From awareness to adverse selection? Intra-household allocations of health insurance in Nigeria

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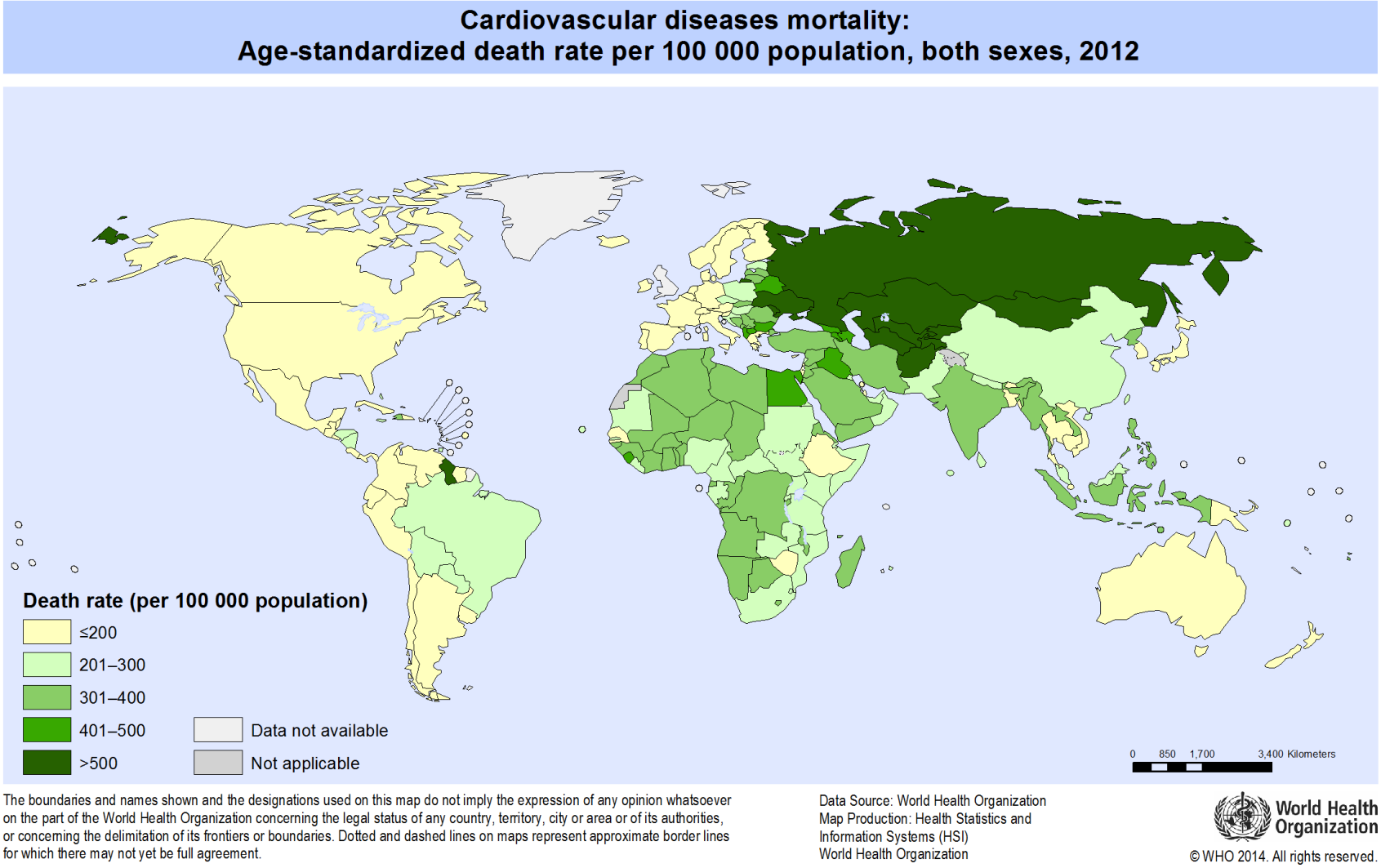
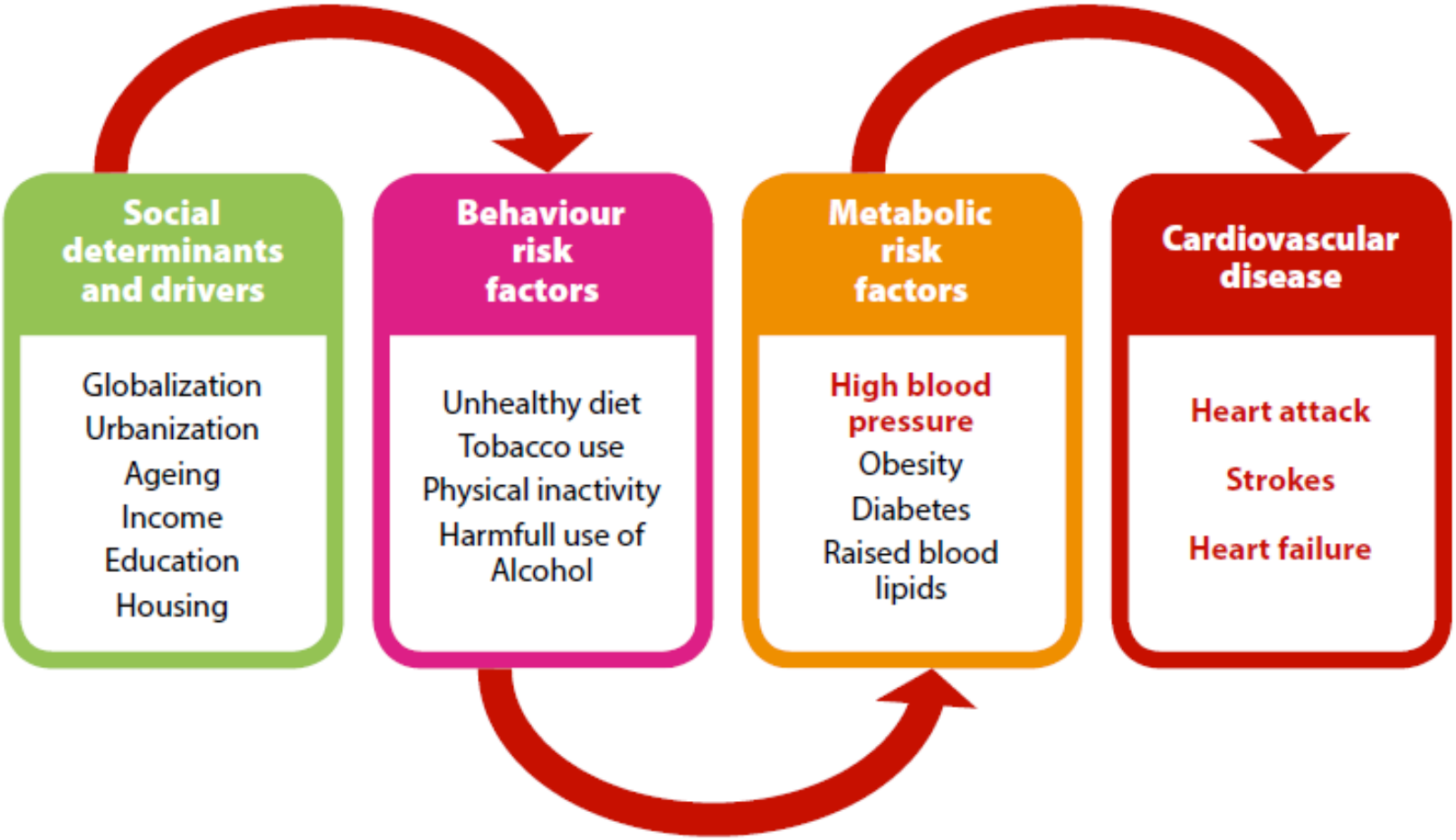
WHO (2014): Cardiovascular diseases (CVD) are #1 cause of death

