The Causal Effect of Medicaid on Mortality: New Evidence from the Universe of Low-Income Adults

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Evolution of the literature on health insurance and mortality

- Given Medicaid's outsized and growing importance, understanding its effect on mortality is crucial
- Until recently, an extensive literature offered "limited reliable evidence on how health insurance affects health" beyond certain sub-populations (Levy and Meltzer 2008)
- Miller, Johnson, and Wherry (2021) and Goldin, Lurie, and McCubbin (2021) challenged this view using large-scale individual data and compelling designs, finding that insurance substantially reduces mortality for older adults
- A remaining question is whether, and by how much, insurance affects mortality in the general adult population

New evidence from the universe of low-income adults

- In this paper, we examine the causal effect of Medicaid on mortality in the general adult population, adhering to a pre-registered analysis plan (link)
- We identify the U.S. population of low-income, non-disabled adults likely to have gained eligibility under the ACA expansions and earlier waivers by linking the 2010 Census to administrative tax and disability program data
- We then link these individuals to administrative Medicaid and mortality data and use the adoption and timing of expansions across states to identify effects on mortality
- We also examine heterogeneity and estimate the model on samples that align with those used in prior studies

Preview of key findings

- We estimate that expansions led to a 12 ppt increase in the enrollment of low-income, non-disabled adults and reduced the annual mortality hazard by about 2.5% in expansion states compared to non-expansion states
- Assuming no spillovers, this suggests a 21% reduction in the mortality hazard of people who enrolled in Medicaid
- Proportional treatment-on-the-treated estimates are not significantly different across subsets of the population by age, race, gender, family status, income, and employment
- Estimates suggest Medicaid expansions cost $5.5 million per life saved or about $168,000 per life-year saved, well below common valuations of a statistical life and life-year

Contributions

- We add to a growing body of evidence that insurance, and Medicaid in particular, improves health, while also suggesting that mortality reductions are not limited to older adults and improving the precision of estimates
- Mortality reductions do not appear to be limited to the near elderly, as found in prior work – our estimates are general to the entire population of potential beneficiaries under recent expansions
- Estimates suggest that expansions of Medicaid to low-income adults under the ACA and earlier expansions may be cost-effective based on mortality reductions alone

Data and Methods

Identifying the population targeted by Medicaid expansions

- We link anonymized individual data from the 2010 Census to administrative tax data to identify adults in families with income below 138% of the poverty line
  - We estimate income by linking these individuals to the universe of 1040 records, W-2s, and 1099-Rs
- We also exclude people indicated as receiving SSI or DI in 2009 Medicare and Medicaid data from our main analyses because they were eligible for public insurance prior to expansions

Data on Medicaid enrollment and mortality

- We observe Medicaid enrollment by linking our sample to administrative datasets from the Centers for Medicare and Medicaid Services (2005-2019)
- We obtain death dates by linking our sample to the Census Bureau's Numerical Identification File, or "Numident" (2010-2022)
  - The Numident, which is derived from Social Security Administration (SSA) records, has been shown to be a "high-quality and timely source of data to study all-cause mortality" (Finlay and Genadek 2021)

Estimating the effect of expansions on Medicaid enrollment

- To estimate the effect of the expansion on enrollment, we consider the following model, where Y_{ist} is a measure of Medicaid enrollment for person *i* in state *s* and year *t:*

$$Y_{ist} = \tau * 1\{t \geq t_s^*\} + \delta_s + \delta_t + \gamma' X_{ist} + \epsilon_{ist}$$

- τ is the average effect of expansion on enrollment; δ_s and δ_t are state and year fixed effects; X_{ist} is a vector of covariates; t_s^* is the year state *s* expanded Medicaid to low-income adults
- To assess parallel trends, we also estimate an event study specification where the post-period indicator is replaced with a sum of event time dummies

Estimating the effect of expansions on mortality hazard

- We specify the mortality hazard $\lambda_i(t)$ using a discrete time model with a non-parametric baseline hazard, which we parameterize using a proportional form:

