kg/ 90cm)		■	
Alcohol consumption	Healthy drinking	Less than 2 glasses per day	■		
Smoking	Smoker	Quit smoking			■
Exercise	Insufficient	Sufficient exercise			■
Blood pressure (mmHg)	114/65	Less than 120/80	■		
Blood sugar level (mg/dL)	120	Less than 100		■	
LDL cholesterol (mmHg)	94	Less than 130 (Less than 100 if diabetes)	■		

Above evaluation presents both your current status and the targeting status based on your behavioral survey and screening results.
If you received medium-risk or high-risk appraisal, much effort is needed to improve your status.

Table: Risk classification rules of the health traffic light report

		Low risk	Medium risk	High risk
BMI (kg/m^2)	No abdominal obesity	18.5-22.9	23.0-29.9 or <18.5	≥ 30.0
	Abdominal obesity		<25.0	≥ 25.0
Fasting blood sugar (mg/dL)	Taking medication		<130	≥ 130
	No medication	<100	100-125	≥ 126
LDL cholesterol (mg/dL)	Taking medication		<130 if diabetes, <100	≥ 130 if diabetes, ≥ 100
	No medication	<130 if diabetes, <100	130-159	≥ 160 if diabetes, ≥ 100

Note: Abdominal obese if waist circumference is at or above 85cm for women and 90cm for men, and not abdominal obese otherwise.

Table: Running variables, samples, cutoffs and risk information

Running variables	Samples	Cutoffs	Risk information: Treatment group (at or just above cutoff)	Risk information: Control group (just below cutoff)
Fasting blood sugar (mg/dL)	No self-reported diabetes	100	Normal B Medium risk 🟨	Normal A Low risk 🟩
		126	Disease suspected High risk 🟥 *Invited to secondary examination/ counseling	Normal B Medium risk 🟨
BMI (kg/m^2)	No abdominal obesity	23	Normal A Medium risk 🟨	Normal A Low risk 🟩
	Abdominal obesity	25	Disease suspected High risk 🟥	Normal A Medium risk 🟨
LDL cholesterol (mg/dL)	No self-reported high cholesterol	160	Disease suspected High risk 🟥	Normal B Medium risk 🟨

Data

- Nationally representative 2% random sample of the population from the administrative data from 2009 to 2013
- Baseline screening: 2009-2010
- Short-run outcomes: **one** or two years after the baseline
- Long-run outcomes: **three** or four years after the baseline

Baseline summary statistics

Variables (N=352,896)	Mean	Std. Dev.
Male	0.51	0.50
Age	48.47	14.23
Employee insurance	0.76	0.42
BMI (kg/m^2)	23.71	3.24
Height (cm)	163.29	9.23
Weight (kg)	63.46	11.58
Waist circumference (cm)	80.21	9.17
Blood sugar (mg/dL)	97.79	24.18
LDL Cholesterol (mg/dL)	114.19	39.01
Exercise METs (min/week)	552.68	559.14
Number of drinks per week	6.90	13.85
Number of days of obesity medication	0.01	1.22
Number of days of diabetes medication	18.05	75.79
Number of days of high cholesterol medication	15.39	61.27
Round 2 screening participation (after 1 or 2 yrs)	0.75	0.43
Round 3 screening participation (after 3 or 4 yrs)	0.52	0.50

Outline

Empirical strategy

- RD design

$$Y_{ict} = \beta \cdot 1\{M_{ic} \geq \tau\} + f(M_{ic}) + \theta_c + \varepsilon_{ict}$$

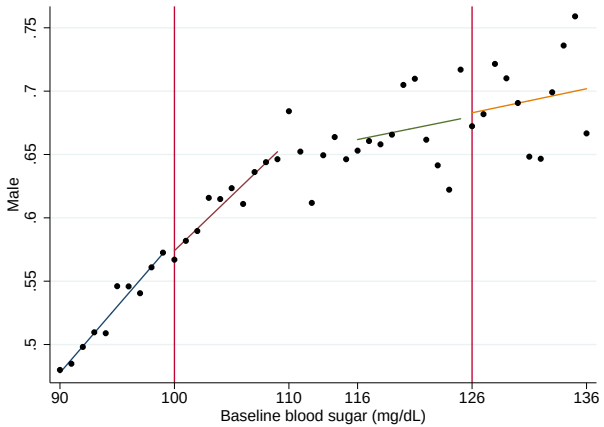
- Y_{ict} is the outcome of interest for individual i, screening cohort c =2009 or 2010, t years after the screening offer
- $1\{M_{ic} \geq \tau\}$ is an indicator function of individual i's baseline running variable (M_{ic}) being greater or equal to the relevant cutoff τ
- θ_c is the cohort-fixed effect, and ε_{ict} is the idiosyncratic error term
- Local linear regression with uniform kernel
- Bandwidth: blood sugar (10 mg/dL), BMI (1 kg/m^2), LDL cholesterol (10 mg/dL)

Validity of regression discontinuity design

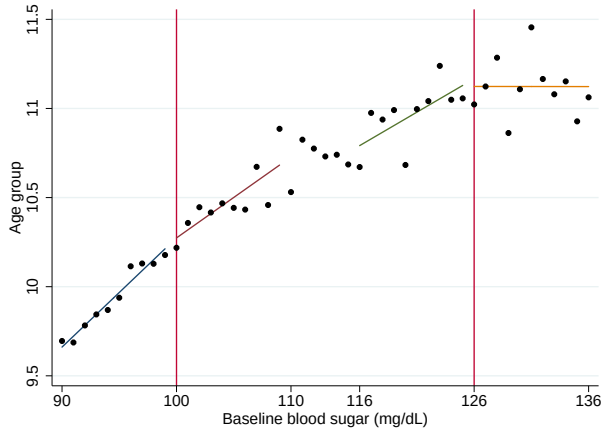
1. Observed and unobserved characteristics of individuals around the cutoffs are comparable.
2. Individuals (both patients and physicians) are not able to precisely manipulate the running variable.

Covariate balance test

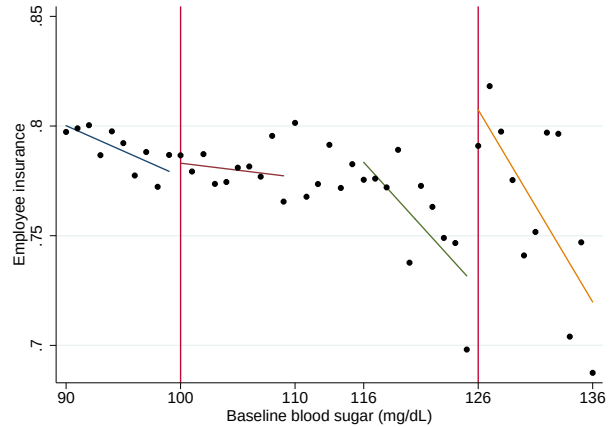
Running variable: fasting blood sugar



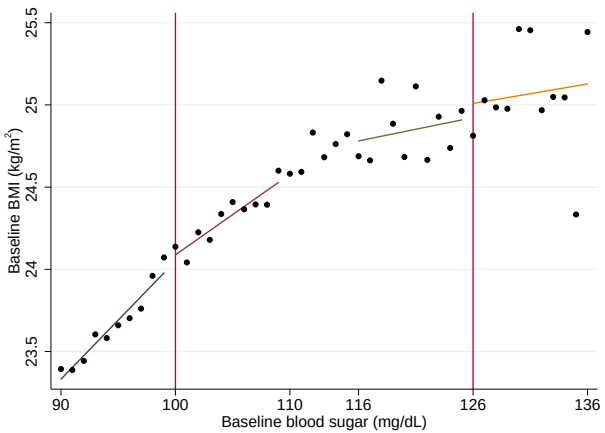
(a) Male



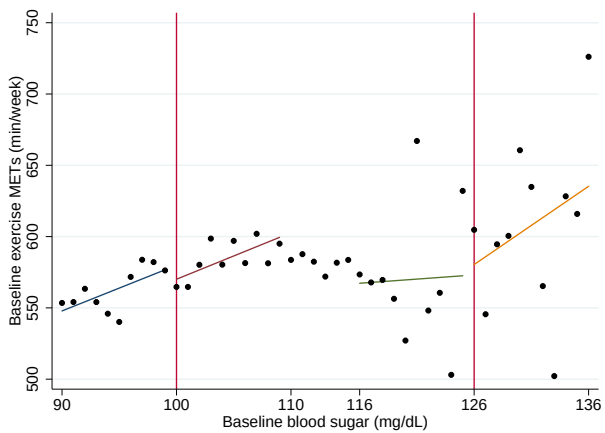
(b) Age group



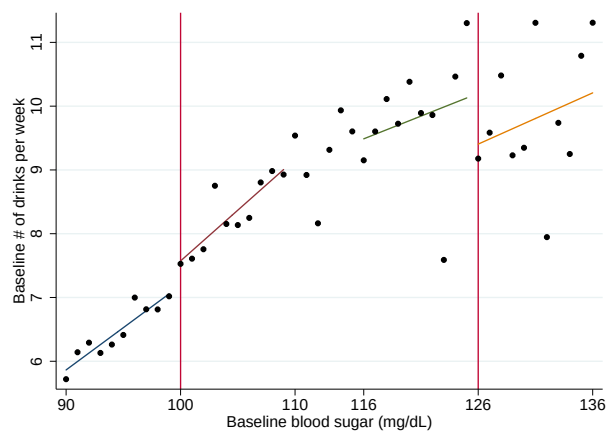
(c) Employee insurance



(d) BMI



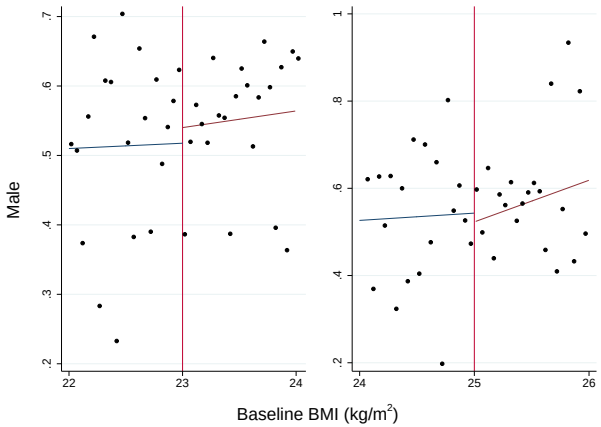
(e) Exercise METs (min/week)



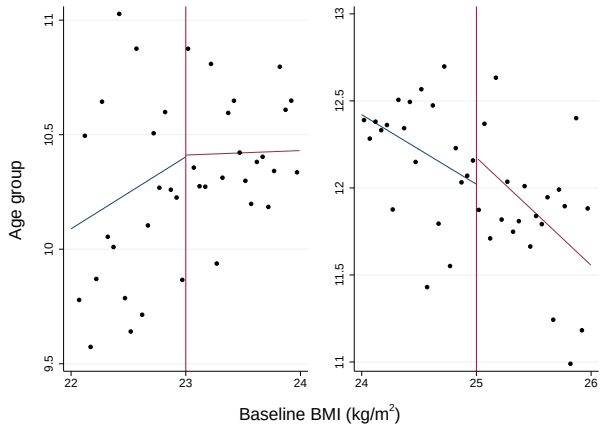
(f) Number of drinks per week

Covariate balance test

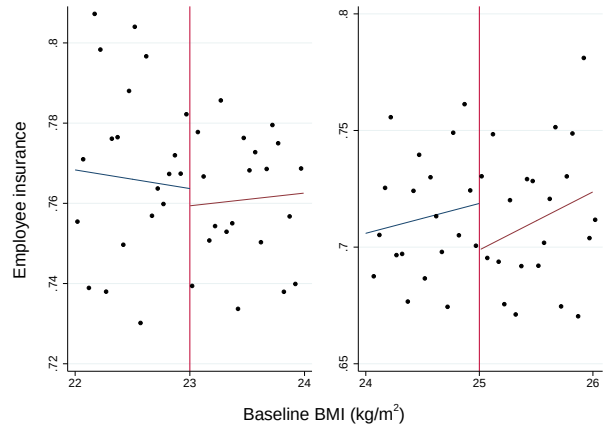
Running variable: BMI



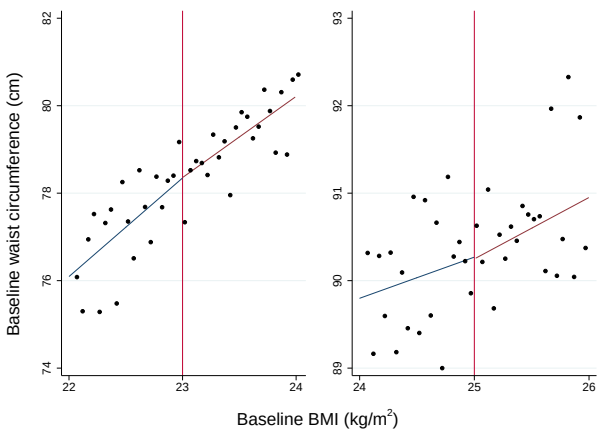
(a) Male



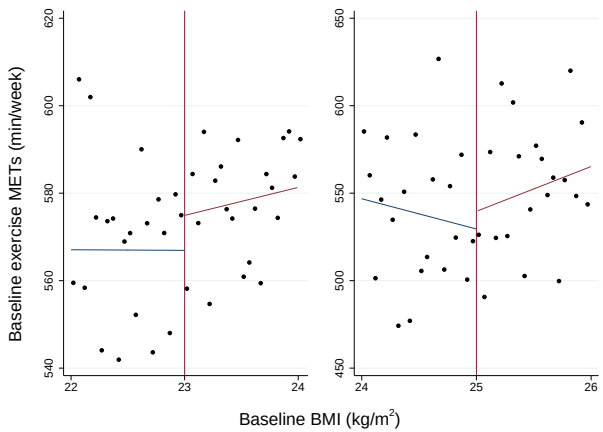
(b) Age group



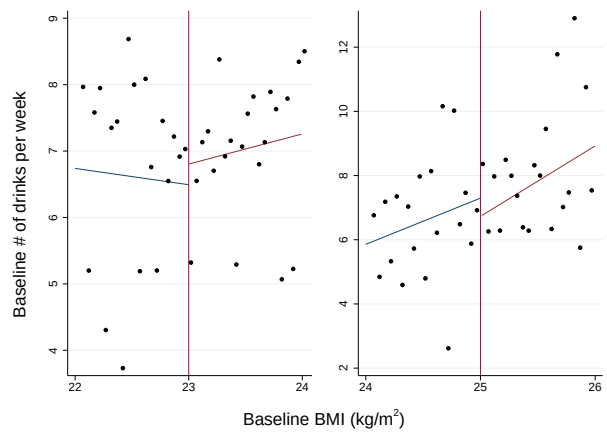
(c) Employee insurance



(d) Waist circumference (cm)