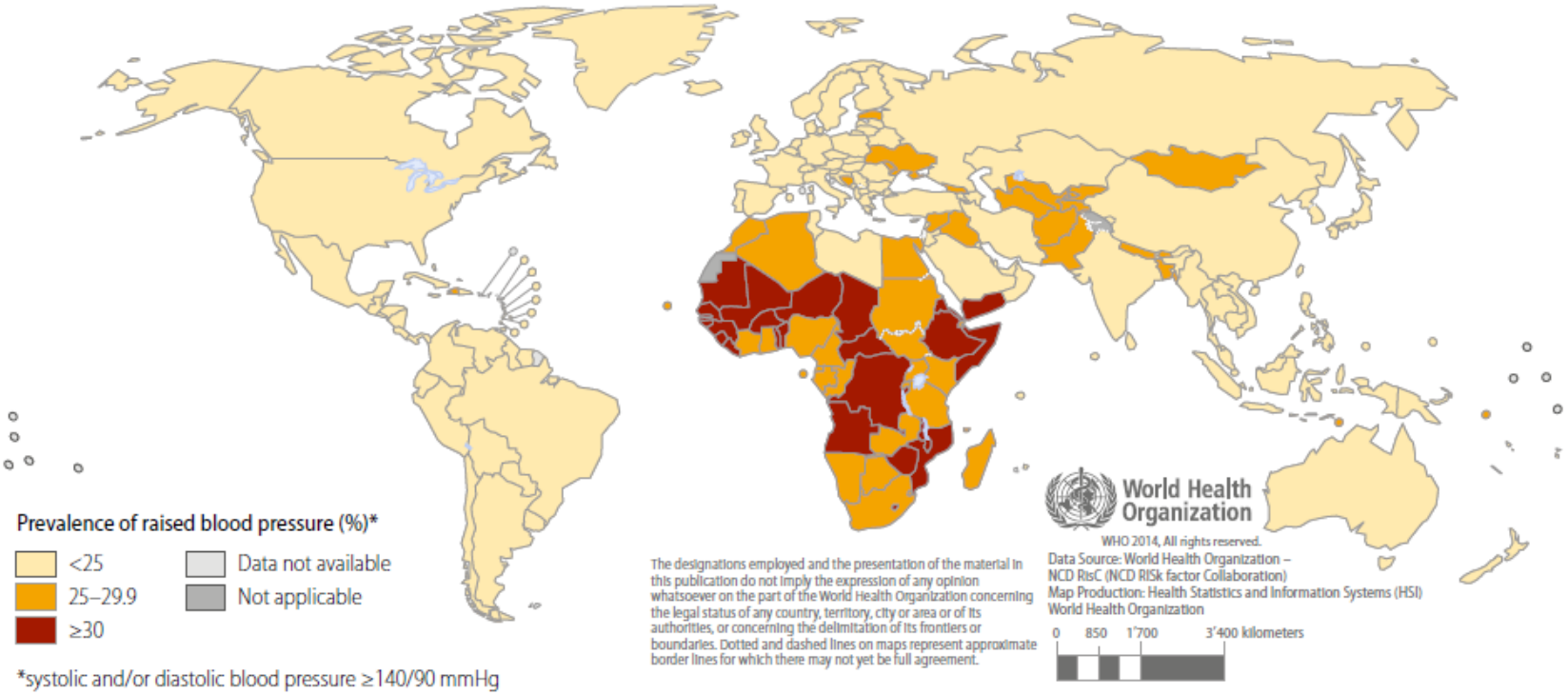


CVDs and their main drivers



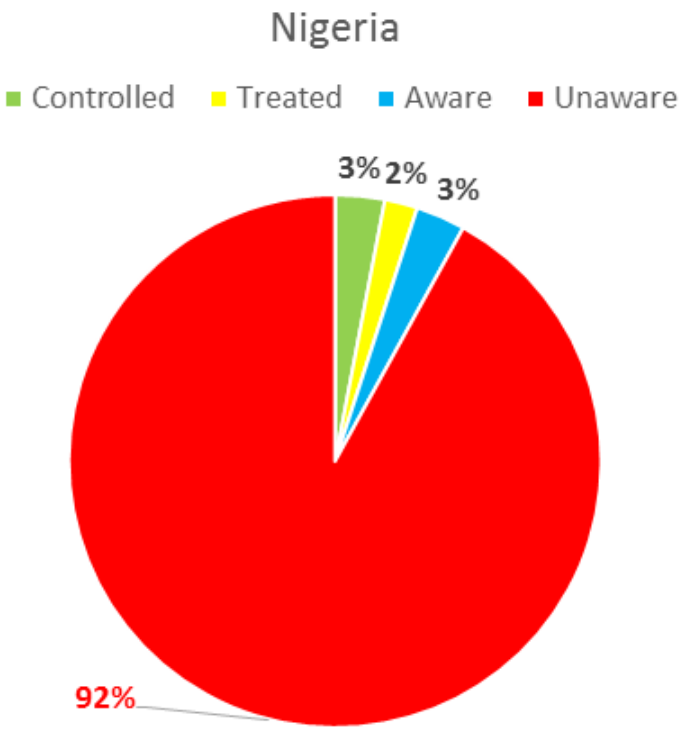
Hypertension: Most prevalent in African region

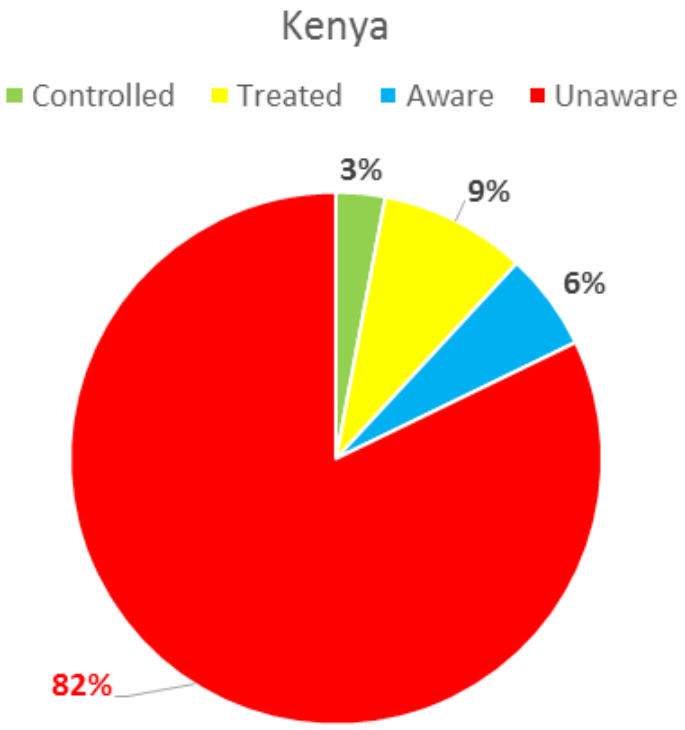
Figure: Prevalence of raised blood pressure in 2012 (female)



Low awareness in LMICs (Addo *et al.* 2007; Zhao *et al.* 2013)

Figure: Treatment status if raised blood pressure (Hendriks *et al.*, 2012)





Motivation and research objective

Medical literature: Prevention, early detection and counseling/medicines are cost-effective and health insurance can improve access (Di Cesare *et al.* 2013; Hogerzeil *et al.* 2013; Hendriks *et al.* 2014, 2015).

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- Adverse selection on CVD risk factors ⇒ Insurance companies may discourage enrollment of high-risk populations.