$$\lambda_i(t) = \lambda_0(t)\exp(z_i(t)'\beta)$$

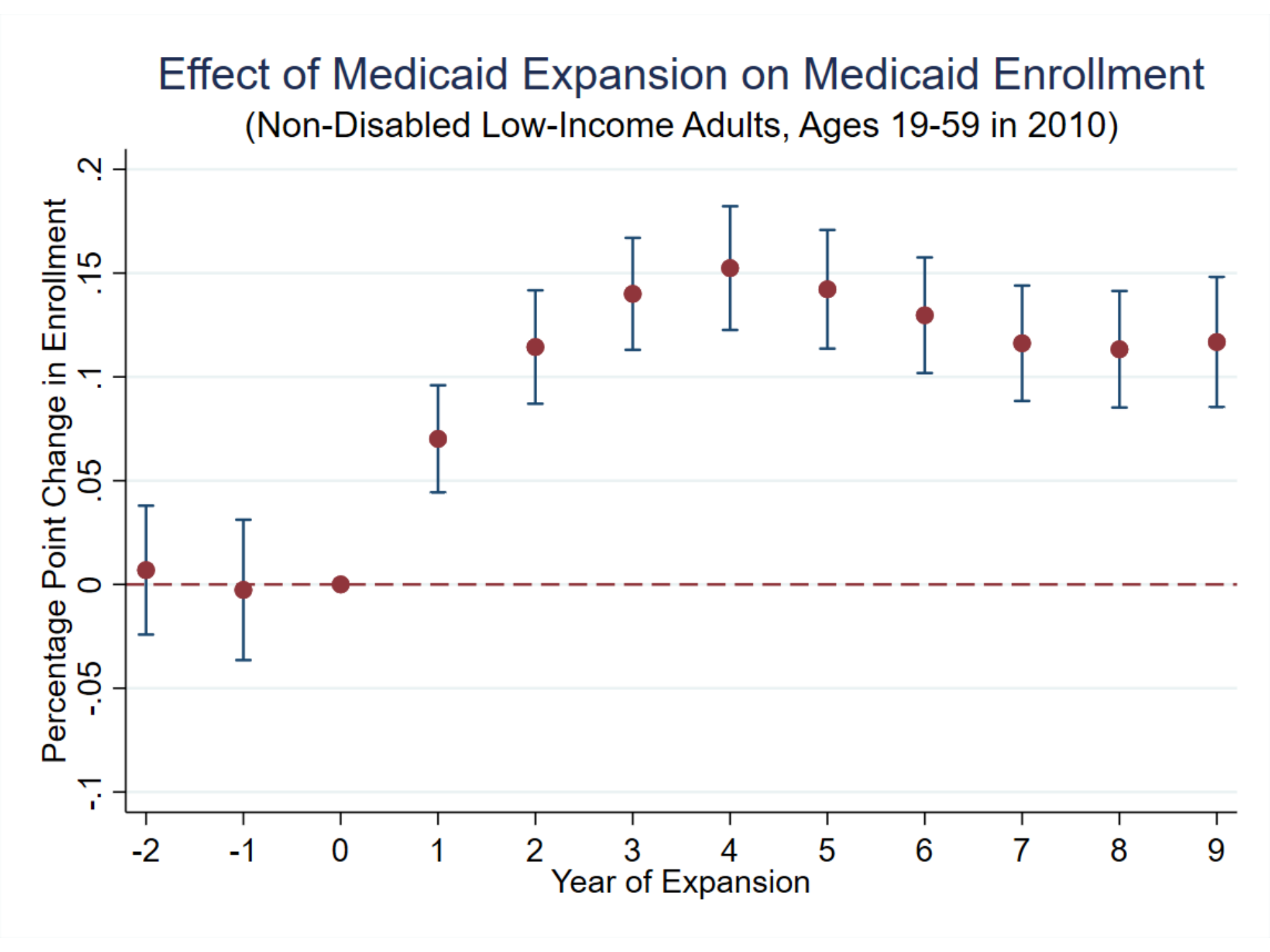
  - $\lambda_0(t)$ is the unknown annual baseline hazard in year t, $z_i(t)$ is a vector of time-dependent explanatory variables (covariates) for individual i, β is a vector of parameters to be estimated
- To estimate the expansions' effect on mortality hazard, we let

$$z_{ist}(t)'\beta = \tau * 1\{t \geq t_s^*\} + \delta_s + \delta_t + \gamma' X_{ist}$$

Results

Table 1: Summary Statistics for Non-Disabled Adults with Income <1.38 x Federal Poverty Level (FPL) (Ages 19-59 in 2010)