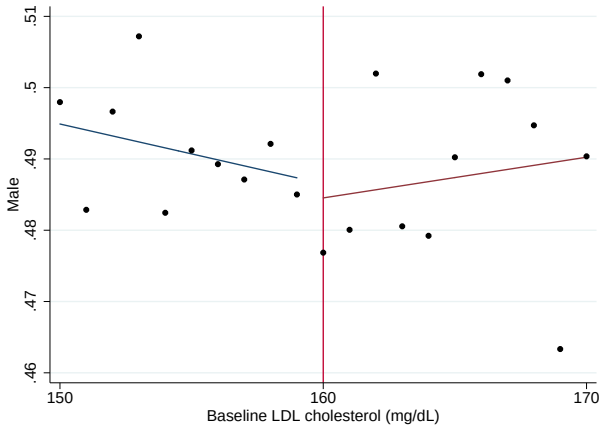
(e) Exercise METs (min/week)



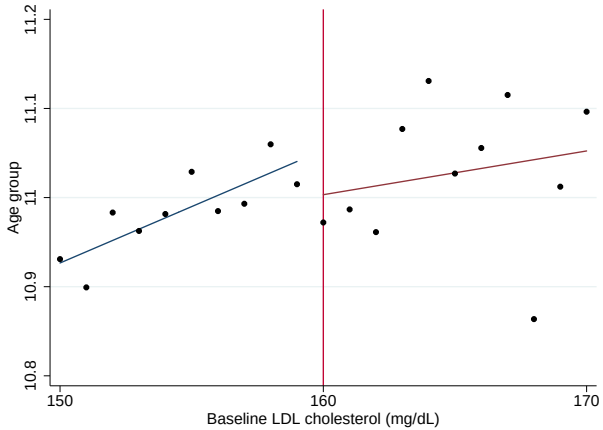
(f) Number of drinks per week

Covariate balance test

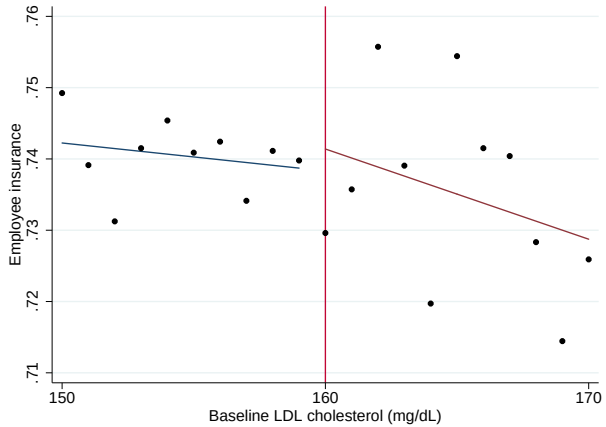
Running variable: LDL cholesterol



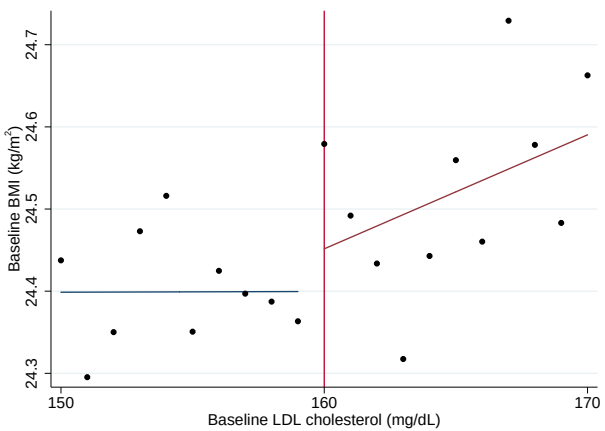
(a) Male



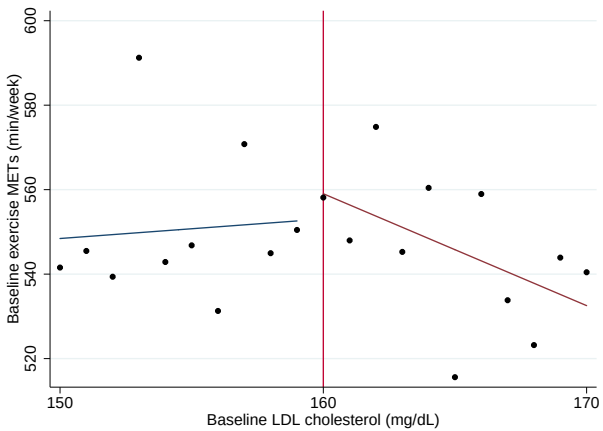
(b) Age group



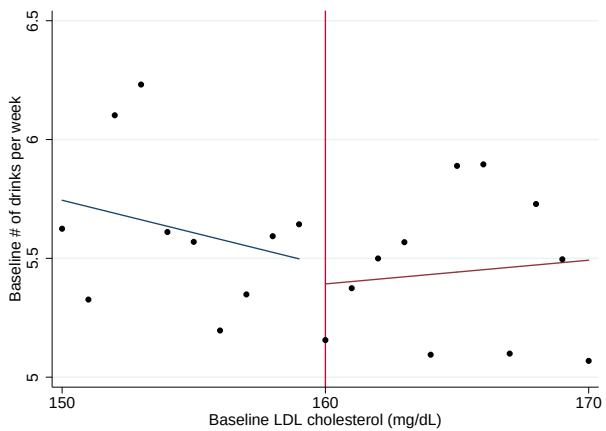
(c) Employee insurance



(d) BMI

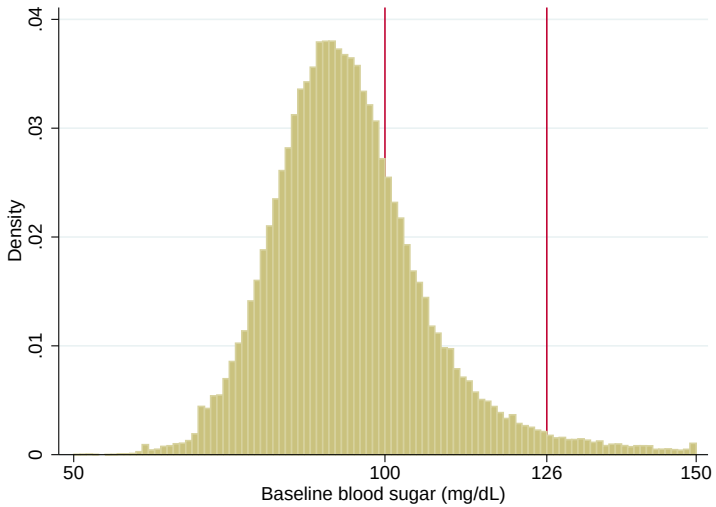


(e) Exercise METs (min/week)

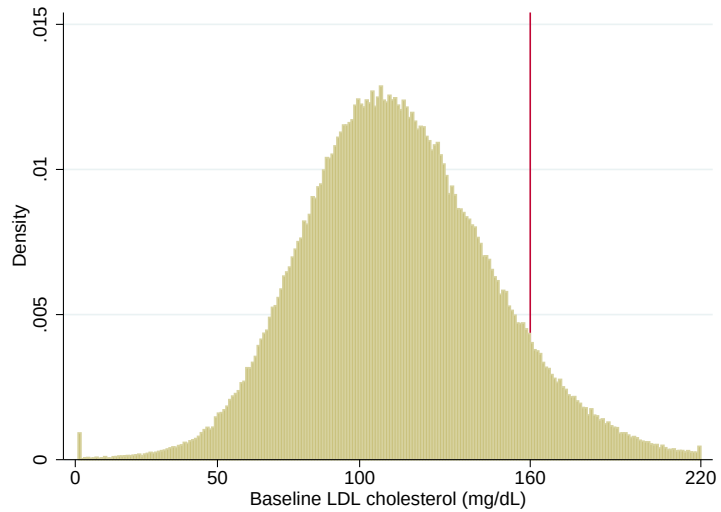


(f) Number of drinks per week

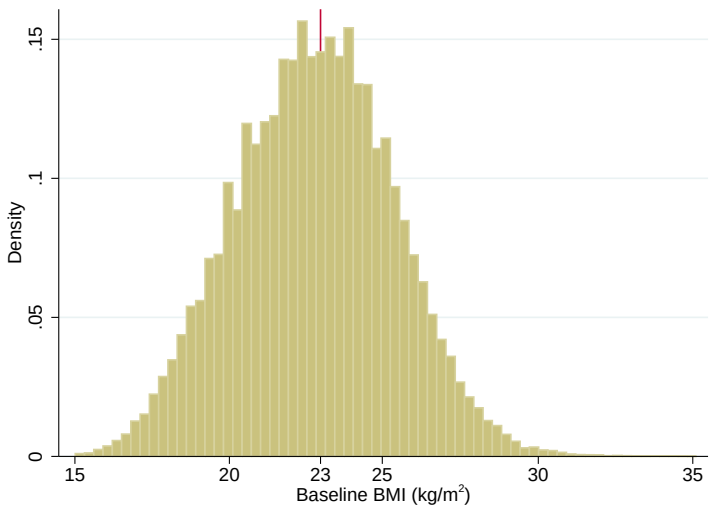
Density of running variables



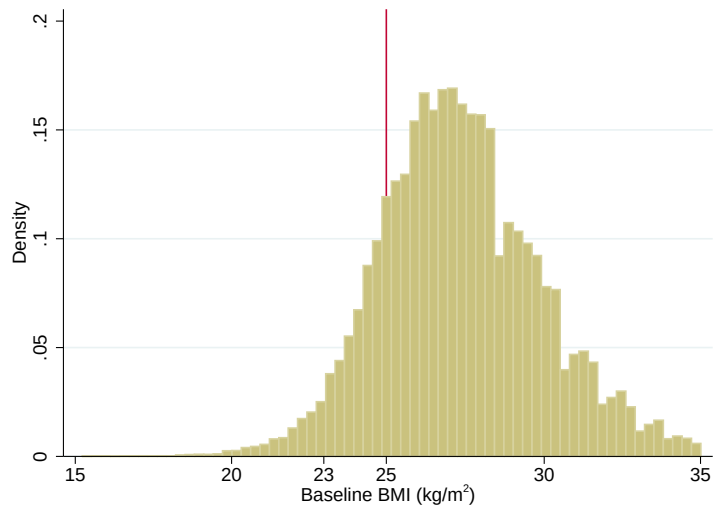
(a) Fasting blood sugar



(b) LDL cholesterol



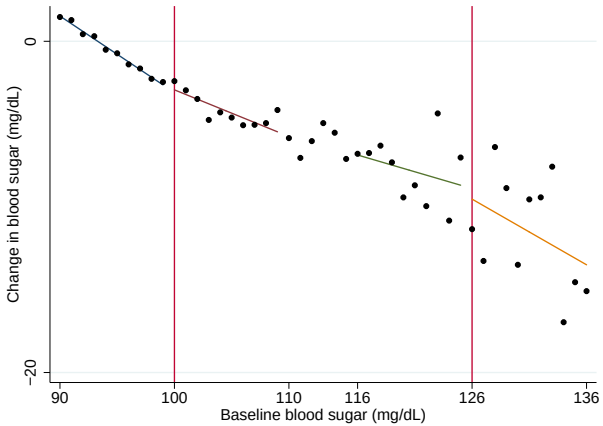
(c) BMI, no abdominal obesity sample



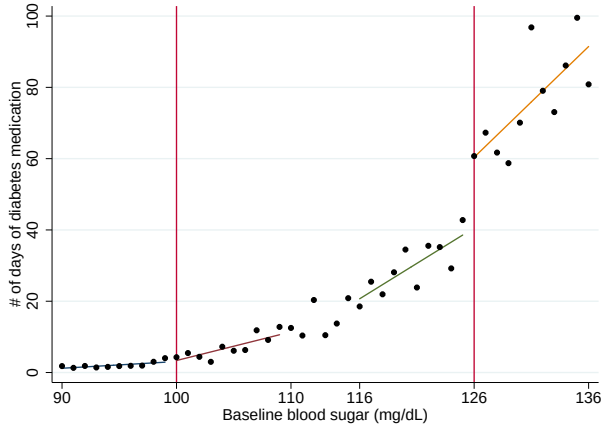
(d) BMI, abdominal obesity sample

Outline

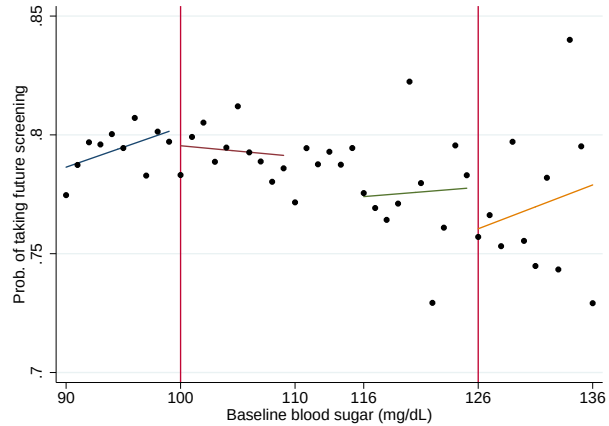
Short-run impact of diabetes risk information