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This study: Estimate relation between CVD risk and enrollment.

Do households selectively enroll individuals with higher CVD risks?

- **Yes: mainly on age-related risk. Increased awareness and insurance induce adverse selection also on risk factors not related to age.**

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   - Sustainability of insurance as financing strategy for CVD treatment.

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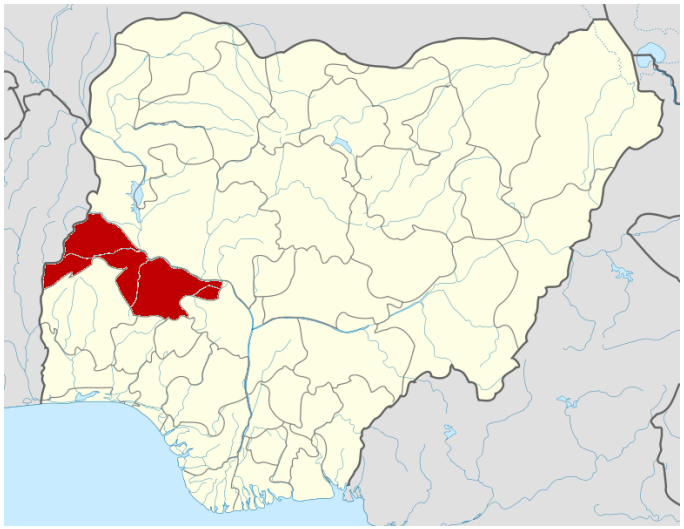
   - Sustainability of insurance as financing strategy for CVD treatment.
3. Effects of awareness and information on demand for and utilization of preventive health goods (Kremer and Glennerster 2011)
   - Does increased awareness also relate to demand for financial products enhancing access to prevention and treatment of CVDs?