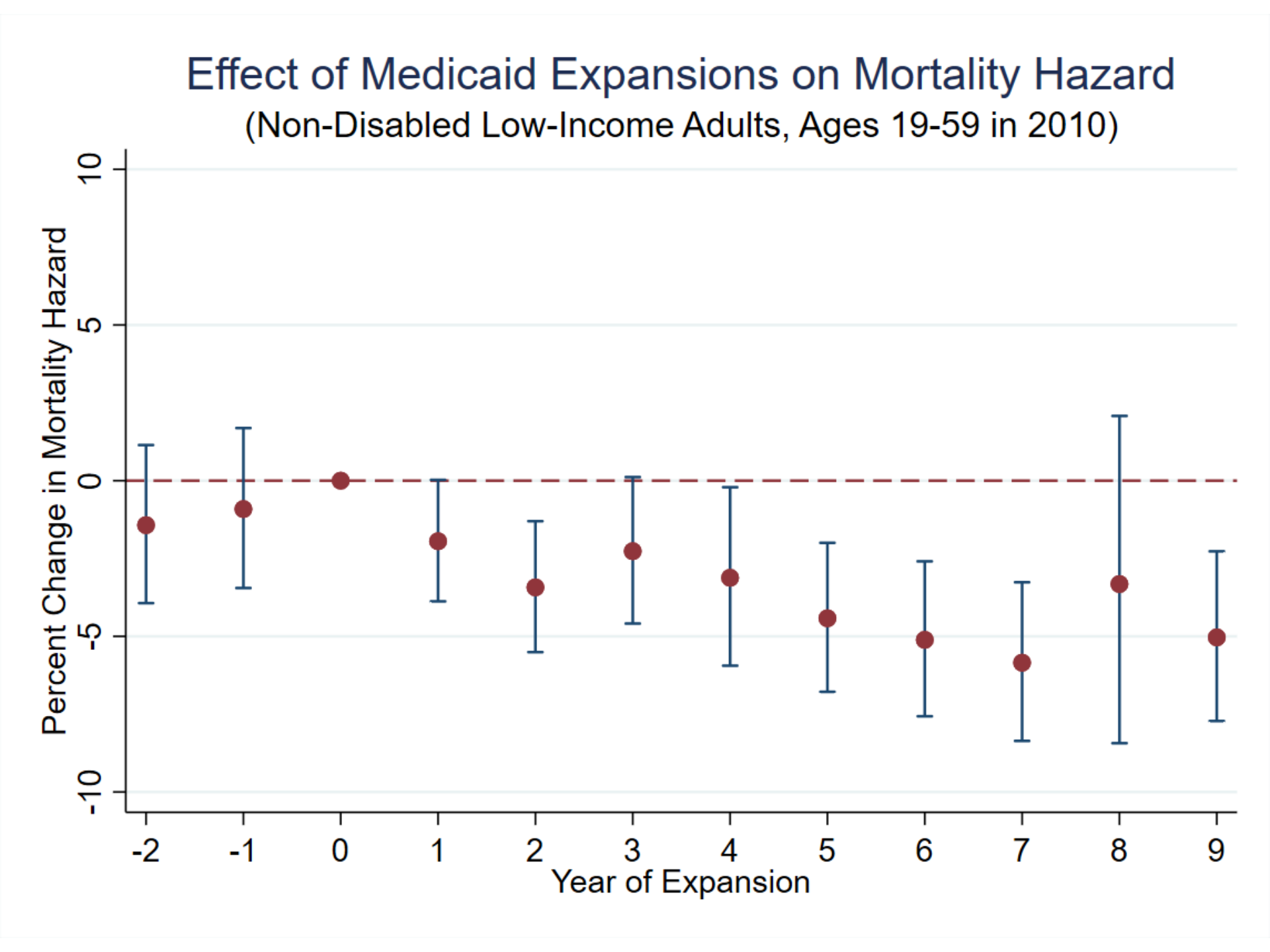
Died in 2010-2022	0.0504
Medicaid in 4/2010	0.2581
Age in 2010	
Mean	34.61
19-24	0.2666
25-29	0.1616
30-34	0.1198
35-39	0.1026
40-44	0.0986
45-49	0.0946
50-54	0.0830
55-59	0.0651
Female	0.5189
Black	0.1766
Other Race	0.1657
Hispanic	0.2082
Married	0.2573
Parent	0.3694
Income in 2009	
None	0.2583
0-0.5 x FPL	0.2304
0.5-1 x FPL	0.2933
1-1.38 x FPL	0.2180
Employed in 2009	0.7520
N (Weighted)	42,270,000
N (Unweighted)	37,460,000