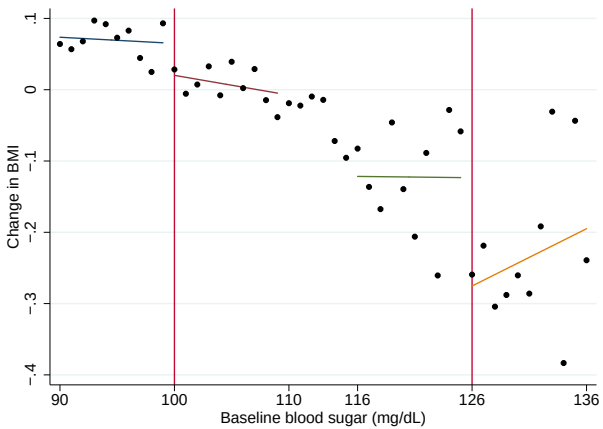
(a) Change in blood sugar



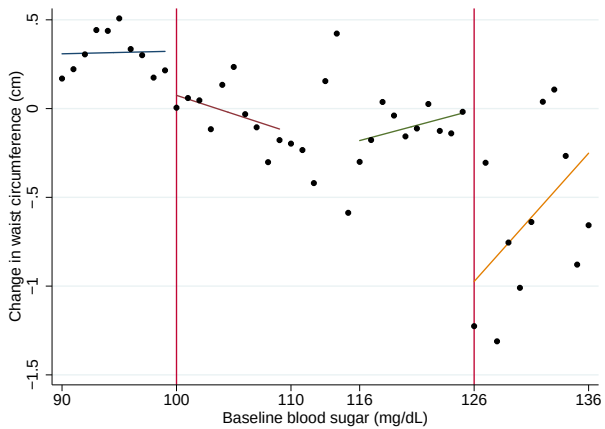
(b) Number of days of diabetes medication



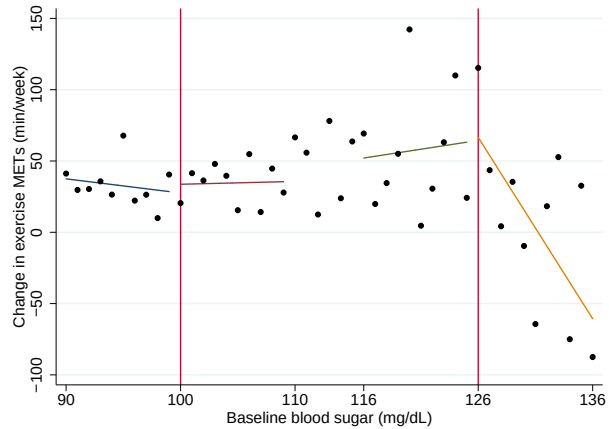
(c) Probability of taking screening



(d) Change in BMI



(e) Change in waist circumference

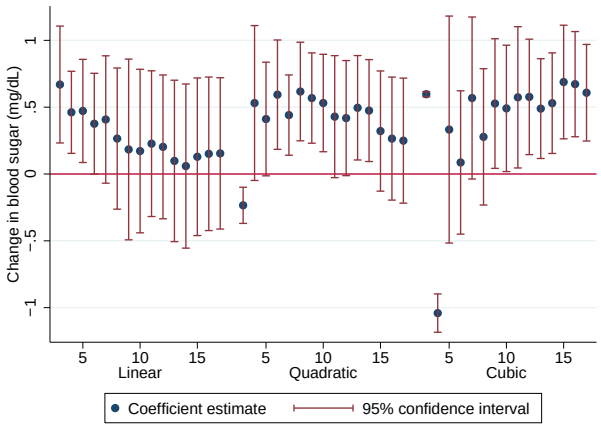


(f) Change in exercise METS (min/week)

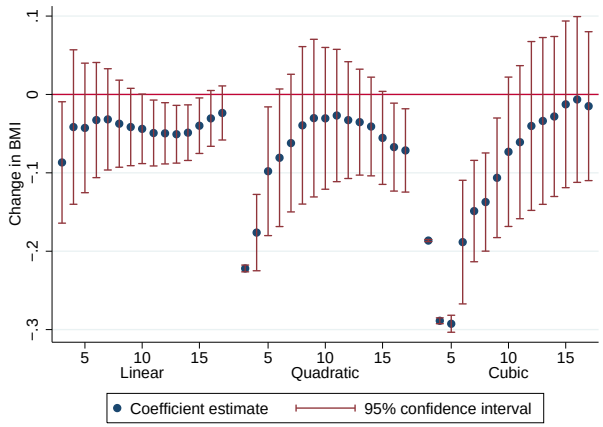
Short-run impact of diabetes risk information

	Change in blood sugar	# of days of diabetes medication	Prob. of future screening	Change in BMI	Change in waist	Change in exercise
Panel A. Medium risk cutoff 100						
RD estimate	0.172	0.186	-0.006	-0.044+	-0.243*	3.594
	(0.293)	(0.900)	(0.009)	(0.021)	(0.090)	(11.886)
Mean of the Dep. Var.						
in levels at [90, 100)	93.81	2.00	0.79	23.72	80.18	601.27
Observations	41,578	52,426	52,426	41,558	41,567	40,440
Panel B. High risk cutoff 126						
RD estimate	-0.647	19.807**	-0.017	-0.152*	-0.966**	2.288
	(2.183)	(4.516)	(0.017)	(0.062)	(0.240)	(35.439)
Mean of the Dep. Var.						
in levels at [116, 126)	112.12	28.11	0.78	24.68	83.89	630.77
Observations	3,648	4,717	4,717	3,643	3,644	3,543

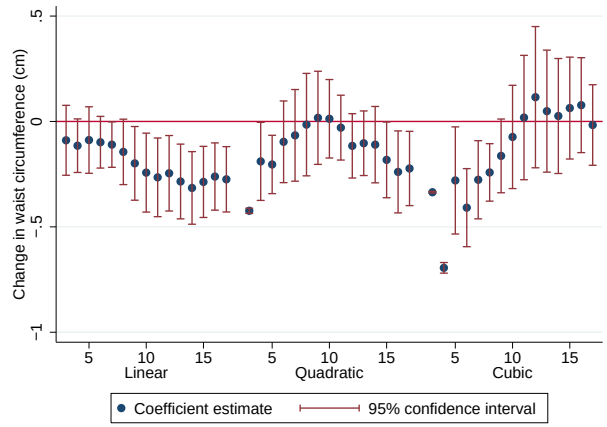
Short-run impact of diabetes risk information



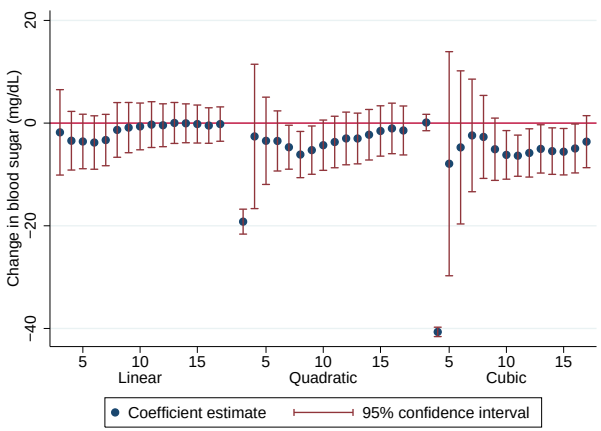
(a) Change in blood sugar, cutoff 100



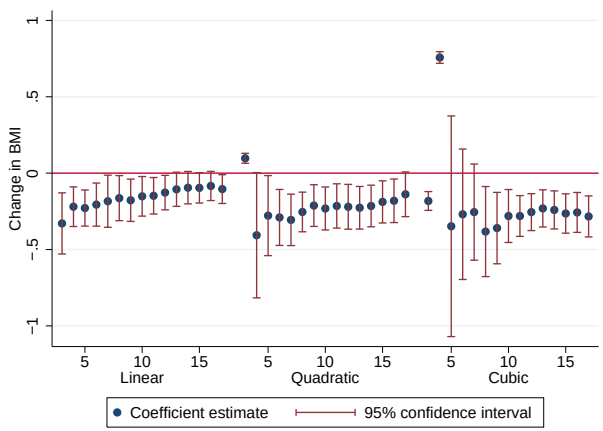
(b) Change in BMI, cutoff 100



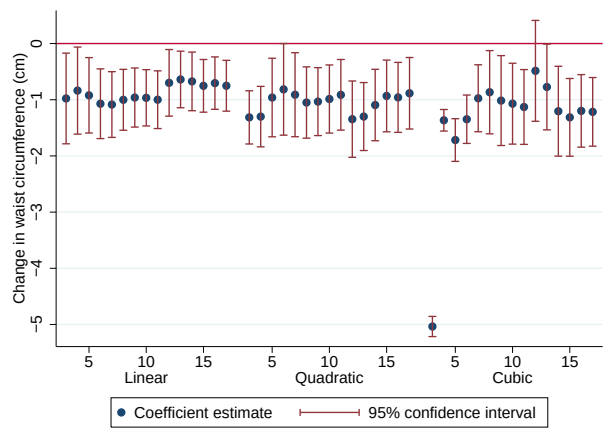
(c) Change in waist circumf., cutoff 100



(d) Change in blood sugar, cutoff 126

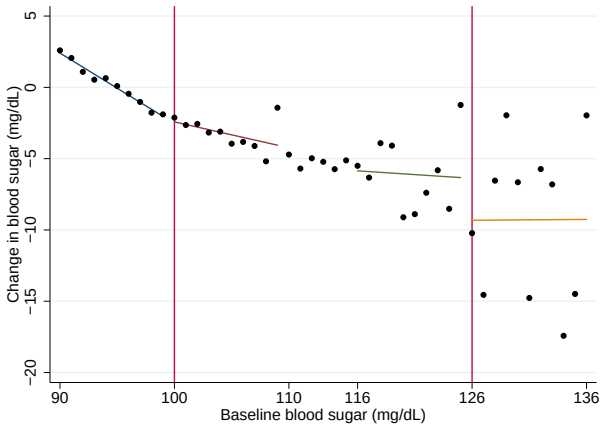


(e) Change in BMI, cutoff 126

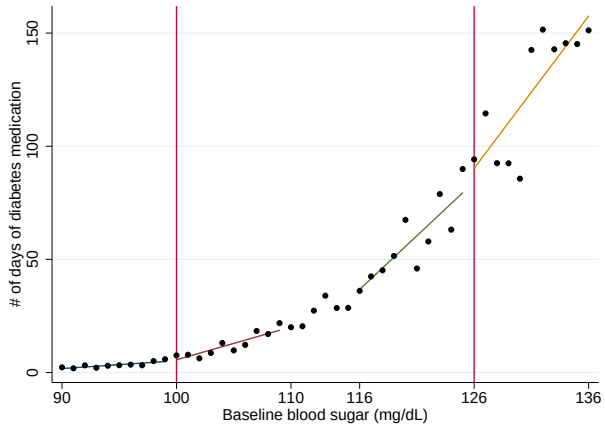


(f) Change in waist circumf., cutoff 126

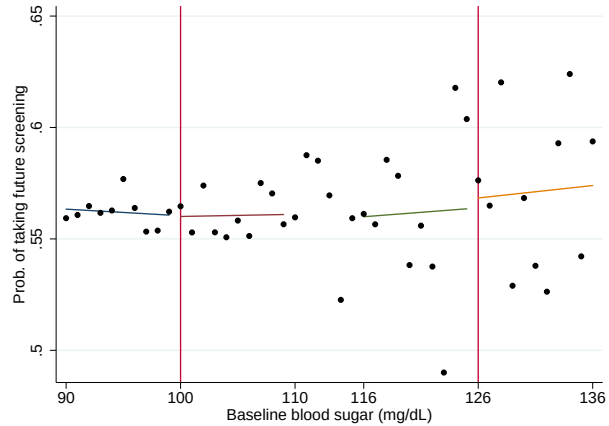
Long-run impact of diabetes risk information



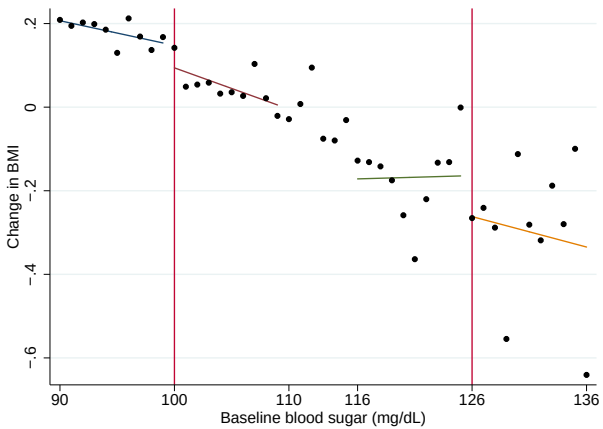
(a) Change in blood sugar



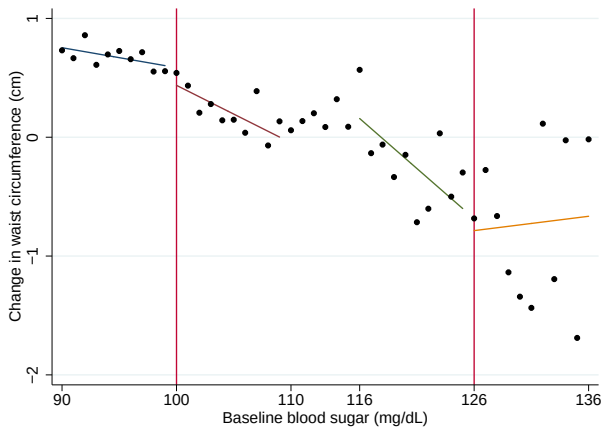
(b) Number of days of diabetes medication