CONTEXT & DATA

The Hygeia Community Health Care (HCHC) program



Kwara State, Nigeria:

- Launched in 2009
- Introducing insurance + upgrading of 2 facilities
- **Impact:** *Utilization* ↑ *Expenditures* ↓, *Hypertension* ↓

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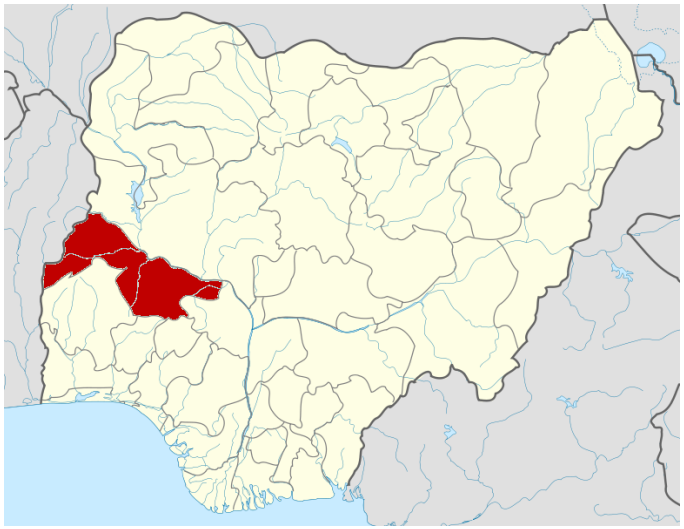

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- Comprehensive benefit package, including hospital admissions and consultations/tests/drugs for hypertension and diabetes.
- Premium is subsidized: Households pay 300 Naira ≈ \$ 2 (23.1 % of per capita health expenditures) per person per year.
- Individual-based instead of family-based enrollment

Data

- Representative household surveys collected in '09, '11 and '13:
- Each wave collected individual-level data on:
  - Age, gender, schooling, employment and income
  - Self-reported health, utilization and health examination
  - Enrollment in insurance
- Include households with at least two adults in a given round.
  - Total sample: 1,164 households (599 at $t = 0$, 565 at $t = 2$)
  - Complete data on health$_t$ and enrollment$_{t+2}$ for 83.4% (971)

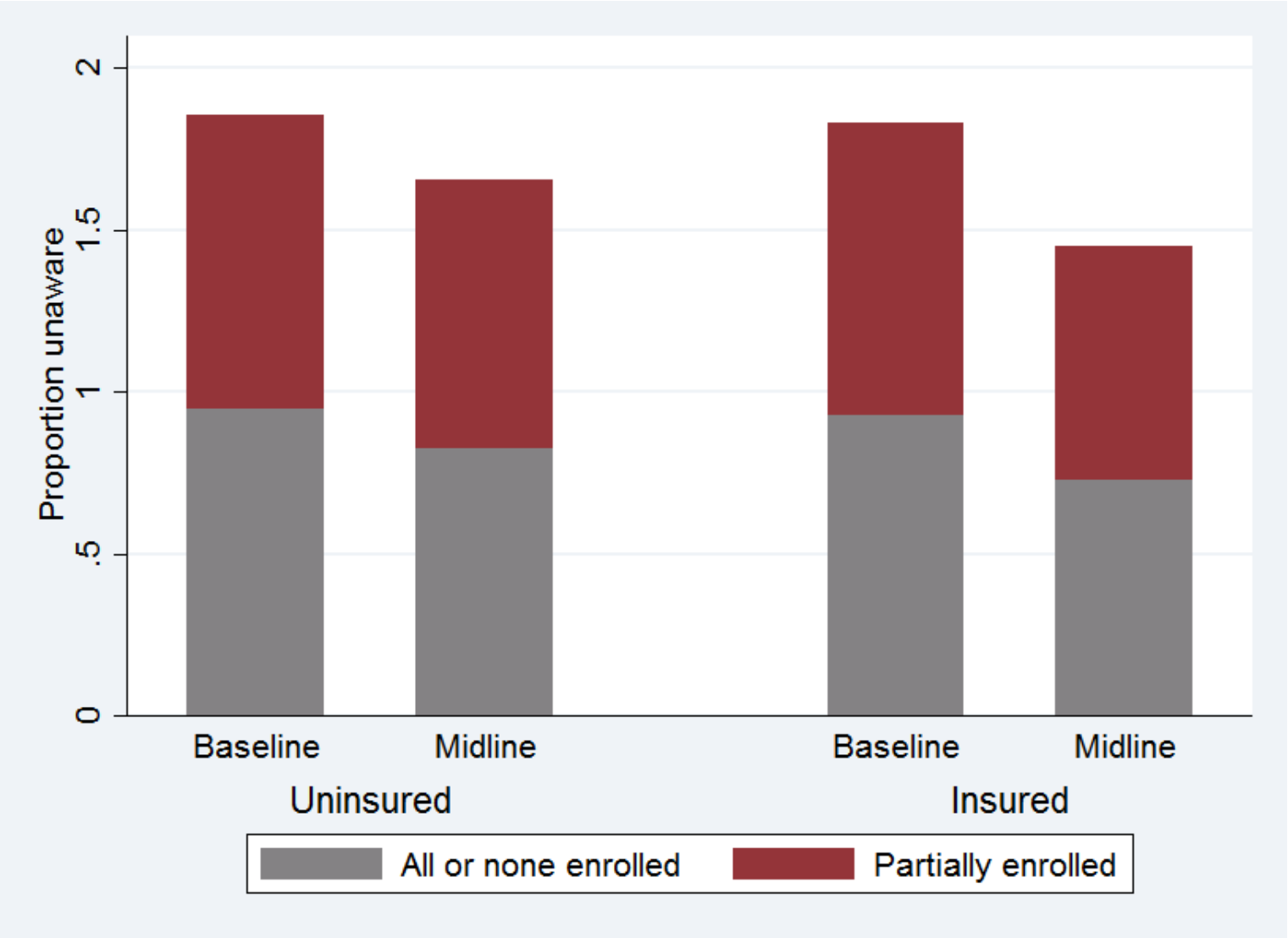
Table: Description of households in the analysis sample

		By enrollment in next survey		
	All allocations	Fully enrolled	Partially enrolled	None enrolled
	(1)	(2)	(3)	(4)
Observation at midline	0.483	0.406	0.515	0.539
Household lives in a town	0.477	0.611	0.481	0.325
Household size	5.342	5.207	5.819	5.059
Number of adults	2.414	2.277	2.689	2.316
Consumption (N 1,000)	85.39	93.38	82.13	79.53
Household head is literate	0.452	0.527	0.410	0.409
Farming main income source	0.475	0.367	0.481	0.588
Trading main income source	0.078	0.092	0.085	0.056
Household head is female	0.074	0.073	0.089	0.062
# household-years	973	357	293	323