Effect of Medicaid Expansion on Medicaid Enrollment
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percentage Point Change in Enrollment
-.1
-.05
0
.05
.1
.15
.2
-2
-1
0
1
2
3
4
5
6
7
8
9
Year of Expansion

Difference-in-Differences Estimates of Effect of Medicaid Expansion on Medicaid Enrollment (Ever Enrolled in Year)

Sample:	Non-Disabled	All
Post x expansion	0.117***	0.106***
	(0.017)	(0.016)
N (People x years, millions)	441.2	489.3
N (People, millions)	37.5	41.9
Mean Medicaid Enrollment		
Expansion states (pre-period)	0.24	0.30
Non-expansion states	0.20	0.25
Demographic controls	Yes	Yes
Fixed effects	State, Year	State, Year
SE clustering	State	State

Notes: Sample includes adults with 2009 income < 1.38x the Federal Poverty Level (FPL) according to administrative tax data who were ages 19-59 in 2010.


Effect of Medicaid Expansions on Mortality Hazard
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percent Change in Mortality Hazard
10
5
0
-5
-10
-2
-1
0
1
2
3
4
5
6
7
8
9
Year of Expansion

Effect of Medicaid Expansion on Mortality Hazard (Proportional Change in the Mortality Hazard)

	Non-Disabled	All
Post x expansion	-2.46%**	-1.27%*
95% CI	(-4.52%, -0.40%)	(-25.96%, 2.15%)
N (People x years, millions)	441.2	489.3
N (People, millions)	37.5	41.9
Demographic controls	Yes	Yes
Fixed effects	State, Year	State, Year
SE clustering	State	State

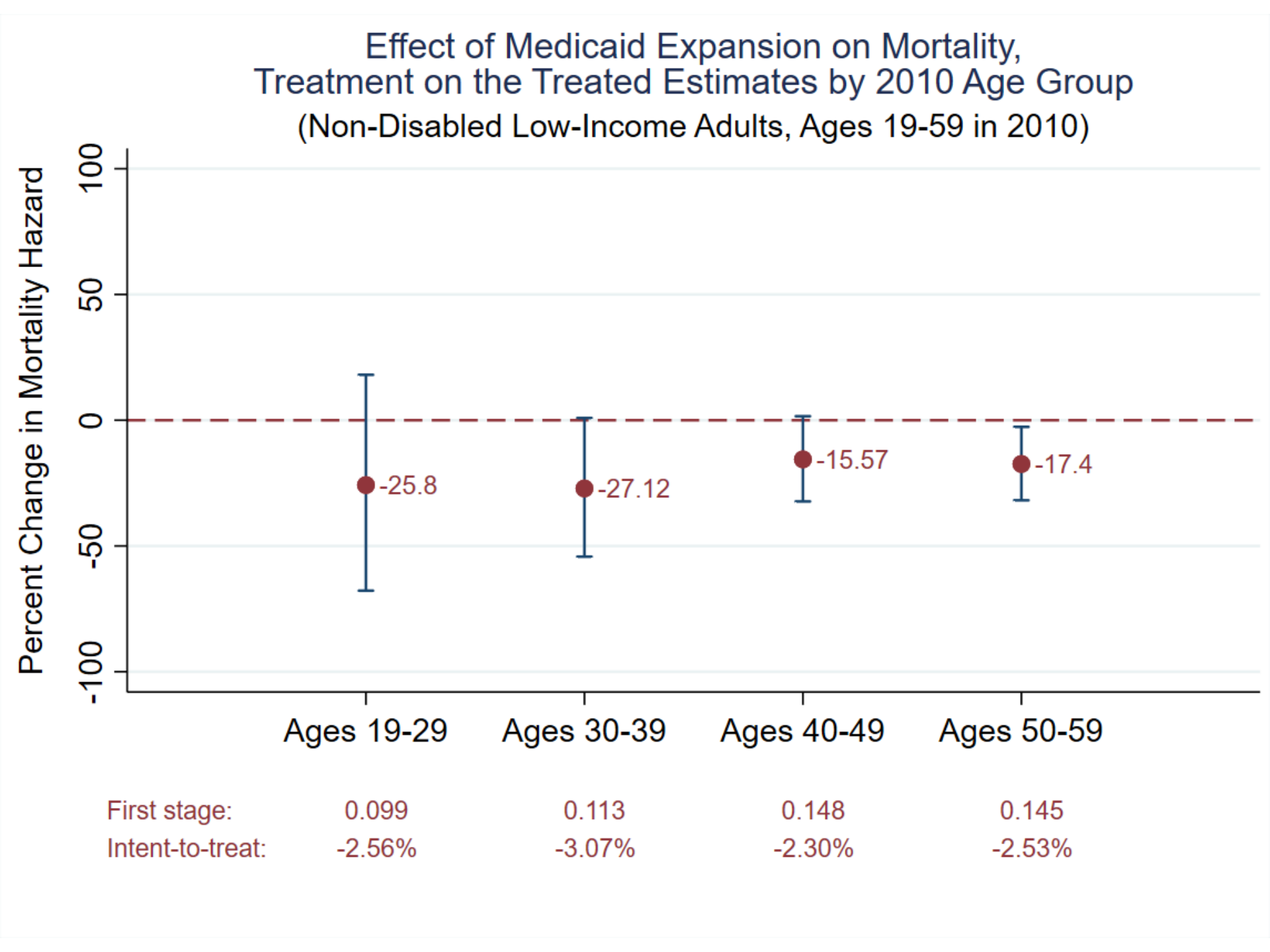
Notes: Sample includes adults with 2009 income < 1.38x the Federal Poverty Level (FPL) according to administrative tax data who were ages 19-59 in 2010.