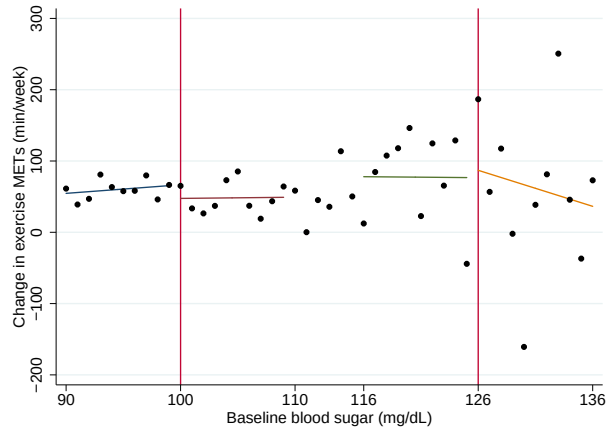
(c) Probability of taking screening



(d) Change in BMI



(e) Change in waist circumference

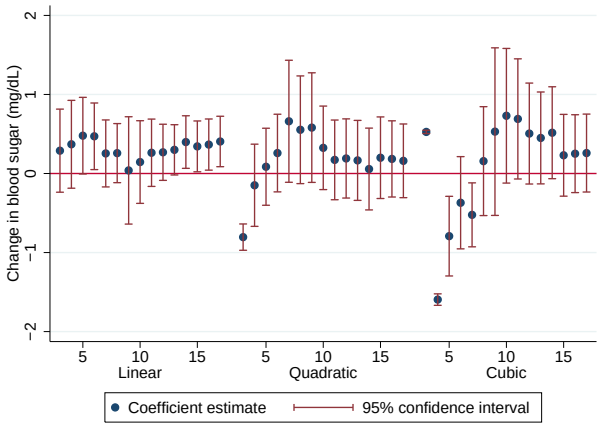


(f) Change in exercise METS (min/week)

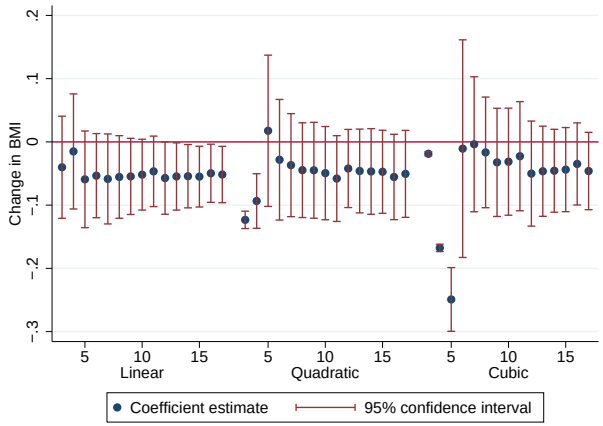
Long-run impact of diabetes risk information

	Change in blood sugar	# of days of diabetes medication	Prob. of future screening	Change in BMI	Change in waist	Change in exercise
Panel A. Medium risk cutoff 100						
RD estimate	0.145	0.436	-0.002	-0.052+	-0.160*	-19.909
	(0.251)	(1.145)	(0.004)	(0.027)	(0.071)	(13.345)
Mean of the Dep. Var.						
in levels at [90, 100)	94.55	3.22	0.56	23.83	80.66	625.33
Observations	29,436	52,426	52,426	29,417	29,428	28,374
Panel B. High risk cutoff 126						
RD estimate	-2.938	5.908	0.011	-0.098	-0.103	10.243
	(3.098)	(10.168)	(0.024)	(0.094)	(0.303)	(73.436)
Mean of the Dep. Var.						
in levels at [116, 126)	113.69	54.45	0.56	24.59	83.67	645.84
Observations	2,662	2,562	2,585	2,658	2,656	2,562

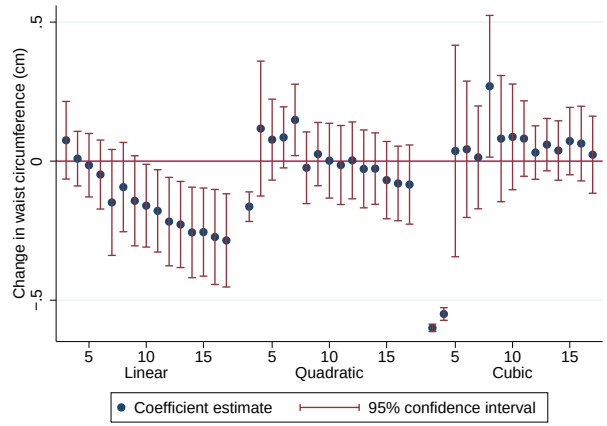
Long-run impact of diabetes risk information



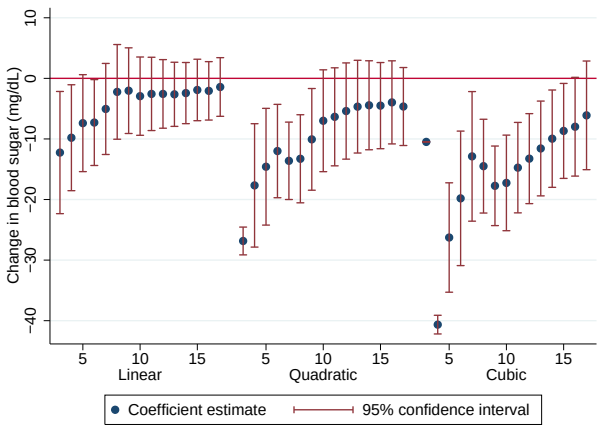
(a) Change in blood sugar, cutoff 100



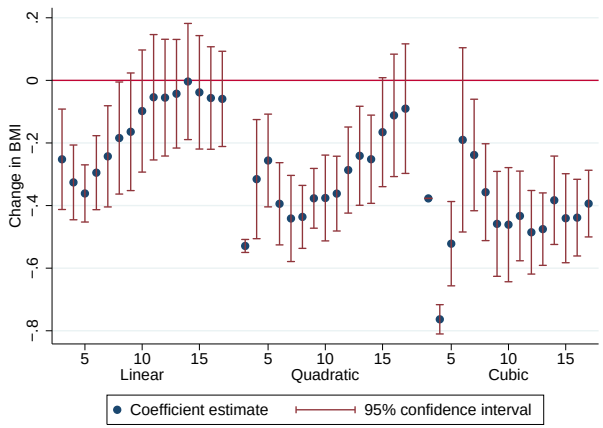
(b) Change in BMI, cutoff 100



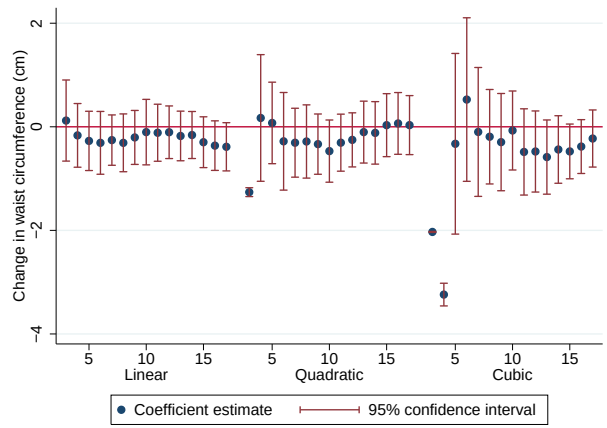
(c) Change in waist circumf., cutoff 100



(d) Change in blood sugar, cutoff 126



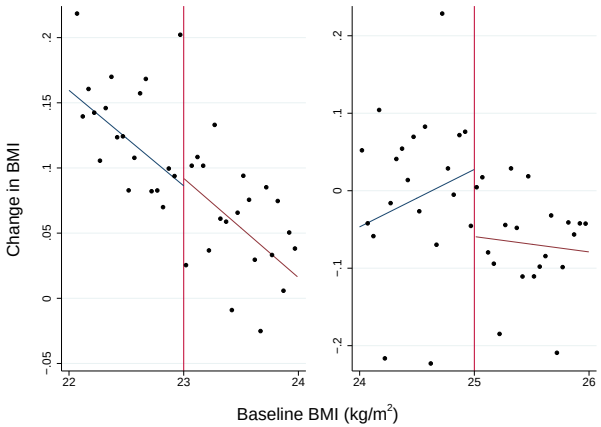
(e) Change in BMI, cutoff 126



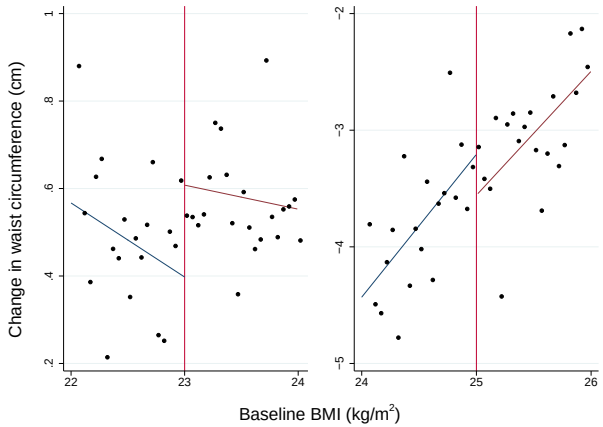
(f) Change in waist circumf., cutoff 126

▸ medication

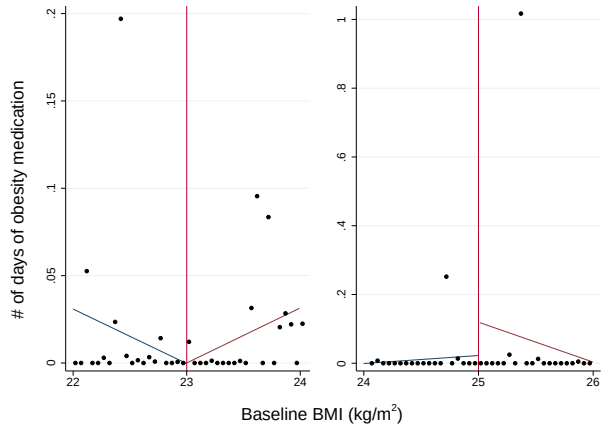
Short-run impact of obesity risk information



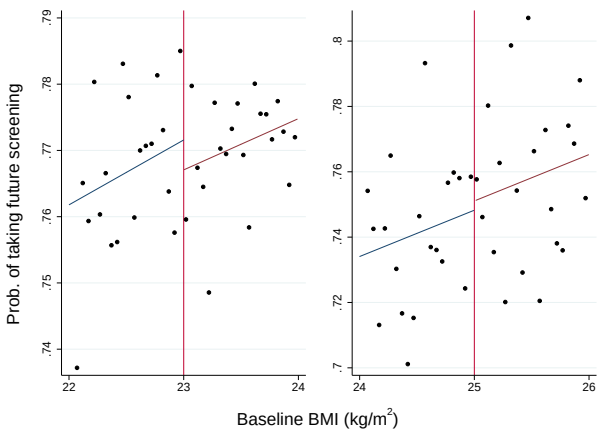
(a) Change in BMI



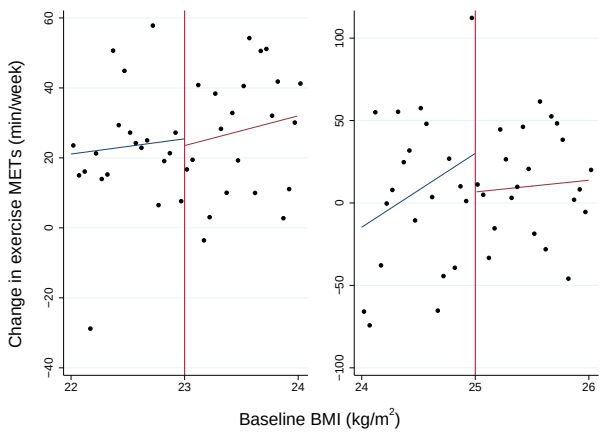
(b) Change in waist circumference



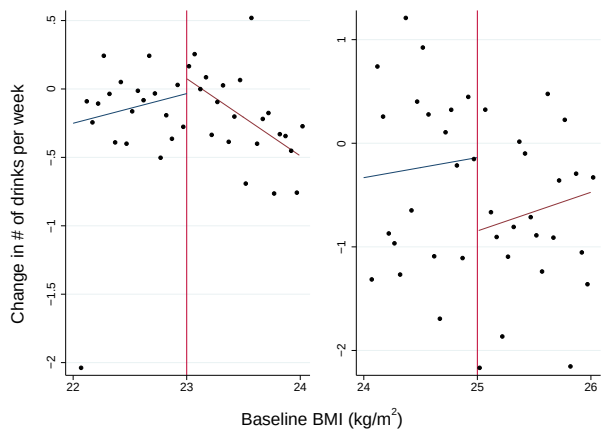
(c) Number of days of obesity medication



(d) Probability of taking screening



(e) Change in exercise METS (min/week)



(f) Change in number of drinks per week

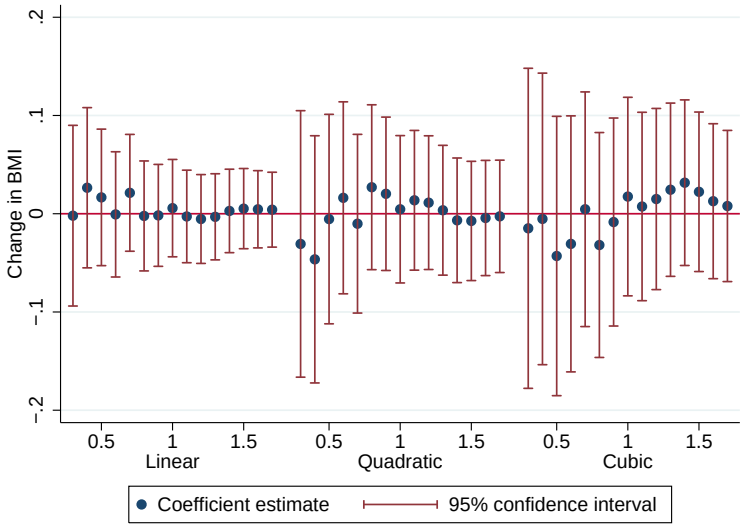
Short-run impact of obesity risk information