Table: Description of individuals in the analysis sample

			By enrollment status	
	Mean value	Within std. dev.	Individual will enroll	Will not enroll
	(1)	(2)	(3)	(4)
Age	45.864	11.619	45.397	46.375
Female	0.543	0.475	0.568	0.516
BMI	22.902	6.576	23.280	22.491
Smoking	0.083	0.204	0.069	0.099
Diabetes	0.017	0.084	0.019	0.014
Raised blood pressure	0.244	0.324	0.238	0.250
High glucose in blood	0.012	0.074	0.014	0.009
Observations	2345		1221	1124

Reduction in unawareness of raised blood pressure



CARDIOVASCULAR DISEASE RISK SCORE

CVD risk: Framingham risk score

10-year risk of developing any CVD (D'Agostino *et al.* 2008)

- Framingham heart study: Joint cohort study of National Heart, Lung and Blood Institute and Boston University
- Risk score based on 8,491 Framingham study participants validated for different ethnic groups
- Risk score available that is based on non-laboratory predictors.

Framingham risk score

$$F_i = 1 - 0.948 Fem_i^{\exp(\beta_{Fem} X_i - 26.01)} - 0.884 Male_i^{\exp(\beta_{Male} X_i - 23.94)}$$

where βX_i is a linear function of included risk factors:

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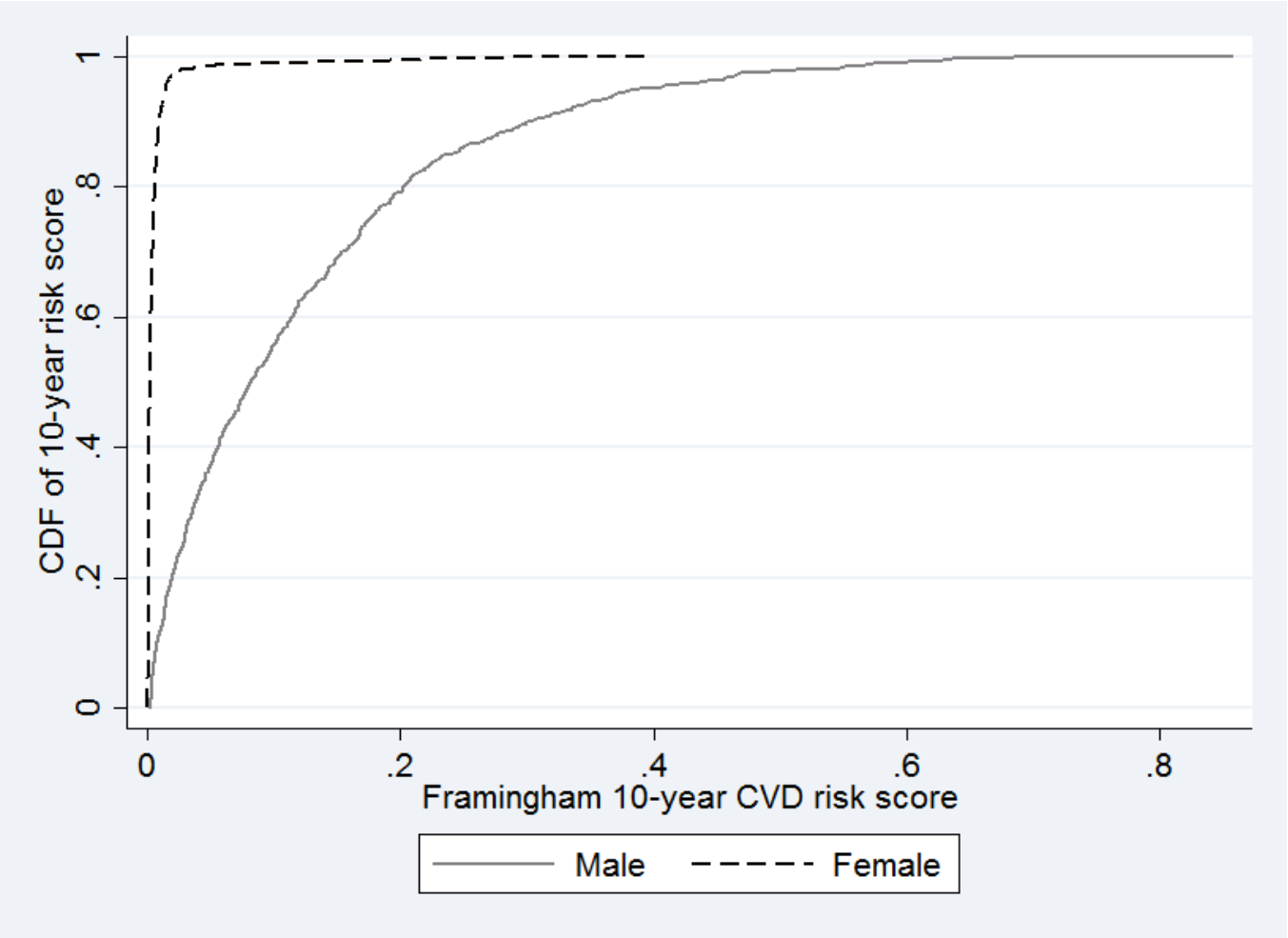
where βX_i is a linear function of included risk factors:

$$\beta_{Fem} X_i = 2.72 LnAge_i + 0.511 LnBMI_i + 2.81 LnSBP_i + \\ 0.072 LnSBP_i * BP\ treated_i + 0.619 Smoking_i + 0.778 Diabetes_i$$