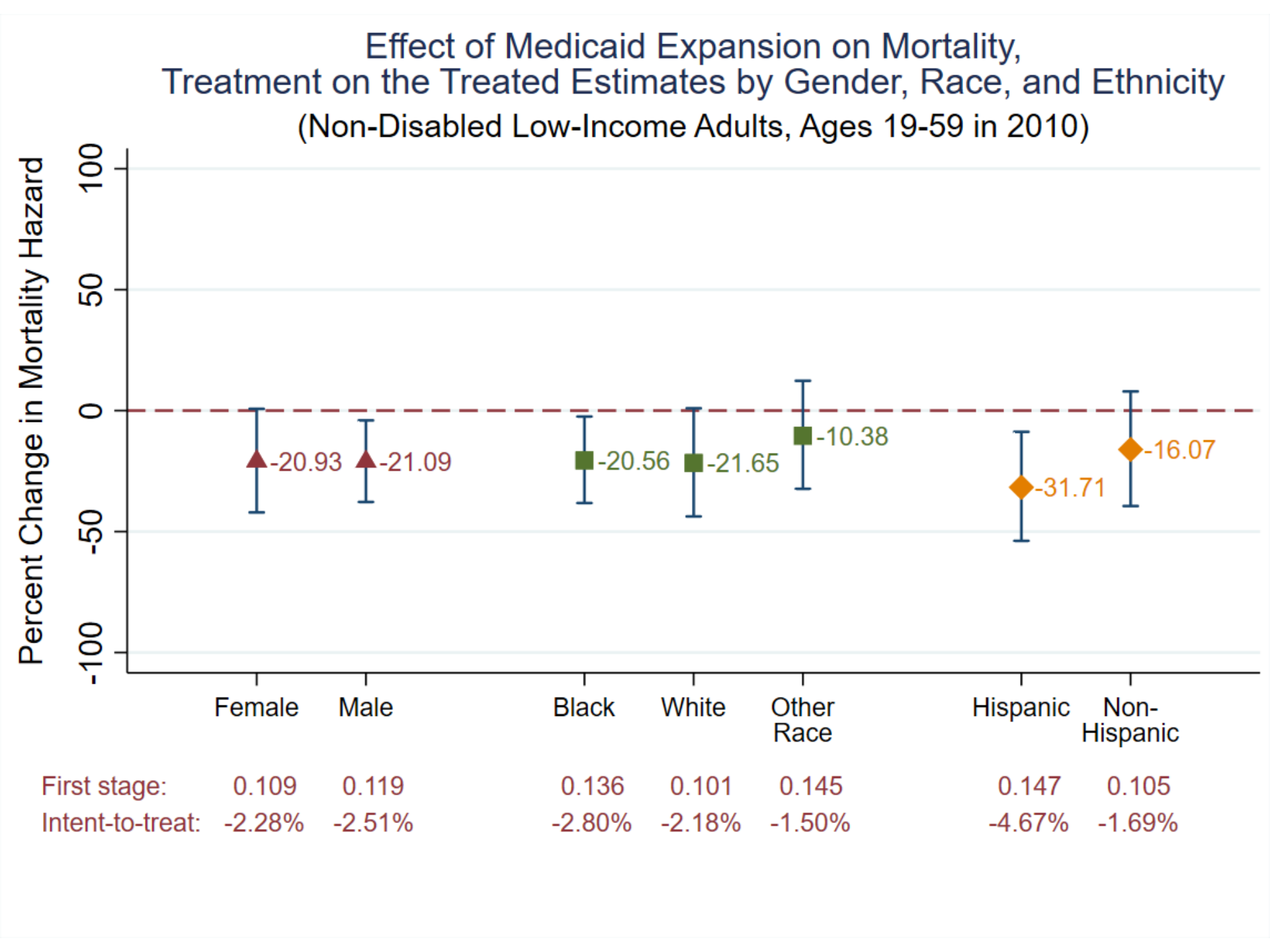
Effect of Medicaid Expansion on Mortality, Treatment on the Treated Estimates