	Change in BMI	Change in waist	# of days of diabetes medication	Prob. of future screening	Change in exercise	Change in # of drinks per week
Panel A. Medium risk cutoff 23						
RD estimate	0.006	0.210**	0.0003	-0.005	-1.926	0.109
	(0.025)	(0.079)	(0.009)	(0.008)	(9.615)	(0.183)
Mean of the Dep. Var.						
in levels at [22, 23)	22.59	77.90	0.02	0.70	609.78	6.84
Observations	64,103	64,094	83,379	83,379	62,926	62,950
Panel B. High risk cutoff 25						
RD estimate	-0.086*	-0.349	0.095	0.003	-23.428	-0.701
	(0.042)	(0.231)	(0.115)	(0.015)	(27.645)	(0.478)
Mean of the Dep. Var.						
in levels at [24, 25)	24.52	86.36	0.01	0.65	575.18	7.16
Observations	11,737	11,736	15,616	15,616	11,574	11,525

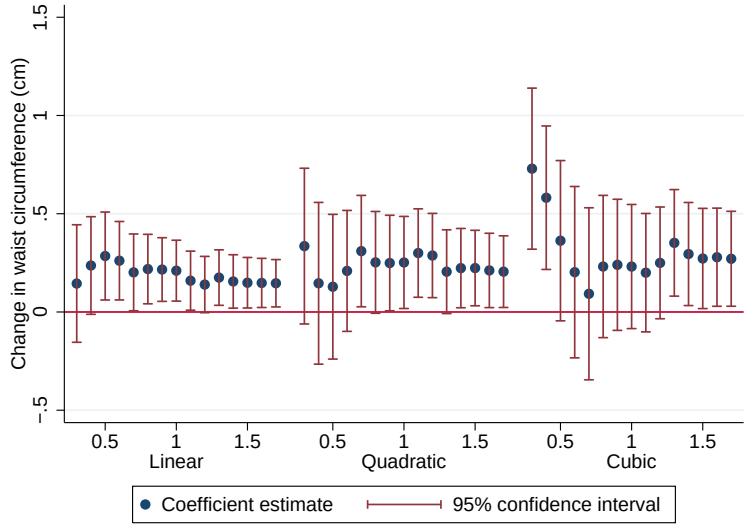
Short-run impact of obesity risk information

Cutoff 23

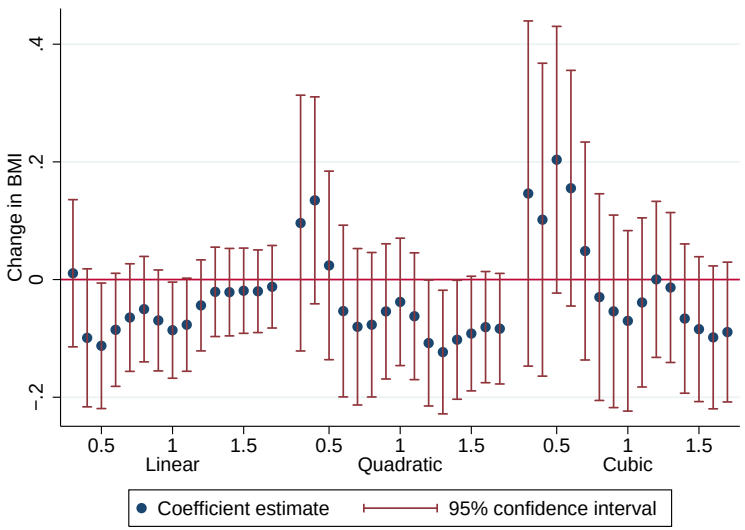
(a) Change in BMI

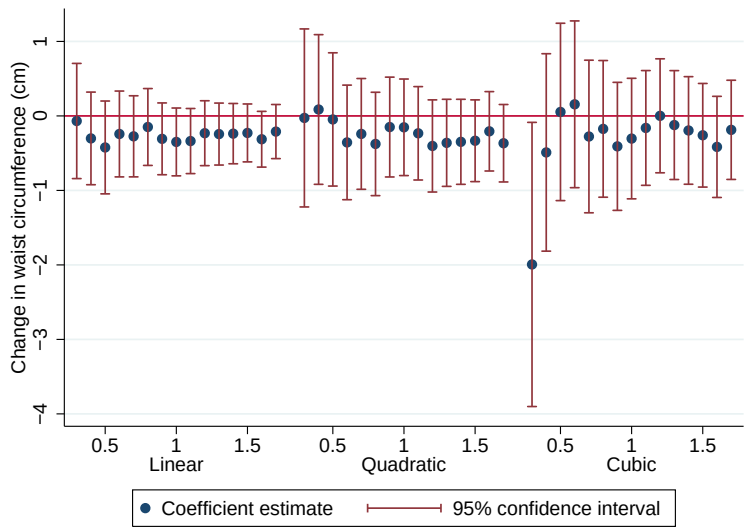


(b) Change in waist circumference

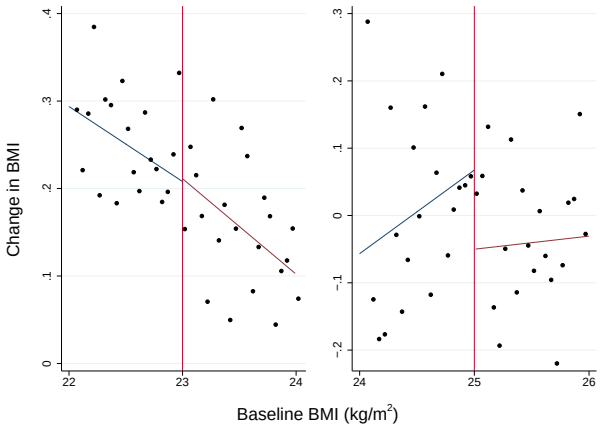


Cutoff 25

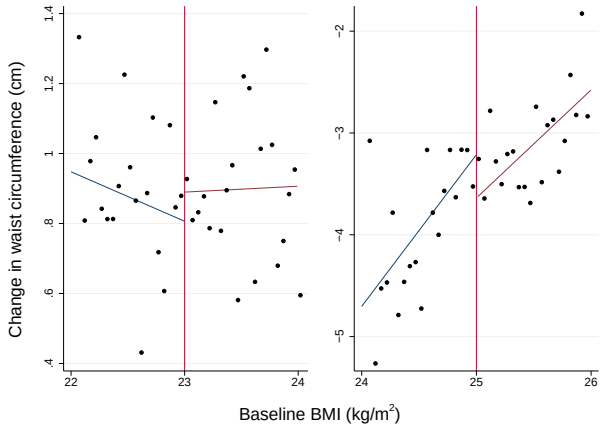




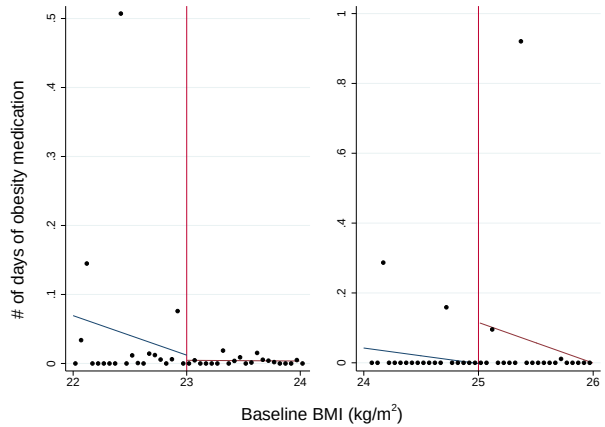
Long-run impact of obesity risk information



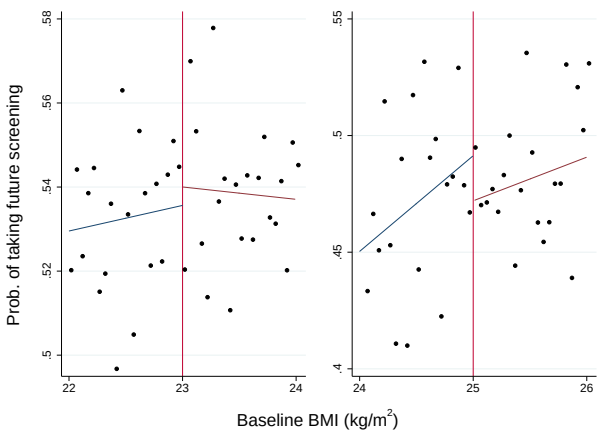
(a) Change in BMI



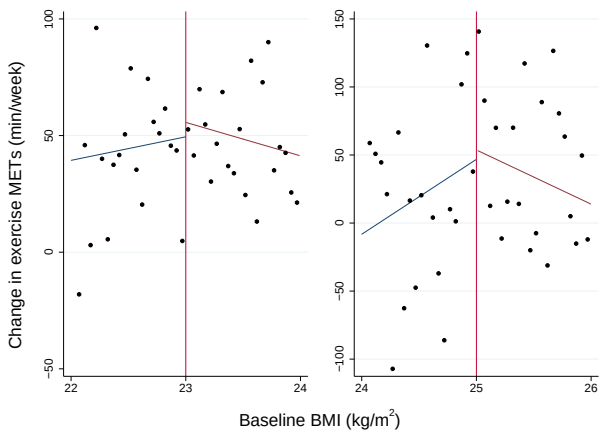
(b) Change in waist circumference



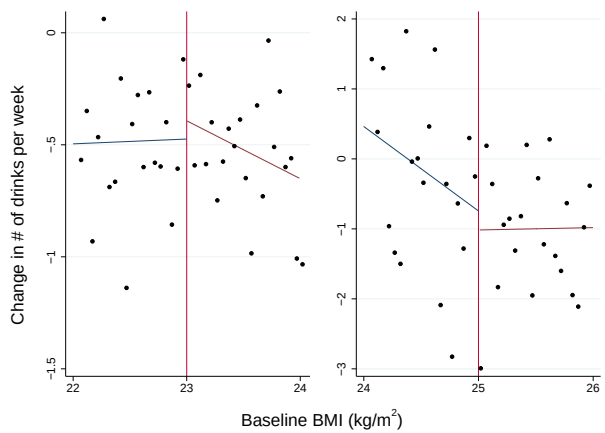
(c) Number of days of obesity medication



(d) Probability of taking screening



(e) Change in exercise METS (min/week)

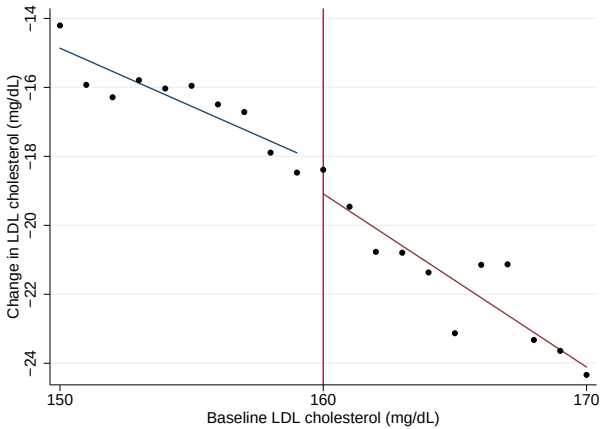


(f) Change in number of drinks per week

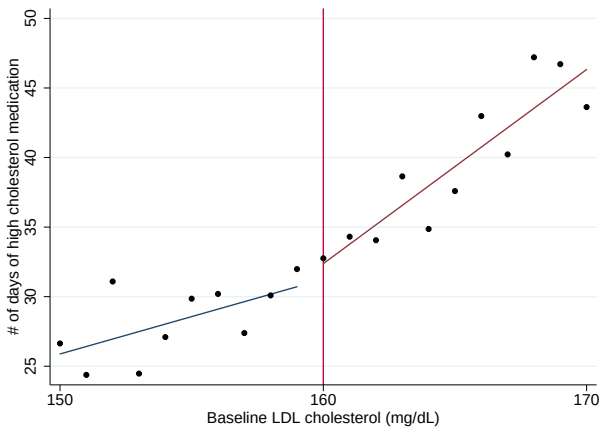
Long-run impact of obesity risk information

	Change in BMI	Change in waist	# of days of diabetes medication	Prob. of future screening	Change in exercise	Change in # of drinks per week
Panel A. Medium risk cutoff 23						
RD estimate	0.003	0.083	-0.008	0.003	6.152	0.082
	(0.042)	(0.126)	(0.026)	(0.010)	(13.403)	(0.232)
Mean of the Dep. Var.						
in levels at [22, 23)	22.73	78.32	0.03	0.37	614.66	6.73
Observations	44,654	44,652	83,379	83,379	43,635	43,746
Panel B. High risk cutoff 25						
RD estimate	-0.118+	-0.422	0.116	-0.006	6.683	-0.264
	(0.071)	(0.266)	(0.105)	(0.017)	(35.375)	(0.732)
Mean of the Dep. Var.						
in levels at [24, 25)	24.50	86.18	0.01	0.34	587.49	7.39
Observations	7,466	7,465	15,616	15,616	7,324	7,310

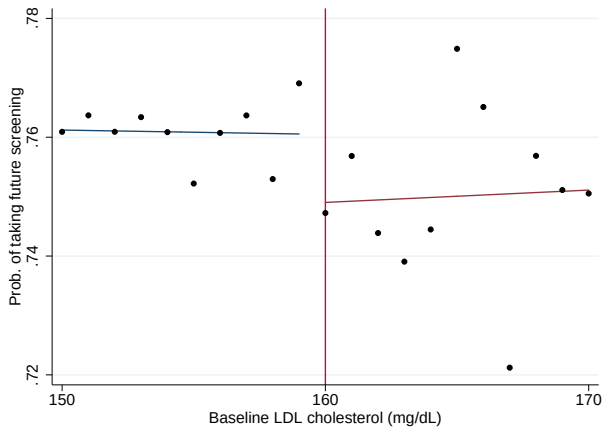
Short-run impact of high cholesterol risk information