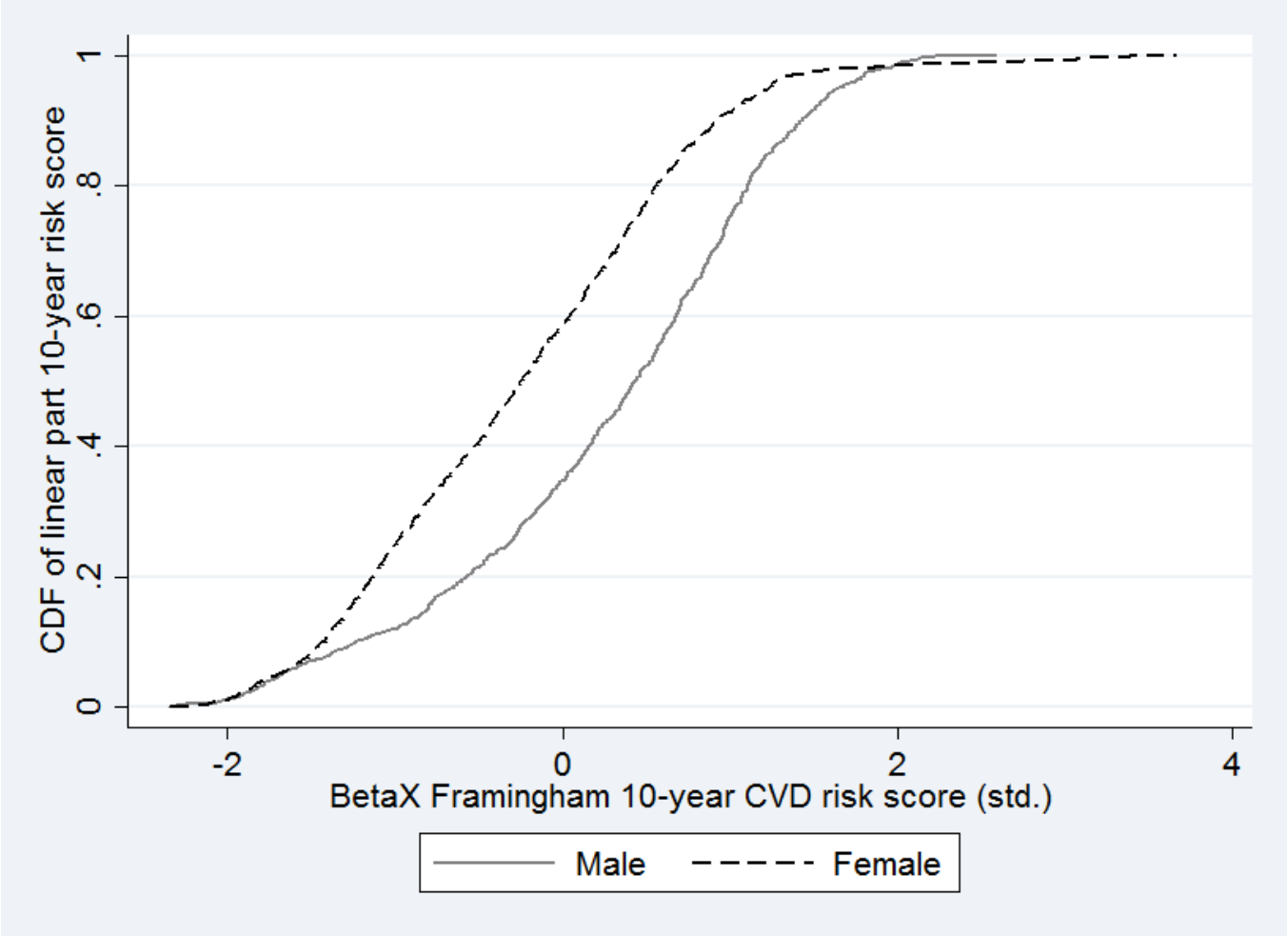
$$\beta_{Male} X_i = 3.11 LnAge_i + 0.793 LnBMI_i + 1.86 LnSBP_i + \\ 0.070 LnSBP_i * BP\ treated_i + 0.710 Smoking_i + 0.532 Diabetes_i$$