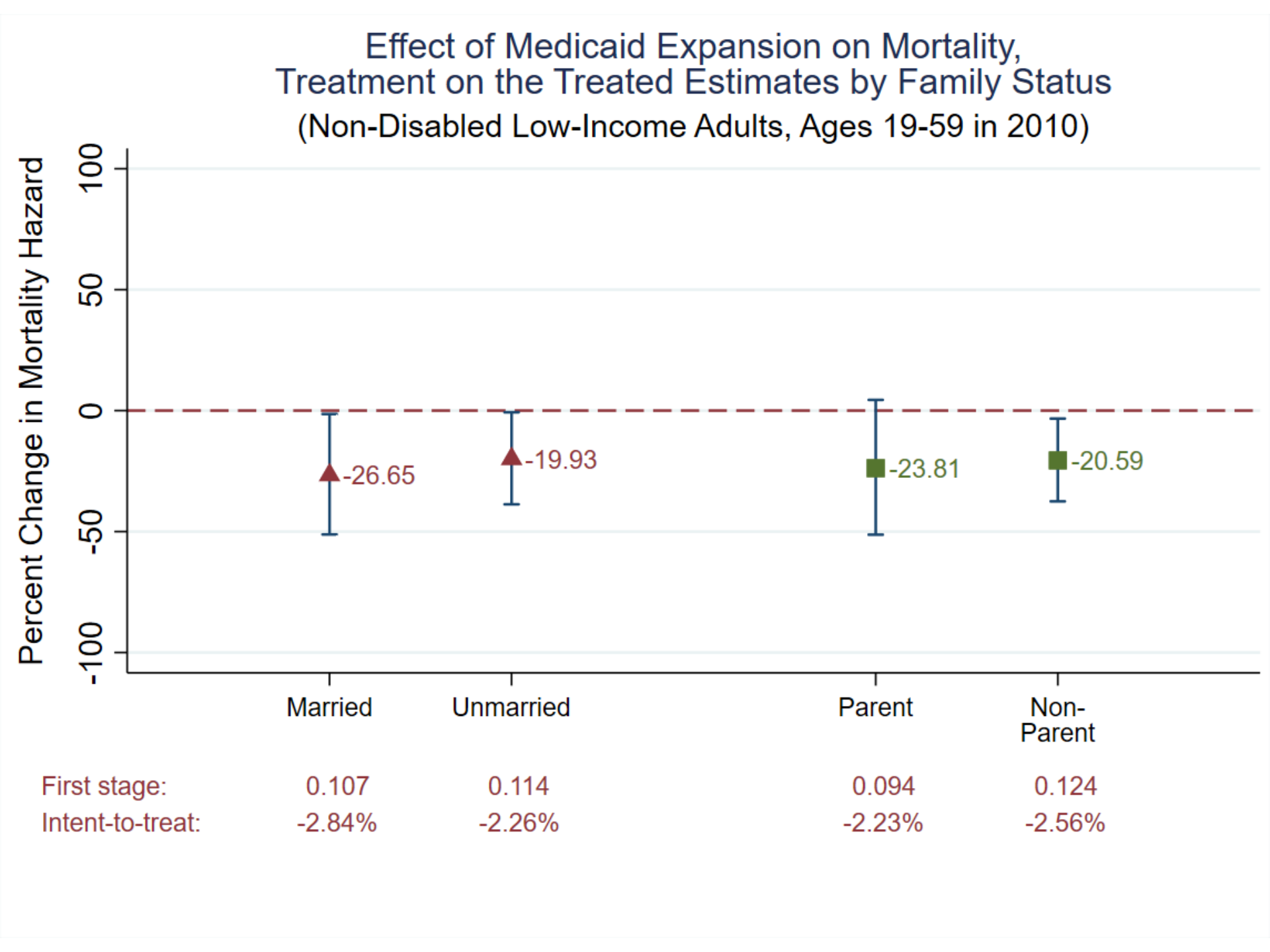
Sample:	Non-Disabled	All
ToT Estimate	-21.02%	-12.00%
95% CI - Upper bound	-3.68%	2.72%
95% CI - Lower bound	-38.00%	-25.77%

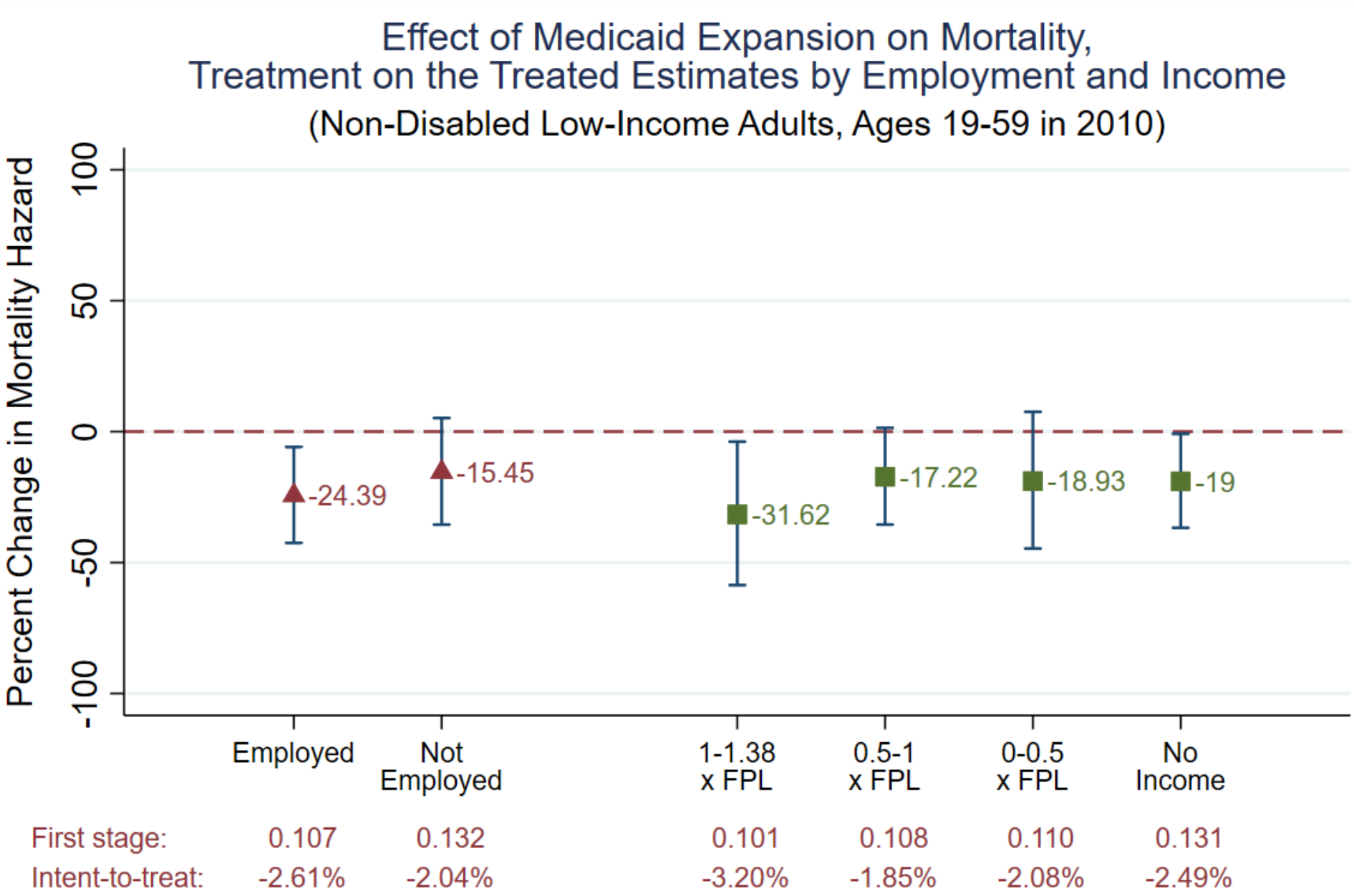
Note: Treatment on treated estimate assumes no spillovers, i.e. no effect of Medicaid expansion on people not induced to enroll.