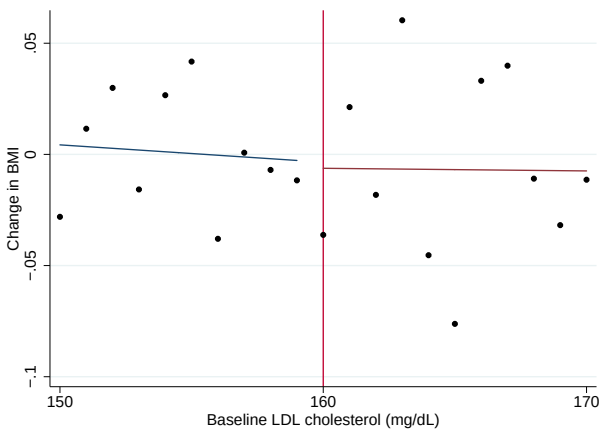
(a) Change in LDL cholesterol



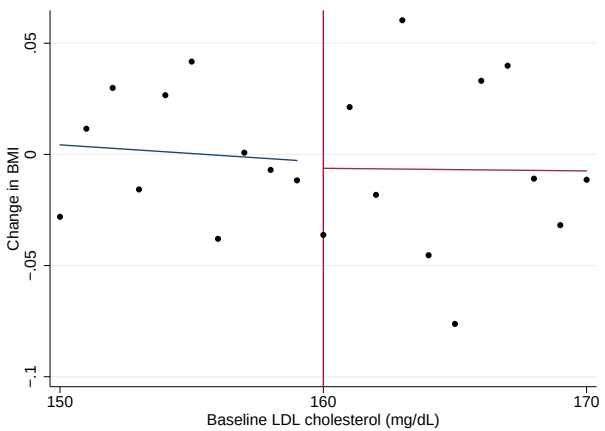
(b) Number of days of cholesterol medication



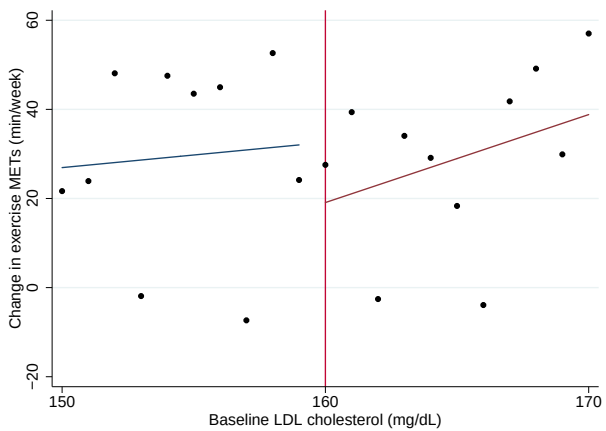
(c) Probability of taking screening



(d) Change in BMI



(e) Change in waist circumference

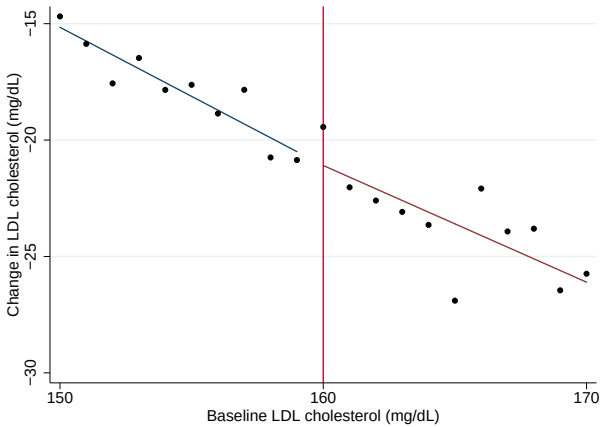


(f) Change in exercise METS (min/week)

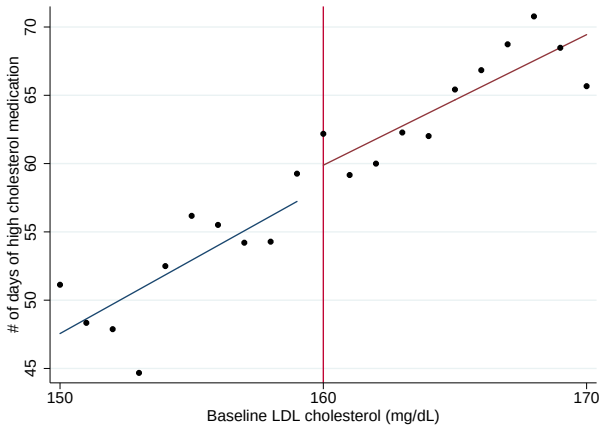
Short-run impact of high cholesterol risk information

	Change in LDL cholesterol	# of days of cholesterol medication	Prob. of future screening	Change in BMI	Change in waist	Change in exercise
Panel A. High risk cutoff 160						
RD estimate	-0.850	1.187	-0.012	-0.003	0.048	-13.391
	(0.858)	(2.351)	(0.010)	(0.033)	(0.145)	(18.448)
Mean of the Dep. Var.						
in levels at [150, 160)	137.94	28.15	0.76	24.42	82.13	589.96
Observations	21,832	29,059	29,059	21,968	21,956	21,618

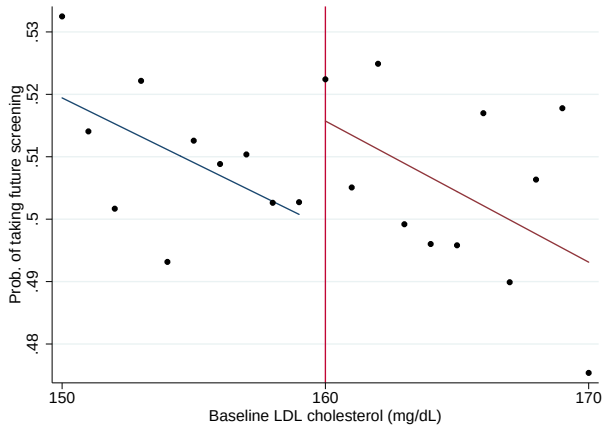
Long-run impact of high cholesterol risk information



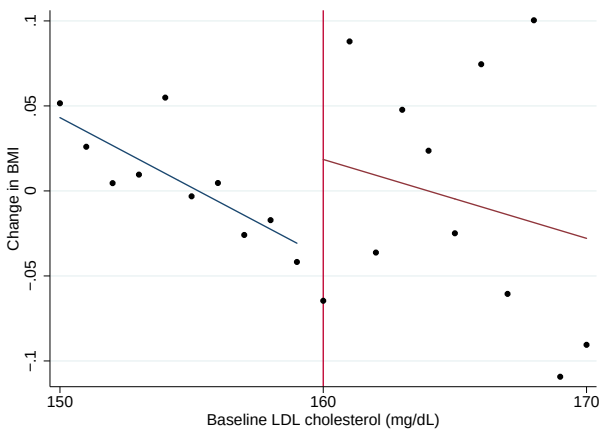
(a) Change in LDL cholesterol



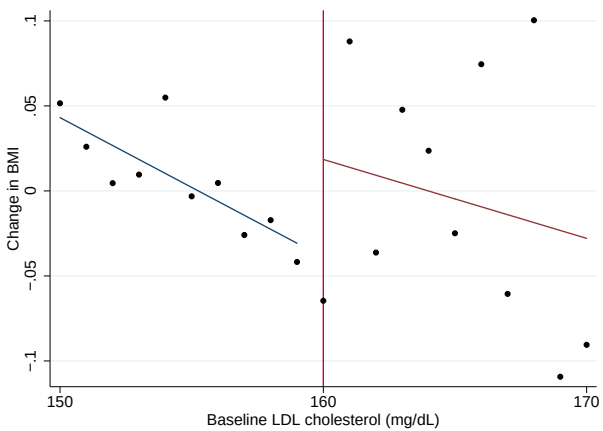
(b) Number of days of cholesterol medication



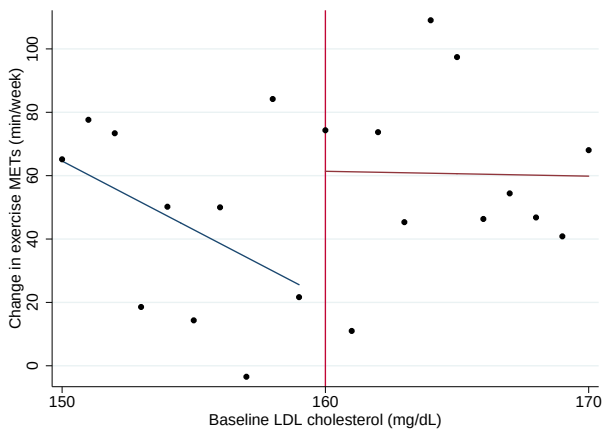
(c) Probability of taking screening



(d) Change in BMI



(e) Change in waist circumference



(f) Change in exercise METS (min/week)

Long-run impact of high cholesterol risk information

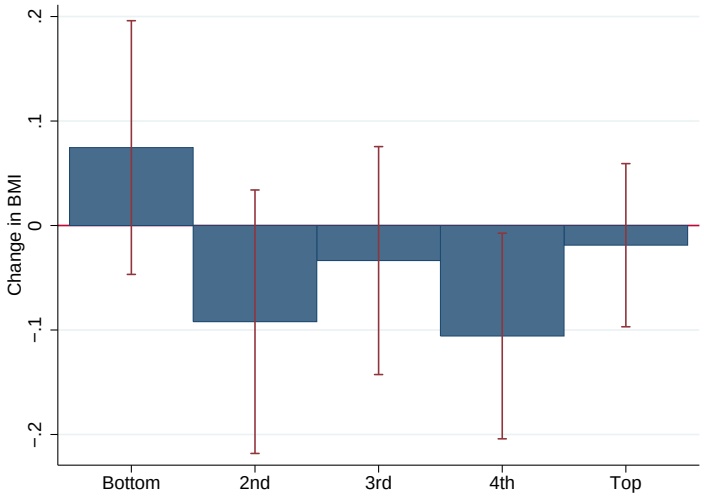
	Change in LDL cholesterol	# of days of cholesterol medication	Prob. of future screening	Change in BMI	Change in waist	Change in exercise
Panel A. High risk cutoff 160						
RD estimate	-0.013	1.676	0.012	0.057	0.355+	40.077+
	(1.105)	(3.589)	(0.010)	(0.046)	(0.188)	(22.824)
Mean of the Dep. Var.						
in levels at [150, 160)	136.55	52.10	0.51	24.46	82.36	604.34
Observations	14,717	29,059	29,059	14,770	14,767	14,467

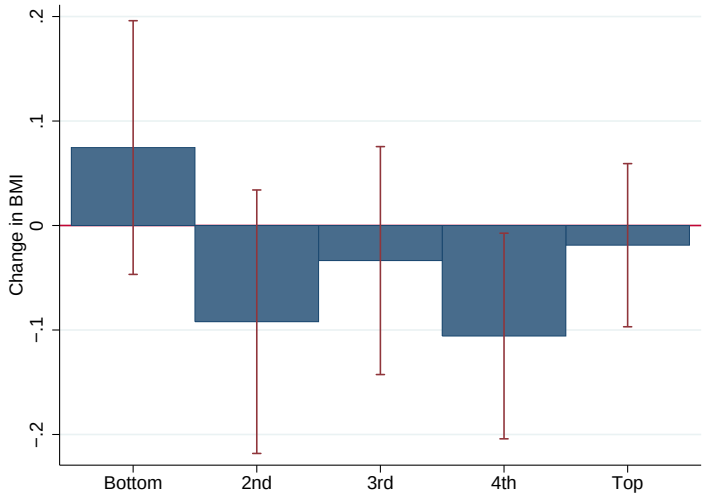
Heterogeneity analysis: change in future BMI

(a) Fasting blood sugar, cutoff 100

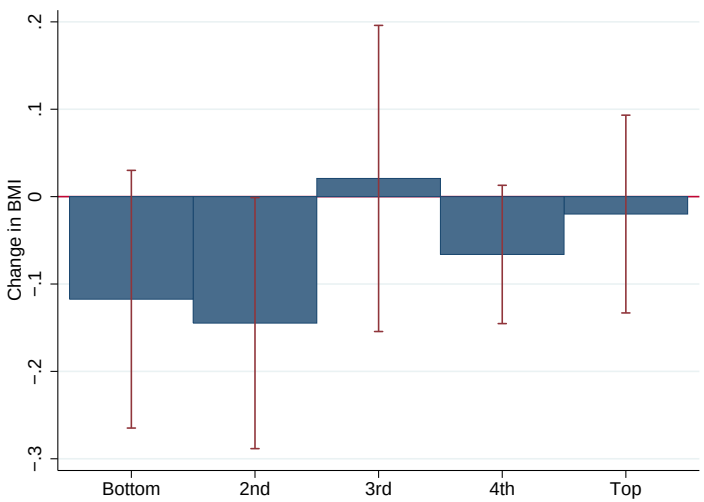
(b) Fasting blood sugar, cutoff 126

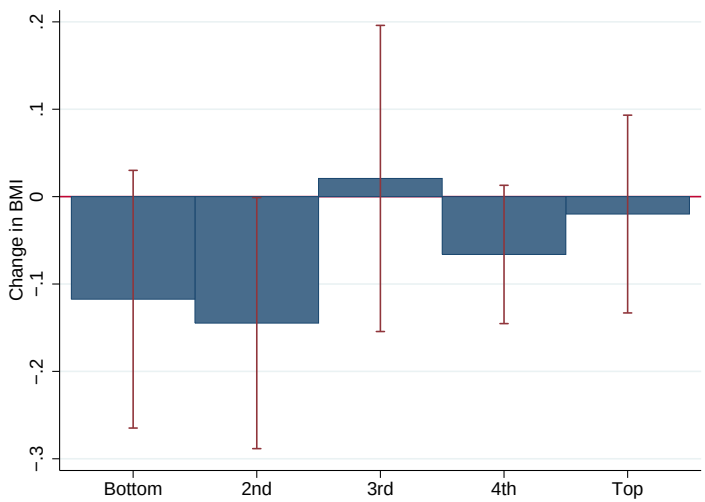
Short-run impact





Long-run impact





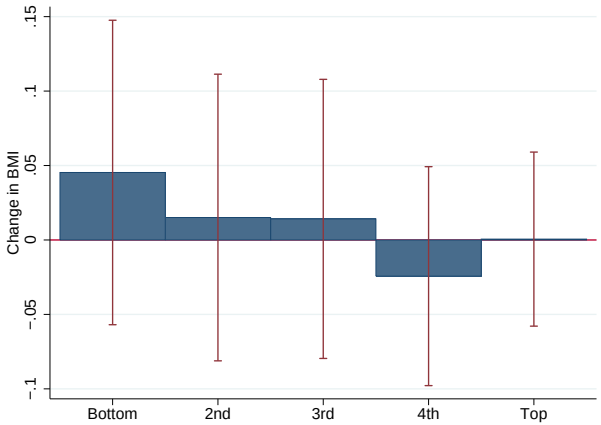
Heterogeneity analysis: change in future BMI