Distribution of Framingham risk score

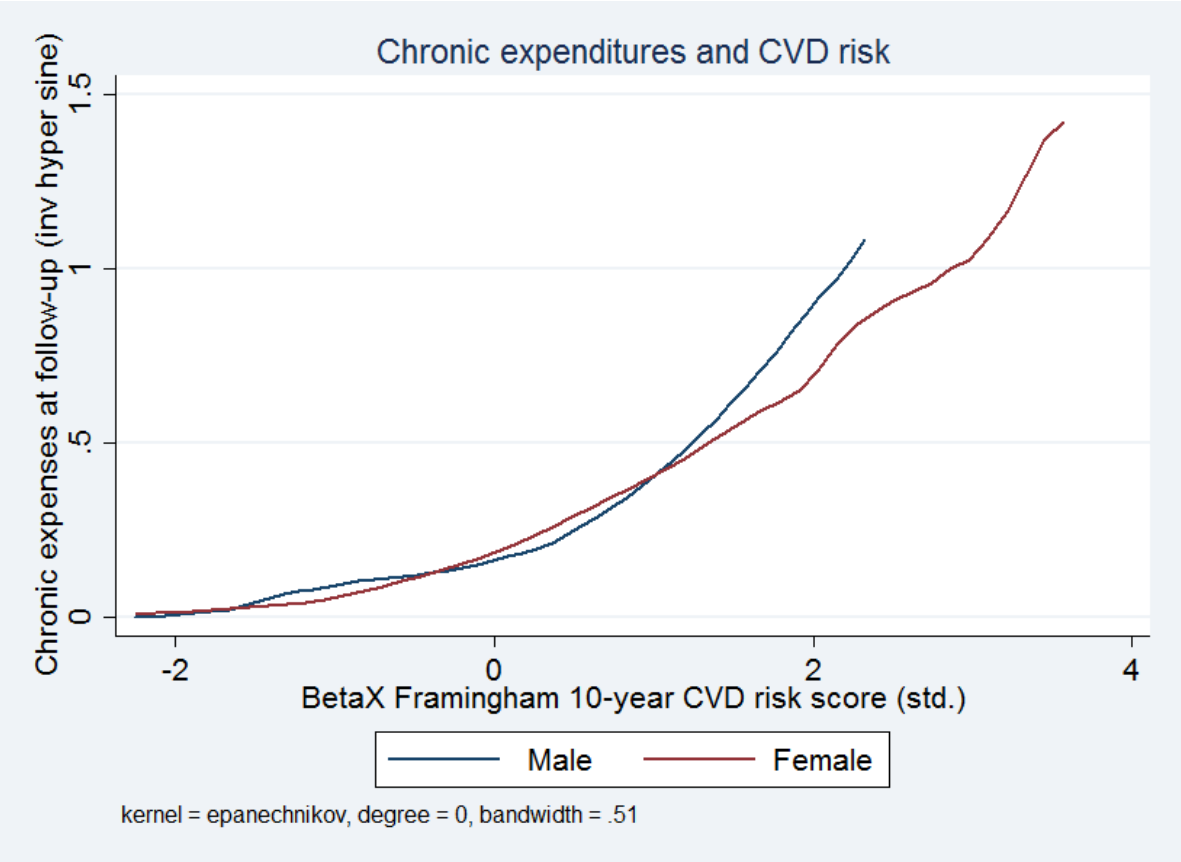


- Average Framingham risk score: $F_M = 0.124$ and $F_F = 0.006$.

Distribution linear part of Framingham risk score



Chronic expenditures at follow-up in control group



- Score up by 1 std. dev. $\Rightarrow$ Expenditures up by 18.3% (F) to 29.8% (M).
- R-squared within households: 9.95%
- Age- and non-age-related components have similar effects

ECONOMETRIC STRATEGY

Econometric strategy

Main specification relates future enrollment to current risk score:

$$Enrolls_{iht+2} = \alpha + Risk_{iht}\beta + Z_{iht}\gamma + \eta_{ht} + \epsilon_{iht}$$

- Baseline health linked to midline enrollment; midline health linked to endline enrollment

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- Controls: Female, reports CVD, insurance status (midline)
- Household fixed effects η_{ht} control for time-varying household and decision-maker characteristics
- Standard errors ϵ_{iht} clustered by census area

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- Household fixed effects η_{ht} control for time-varying household and decision-maker characteristics
- Standard errors ϵ_{iht} clustered by census area
- Separate tables will show model estimated for
  1. Observations from baseline to midline
  2. Uninsured households observed from midline to endline
  3. (Partially) insured households observed from midline to endline

RESULTS

Findings

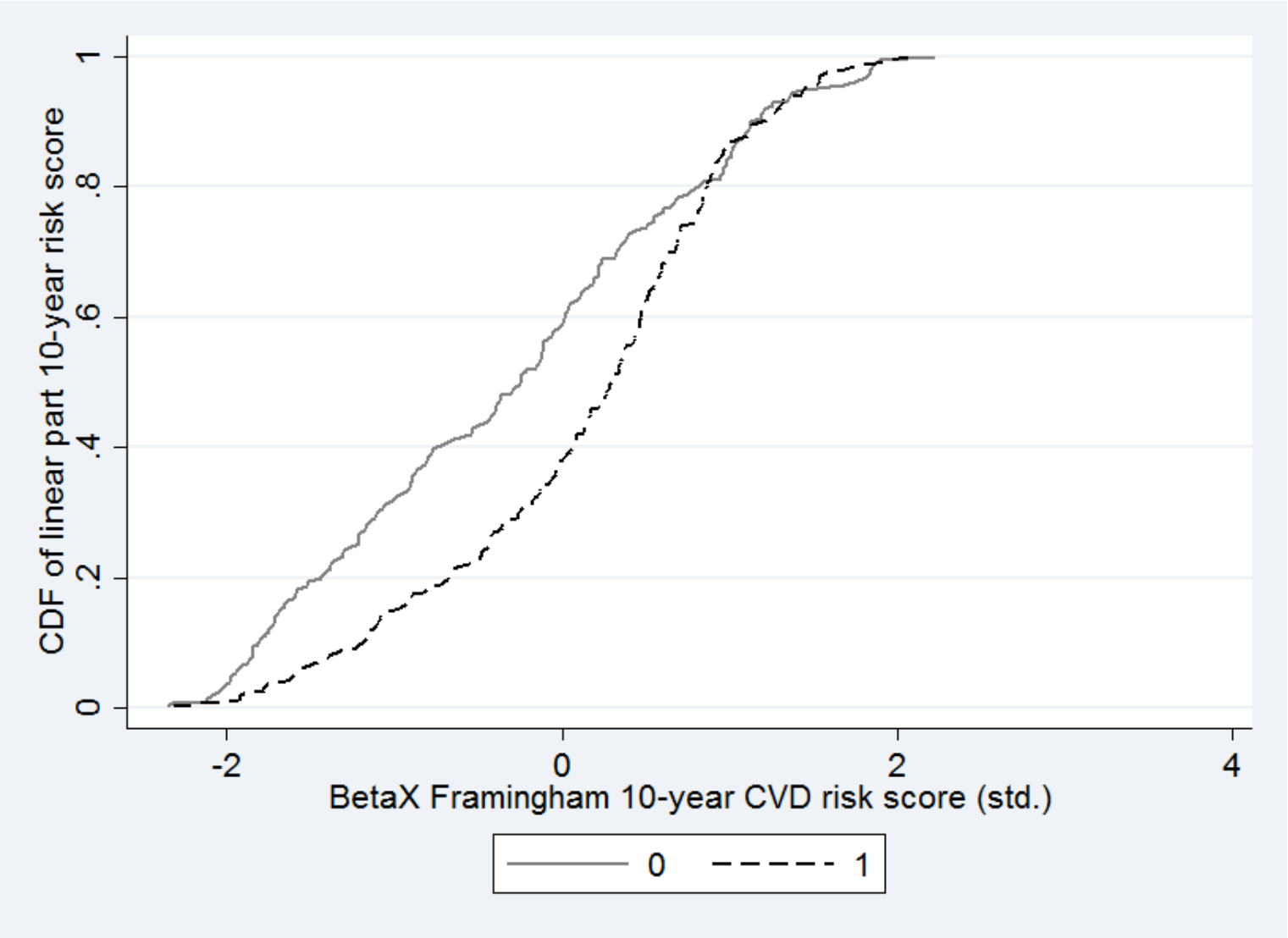
1. Risk - related to age and non-age factors - predicts chronic expenditures in uninsured control group
2. From baseline to midline, adverse selection on CVD risk