Sub-Group Analysis and Comparison to Key Prior Studies


Effect of Medicaid Expansion on Mortality,
Treatment on the Treated Estimates by 2010 Age Group
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percent Change in Mortality Hazard
100
50
0
-50
-100
-25.8
-27.12
-15.57
-17.4
Ages 19-29
Ages 30-39
Ages 40-49
Ages 50-59
First stage: 0.099 0.113 0.148 0.145
Intent-to-treat: -2.56% -3.07% -2.30% -2.53%

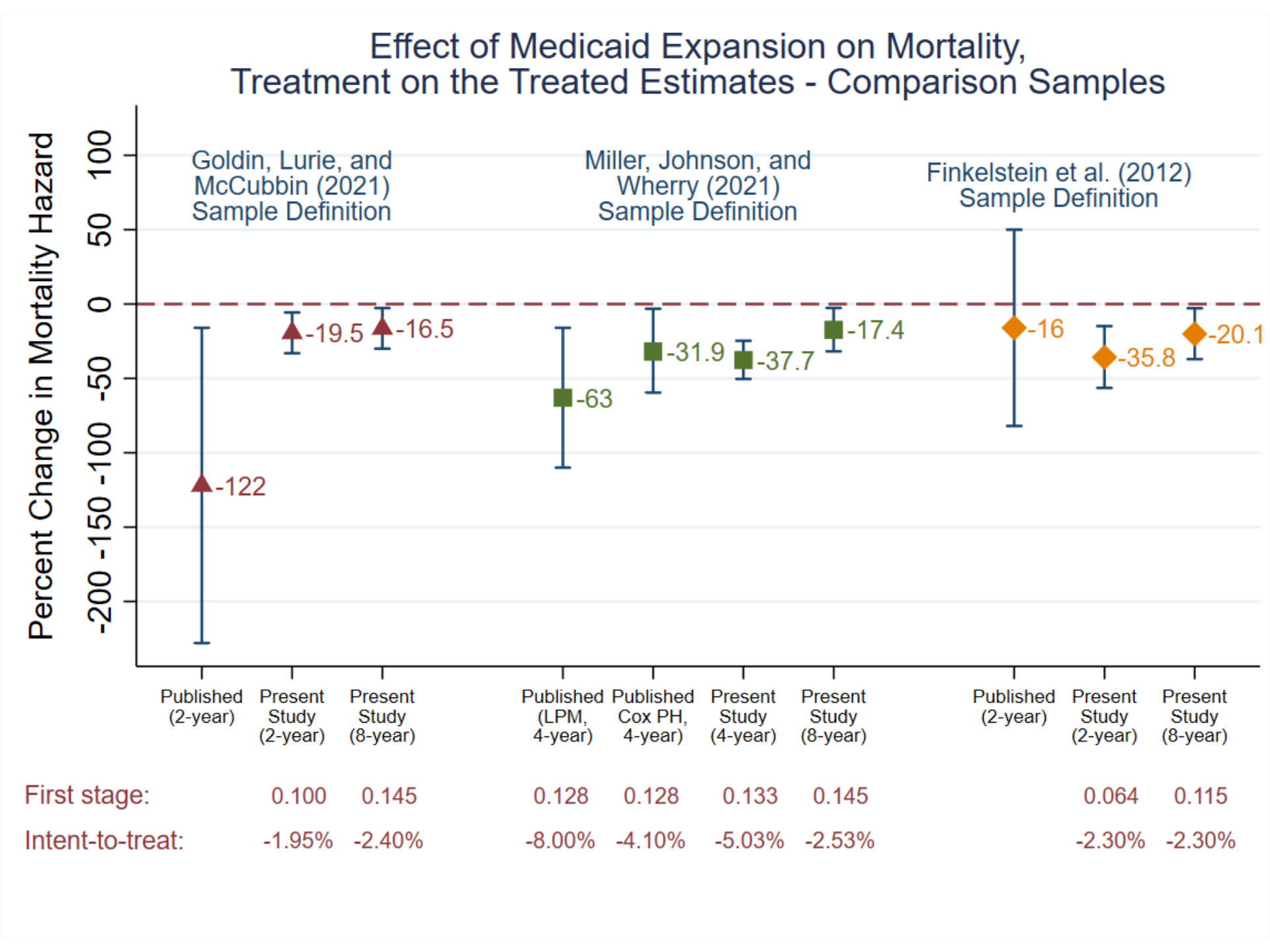

Effect of Medicaid Expansion on Mortality,
Treatment on the Treated Estimates by Gender, Race, and Ethnicity
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percent Change in Mortality Hazard
100
50
0
-50
-100
-20.93
-21.09
-20.56
-21.65
-10.38
-31.71
-16.07
Female
Male
Black
White
Other Race
Hispanic
Non-Hispanic
First stage: 0.109 0.119 0.136 0.101 0.145 0.147 0.105
Intent-to-treat: -2.28% -2.51% -2.80% -2.18% -1.50% -4.67% -1.69%


Effect of Medicaid Expansion on Mortality,
Treatment on the Treated Estimates by Family Status
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percent Change in Mortality Hazard
100
50
0
-50
-100
-26.65
-19.93
-23.81
-20.59
Married
Unmarried
Parent
Non-
Parent
First stage:
0.107
0.114
0.094
0.124
Intent-to-treat:
-2.84%
-2.26%
-2.23%
-2.56%


Effect of Medicaid Expansion on Mortality,
Treatment on the Treated Estimates by Employment and Income
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percent Change in Mortality Hazard
100
50
0
-50
-100
-24.39
-15.45
-31.62
-17.22
-18.93
-19
Employed
Not Employed
1-1.38 x FPL
0.5-1 x FPL
0-0.5 x FPL
No Income
First stage: 0.107 0.132 0.101 0.108 0.110 0.131
Intent-to-treat: -2.61% -2.04% -3.20% -1.85% -2.08% -2.49%

Comparison to key prior studies

- We compare our estimates of the average effect of treatment on the treated to three previous studies:
  - Finkelstein et al. (2012) estimate effect of gaining Medicaid through the Oregon Health Insurance Experiment (OHIE)
  - Goldin, Lurie, and McCubbin (2021) use an experiment that randomly assigned uninsured taxpayers to receive a letter informing them of penalties and insurance options
  - Miller, Johnson, and Wherry (2021) link low-income adults from the American Community Survey (ACS) to Medicaid and SSA mortality data and use ACA expansions to estimate effect
- OHIE sample included all poor and includes the disabled; other studies focus on older adults


Effect of Medicaid Expansion on Mortality,
Treatment on the Treated Estimates - Comparison Samples
Percent Change in Mortality Hazard
100
50
0
-50
-100
-150
-200
Goldin, Lurie, and McCubbin (2021) Sample Definition
Miller, Johnson, and Wherry (2021) Sample Definition
Finkelstein et al. (2012) Sample Definition
-122
-19.5
-16.5
-63
-31.9
-37.7
-17.4
-16
-35.8
-20.1
Published (2-year)
Present Study (2-year)
Present Study (8-year)
Published (LPM, 4-year)
Published Cox PH, 4-year)
Present Study (4-year)
Present Study (8-year)
Published (2-year)
Present Study (2-year)
Present Study (8-year)
First stage: 0.100 0.145 0.128 0.128 0.133 0.145 0.064 0.115
Intent-to-treat: -1.95% -2.40% -8.00% -4.10% -5.03% -2.53% -2.30% -2.30%