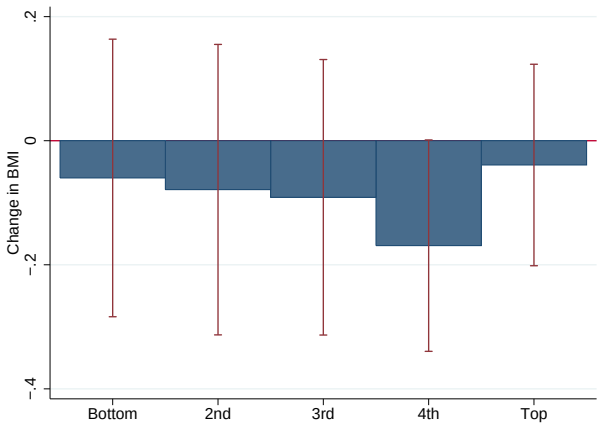
(a) BMI, cutoff 23

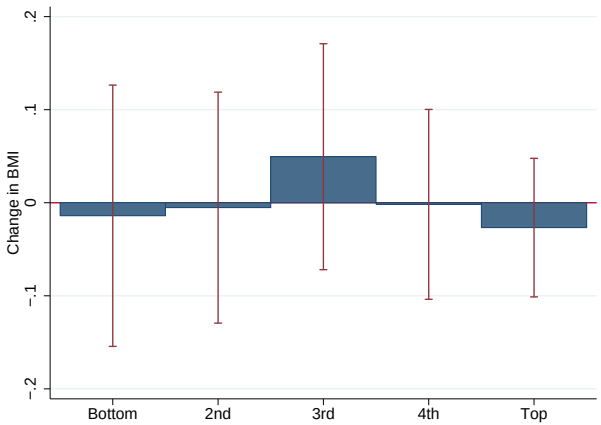
(b) BMI, cutoff 25

(c) LDL cholesterol, cutoff 160

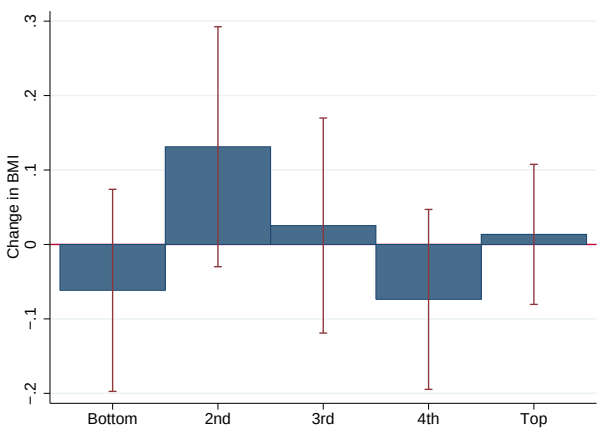
Short-run impact

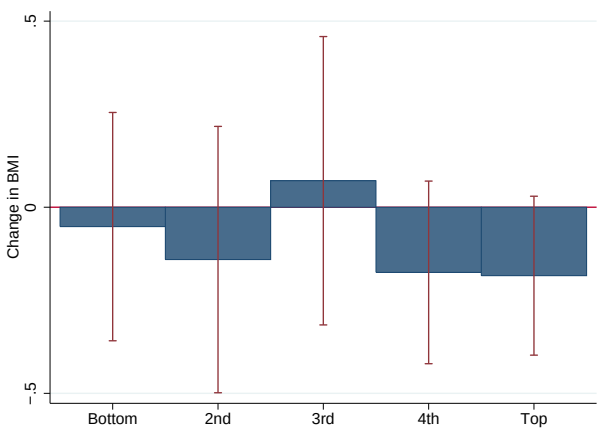


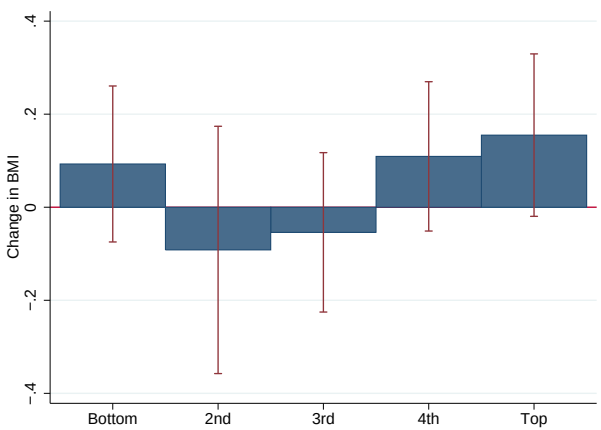




Long-run impact







Outline

Discussion

- We find evidence of weight loss around the high risk threshold for diabetes, while we find little to no differences around other risk classification thresholds.

1. The most striking differences between the high risk classification for diabetes compared to the other classifications: further interventions in addition to the risk information.
2. One may reason that people consider diabetes as a more serious disease than obesity and high cholesterol.
3. Individuals who understand that they are just above the risk classification cutoffs from the first page of the screening report may not take the risk information seriously.

Concluding remarks

- There are some limitations to our study.

1. Missing very short-term behavior changes that happen within as soon as the first few months.
   - However, long-term behavior changes are important for the lifestyle diseases and hence are more relevant to our study.
2. No food intake information.
   - However, our administrative and self-reported data provide strong and relevant correlates to food consumption (e.g., BMI) that combined with other variables like exercise, help us to gain a very thorough picture of relevant behavior changes.

Concluding remarks

- Although the findings of this study specifically reflected the behavioral responses and health outcomes to the NHSP in Korea, this analysis still provides a number of implications for other health and social programs that provide (risk) information.

- Our results suggest that risk information itself might not be sufficient to lead to behavioral changes, and that further interventions (e.g., counseling with a doctor and medical intervention about screening results and behavior change strategies) in addition to the risk information may increase the marginal benefits of risk classifications.

Thank you!

Short-run Impact by diabetes medication

Fasting blood sugar, high risk cutoff 126

	Change in blood sugar	Prob. of future screening	Change in BMI	Change in waist	Change in exercise
Panel A. No diabetes medication during or one year after baseline					
RD estimate	-0.446	-0.027	-0.217**	-1.366**	43.265
	(2.084)	(0.022)	(0.061)	(0.290)	(29.396)
Mean of the Dep. Var. in levels at [116, 126)	110.53	0.77	24.65	83.79	625.14
Observations	3,086	4,007	3,081	3,083	2,989
Panel B. Took diabetes medication during or one year after baseline					
RD estimate	-6.024	-0.023	0.147	0.558	-141.237
	(4.781)	(0.044)	(0.269)	(0.468)	(111.803)
Mean of the Dep. Var. in levels at [116, 126)	112.46	0.57	24.59	83.60	647.41
Observations	562	710	562	561	554

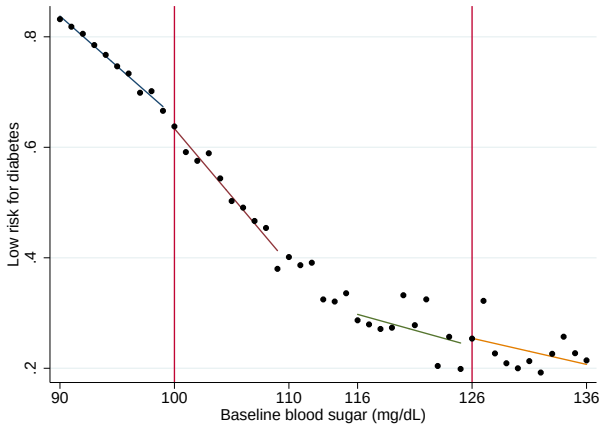
Long-run Impact by diabetes medication

Fasting blood sugar, high risk cutoff 126

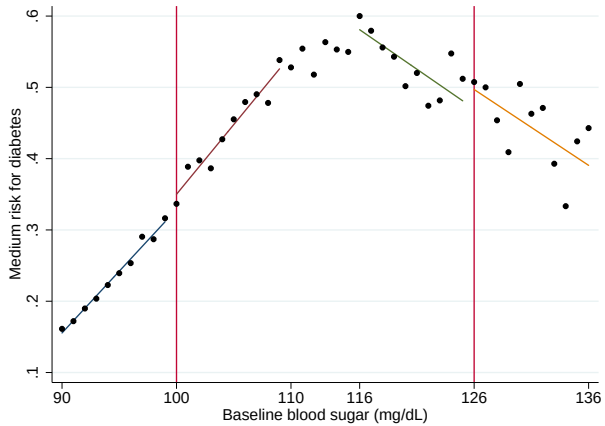
	Change in blood sugar	Prob. of future screening	Change in BMI	Change in waist	Change in exercise
Panel A. No diabetes medication during or one year after baseline					
RD estimate	-2.289	-0.001	-0.116	-0.049	-4.761
	(3.522)	(0.026)	(0.119)	(0.383)	(68.168)
Mean of the Dep. Var. in levels at [116, 126)	125.24	0.79	24.95	84.74	677.32
Observations	2,293	4,007	2,289	2,288	2,203
Panel B. Took diabetes medication during or one year after baseline					
RD estimate	-11.587+	0.081*	0.141	-0.061	117.146
	(6.200)	(0.035)	(0.226)	(0.829)	(127.239)
Mean of the Dep. Var. in levels at [116, 126)	125.52	0.50	24.65	84.31	630.63
Observations	369	710	369	368	359

back

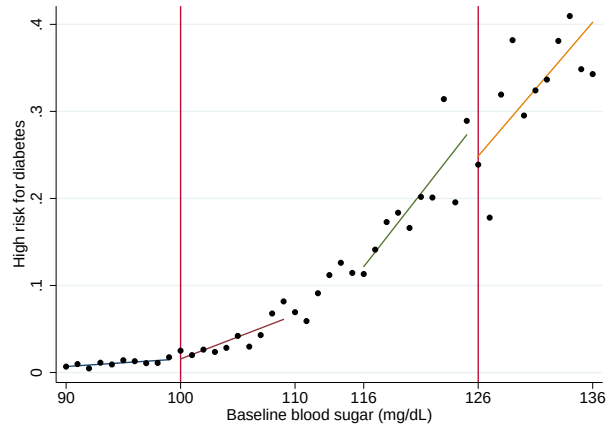
Impact on future diabetes risk classification