Table: Dependent variable: Enrolls between baseline and midline

	All households		Partially enrolled	
	(1)	(2)	(3)	(4)
Baseline risk score	0.006	0.099***	0.123***	0.215***
	(0.017)	(0.017)	(0.023)	(0.033)
Female	0.037	0.098***	0.184***	0.249***
	(0.022)	(0.020)	(0.055)	(0.062)
Reports CVD	0.059	-0.203**	-0.223**	-0.480**
	(0.078)	(0.090)	(0.109)	(0.182)
Fixed effects	No	Yes	No	Yes
Individuals	1215	1215	388	388
Households	503	503	142	142
R-sq. (within)	0.002	0.061	0.081	0.137
Mean dep. var.	0.565	0.565	0.518	0.518

Clustered std. errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Baseline risk for households partially enrolled at midline



Findings

1. Risk - related to age and non-age factors - predicts chronic expenditures in uninsured control group
2. From baseline to midline, adverse selection on CVD risk
   - This effect is solely driven by age component of risk score

Table: Dependent variable: Enrolls between baseline and midline

	All households		Partially enrolled	
	(1)	(2)	(3)	(4)
Age-related risk	0.011	0.093***	0.129***	0.228***
	(0.015)	(0.013)	(0.020)	(0.030)
Non age-related risk	-0.025	-0.026	-0.127**	-0.198**
	(0.037)	(0.024)	(0.055)	(0.078)
Female	0.081	0.246***	0.493***	0.769***
	(0.058)	(0.039)	(0.095)	(0.130)
Reports CVD	0.080	-0.125	-0.139	-0.316
	(0.079)	(0.092)	(0.109)	(0.189)
Fixed effects	No	Yes	No	Yes
Individuals	1215	1215	388	388
Households	503	503	142	142
R-squared (within)	0.002	0.076	0.110	0.187
Mean dep. var.	0.565	0.565	0.518	0.518
P(Age = NonAge)	0.4096	0.0000	0.0002	0.0000

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3. From midline to endline, heterogeneity in the results:
   - Uninsured households: No adverse or advantageous selection

Table: Dependent variable: Enrolls between midline and endline. Previously uninsured households.

	All households		Partially enrolled	
	(1)	(2)	(3)	(4)
Age-related risk	-0.074**	-0.042	-0.032	-0.107*
	(0.029)	(0.026)	(0.035)	(0.057)
Non age-related risk	-0.043	-0.053	-0.225	-0.316
	(0.049)	(0.045)	(0.203)	(0.295)
Female	-0.079	-0.021	0.243	0.174
	(0.084)	(0.084)	(0.288)	(0.404)
Reports CVD	0.053	0.205*	0.748***	1.552***
	(0.114)	(0.120)	(0.192)	(0.338)
Fixed effects	No	Yes	No	Yes
Individuals	286	286	78	78
Households	120	120	30	30
R-sq. (within)	0.039	0.029	0.072	0.148
Mean dep. var.	0.237	0.237	0.482	0.482

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   - Uninsured households: No adverse or advantageous selection
   - Insured households: Only among members who were insured between baseline and midline, and members reporting CVDs

Table: Dependent variable: Enrolls between midline and endline. Previously insured households.

	All households		Partially enrolled	
	(1)	(2)	(3)	(4)
Age-related risk	-0.018	-0.040	-0.046	-0.070
	(0.037)	(0.037)	(0.042)	(0.070)
... *Insured	0.022	0.062	0.081*	0.129*
	(0.041)	(0.038)	(0.047)	(0.075)
Non age-related risk	-0.073	-0.063	-0.230**	-0.345**
	(0.067)	(0.067)	(0.094)	(0.142)
... *Insured	0.086	0.087	0.254***	0.369***
	(0.064)	(0.062)	(0.071)	(0.126)
Fixed effects	No	Yes	No	Yes
Individuals	844	844	317	317
Households	348	348	317	317
R-squared (within)	0.060	0.103	0.161	0.224
Mean dep. var.	0.558	0.558	0.509	0.509

Controls: Female, insured (main effect), reports CVD.

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	All households		Partially enrolled	
	(1)	(2)	(3)	(4)
Age-related risk	-0.010	0.001	0.003	0.003
	(0.017)	(0.020)	(0.023)	(0.047)
... *Reports CVD	0.067	0.050	0.153	0.264
	(0.045)	(0.040)	(0.105)	(0.186)
Non age-related risk	0.030	0.006	-0.047	-0.067
	(0.053)	(0.042)	(0.069)	(0.108)
... *Reports CVD	-0.015	0.034	0.163**	0.239*
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Controls: Female, insured, reports CVD (main effect).

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Conclusion

- Health insurance can improve prevention, early detection and treatment of CVDs but may be subject to adverse selection
- Test for selection on CVD risk in highly unaware population:
  - Age-related and non-age-related factors predict chronic expenditures in uninsured control group
  - Selection in first-time enrollment driven by age-related risk; selection on non-age related risk becomes stronger over time
  - Effect concentrated among previously insured individuals and those who are aware they are at risk

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  - Selection in first-time enrollment driven by age-related risk; selection on non-age related risk becomes stronger over time
  - Effect concentrated among previously insured individuals and those who are aware they are at risk
- Awareness and insurance coverage lead to adverse selection:
  - Risk adjustment/targeted subsidies in first-time enrollment to compensate providers for enrolling the elderly
  - Insurance may not be the most appropriate strategy to finance treatment of CVDs

Thank you!