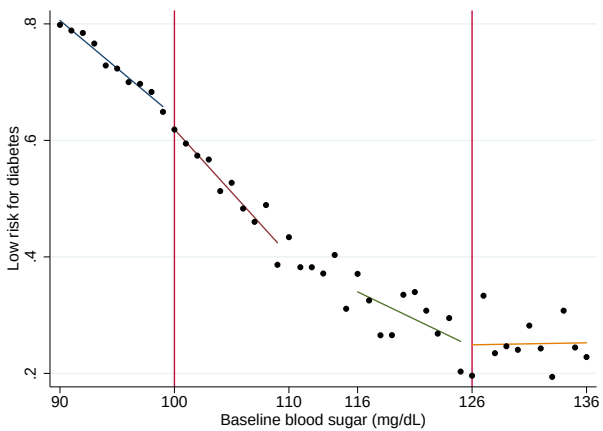
(a) Low risk for diabetes in round 2



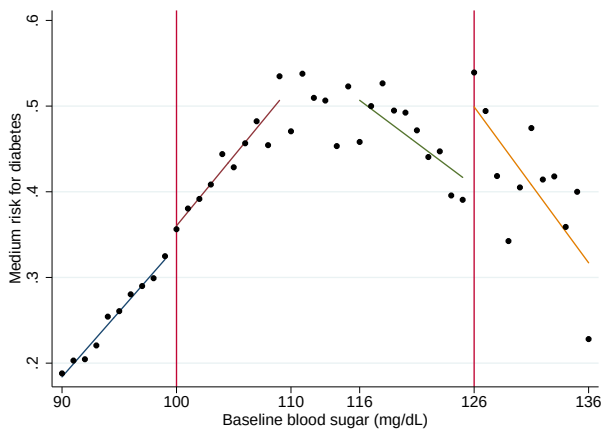
(b) Medium risk for diabetes in round 2



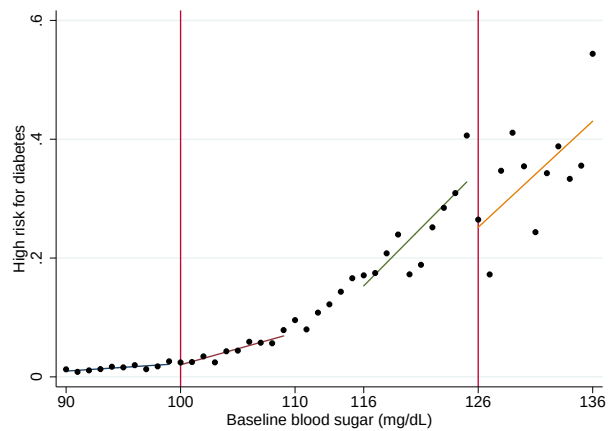
(c) High risk for diabetes in round 2



(d) Low risk for diabetes in round 3



(e) Medium risk for diabetes in round 3

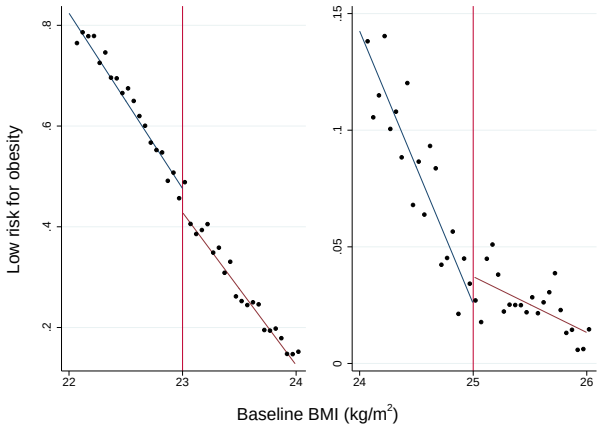


(f) High risk for diabetes in round 3

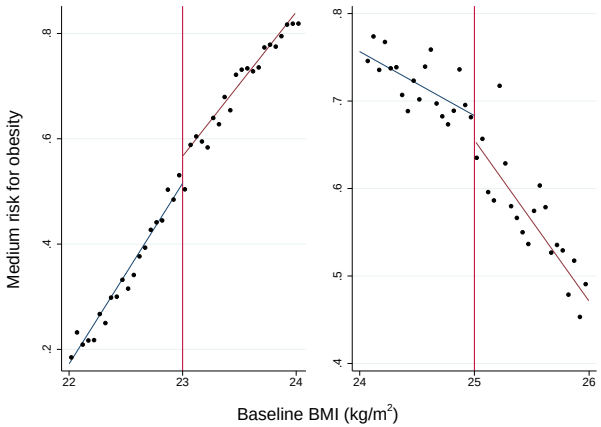
Impact on future diabetes risk classification

	Low risk in round 2	Medium risk in round 2	High risk in round 2	Low risk in round 3	Medium risk in round 3	High risk in round 3
Panel A. Medium risk cutoff 100						
RD Estimate	-0.023*	0.023*	-0.0003	-0.025**	0.028**	-0.004
	(0.010)	(0.011)	(0.005)	(0.007)	(0.007)	(0.004)
Mean of the Dep. Var.						
at [90, 100)	0.76	0.23	0.01	0.74	0.25	0.02
Observations	41,584	41,584	41,584	29,438	29,438	29,438
Panel B. High risk cutoff 126						
RD Estimate	0.015	0.027	-0.041	0.004	0.092*	-0.096+
	(0.035)	(0.029)	(0.042)	(0.040)	(0.034)	(0.050)
Mean of the Dep. Var.						
at [116, 126)	0.28	0.54	0.18	0.30	0.47	0.23
Observations	3,648	3,648	3,648	2,662	2,662	2,662

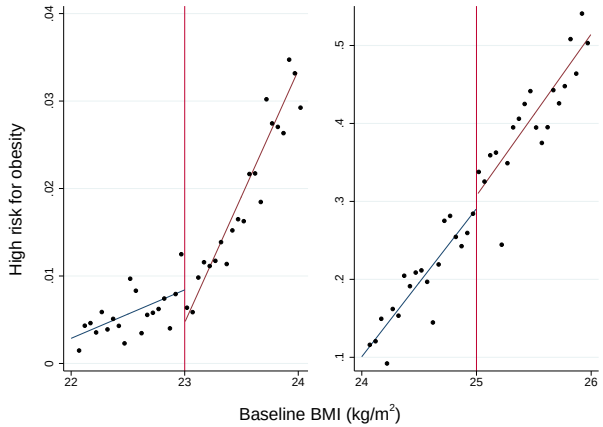
Impact on future obesity risk classification



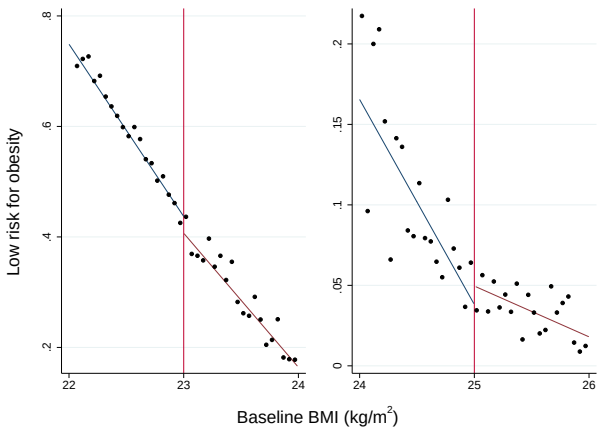
(a) Low risk for obesity in round 2



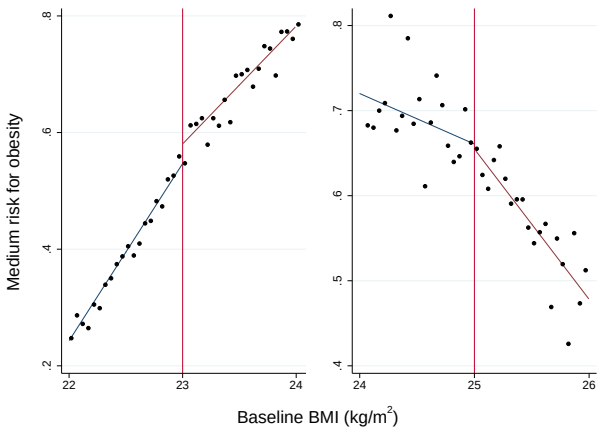
(b) Medium risk for obesity in round 2



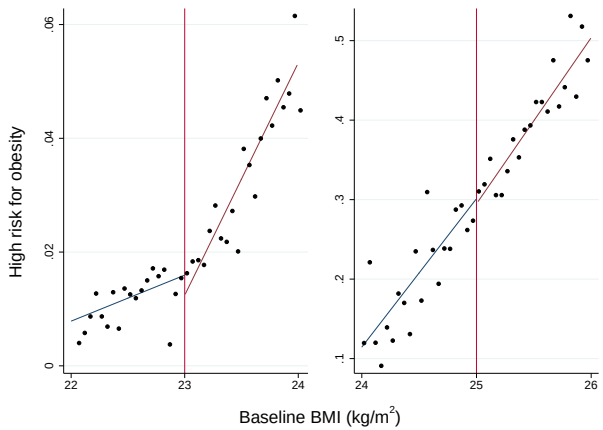
(c) High risk for obesity in round 2



(d) Low risk for obesity in round 3



(e) Medium risk for obesity in round 3

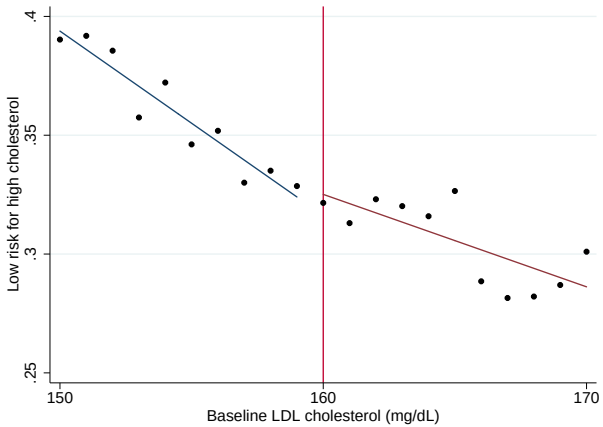


(f) High risk for obesity in round 3

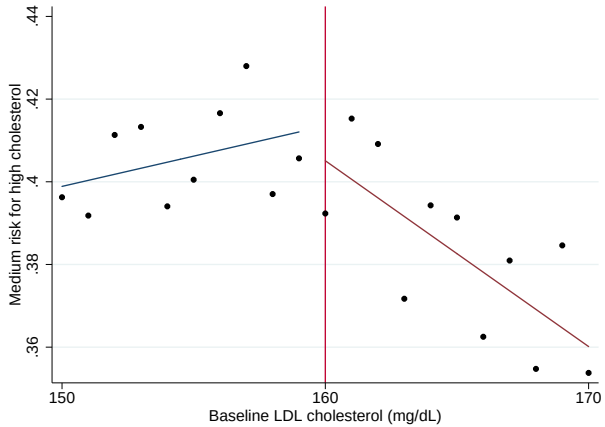
Impact on future obesity risk classification

	Low risk in round 2	Medium risk in round 2	High risk in round 2	Low risk in round 3	Medium risk in round 3	High risk in round 3
Panel A. Medium risk cutoff 23						
RD Estimate	-0.048**	0.051**	-0.004*	-0.030*	0.034*	-0.004
	(0.012)	(0.012)	(0.002)	(0.014)	(0.014)	(0.003)
Mean of the Dep. Var.						
at [22, 23)	0.65	0.35	0.01	0.59	0.40	0.01
Observations	64,108	64,108	64,108	44,657	44,657	44,657
Panel B. High risk cutoff 25						
RD Estimate	0.011	-0.028+	0.016	0.012	-0.006	-0.006
	(0.007)	(0.016)	(0.016)	(0.011)	(0.018)	(0.019)
Mean of the Dep. Var.						
at [24, 25)	0.08	0.72	0.20	0.10	0.69	0.22
Observations	11,741	11,741	11,741	7,467	7,467	7,467

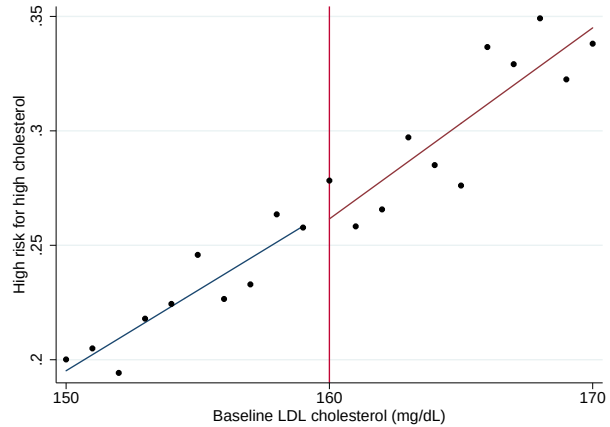
Impact on future high cholesterol risk classification



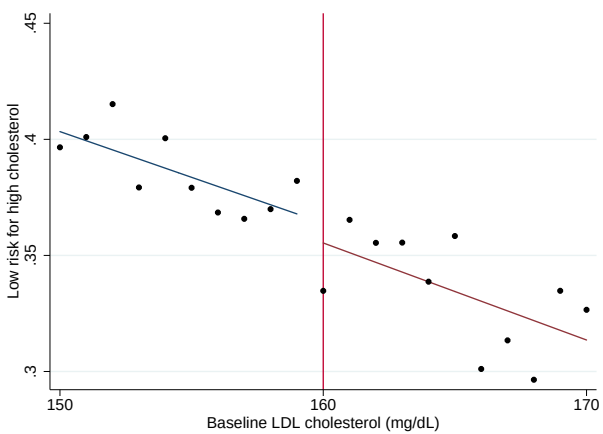
(a) Low risk for high cholesterol in round 2



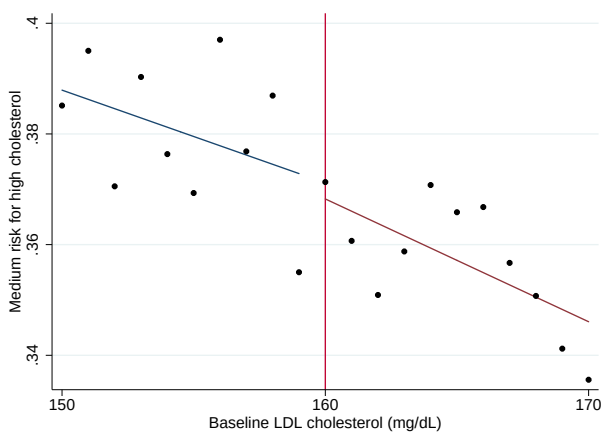
(b) Medium risk for high cholesterol in round 2



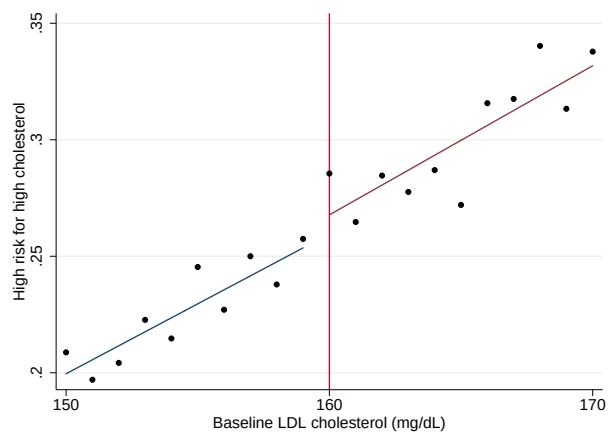
(c) High risk for high cholesterol in round 2



(d) Low risk for high cholesterol in round 3



(e) Medium risk for high cholesterol in



(f) High risk for high cholesterol in round

Impact on future high cholesterol risk classification

	Low risk in round 2	Medium risk in round 2	High risk in round 2	Low risk in round 3	Medium risk in round 3	High risk in round 3
Panel A. High risk cutoff 160						
RD Estimate	0.009	-0.009	-0.004	-0.008	-0.003	0.008
	(0.013)	(0.013)	(0.012)	(0.016)	(0.016)	(0.014)
Mean of the Dep. Var.						
at [150, 160)	0.36	0.41	0.22	0.39	0.38	0.22
Observations	21,978	21,978	21,978	14,775	14,775	14,775