Robustness Checks

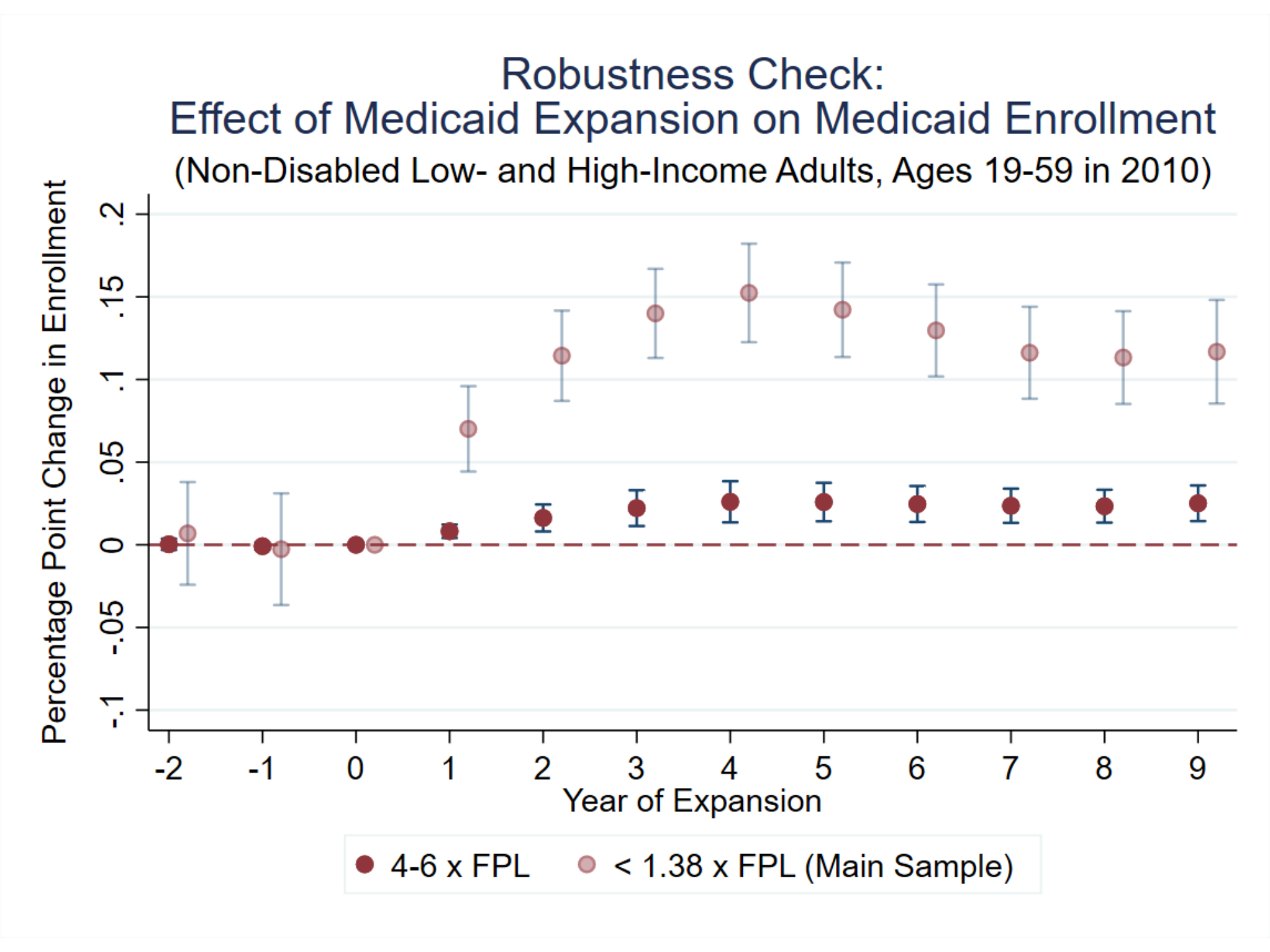
Summary of robustness checks

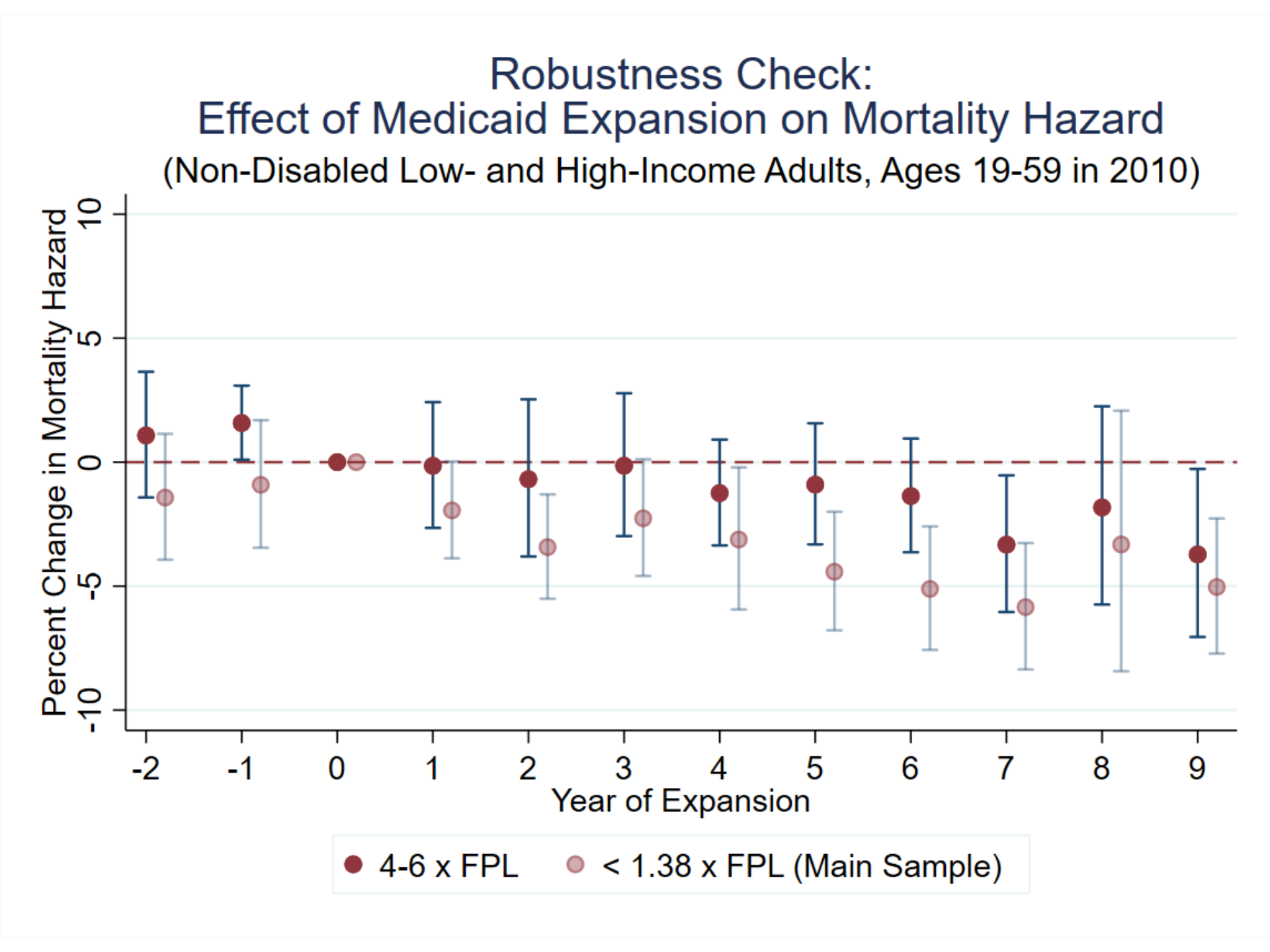
- Our findings change little when we estimate a triple-differences specification using higher income adults
- We also estimate our model separately for higher income adults and a find small (1.5 ppt) effect on enrollment and statistically insignificant effect on mortality
- Finally, we show that parallel trends in Medicaid enrollment persist when we begin our pre-period in 2005 rather than 2010

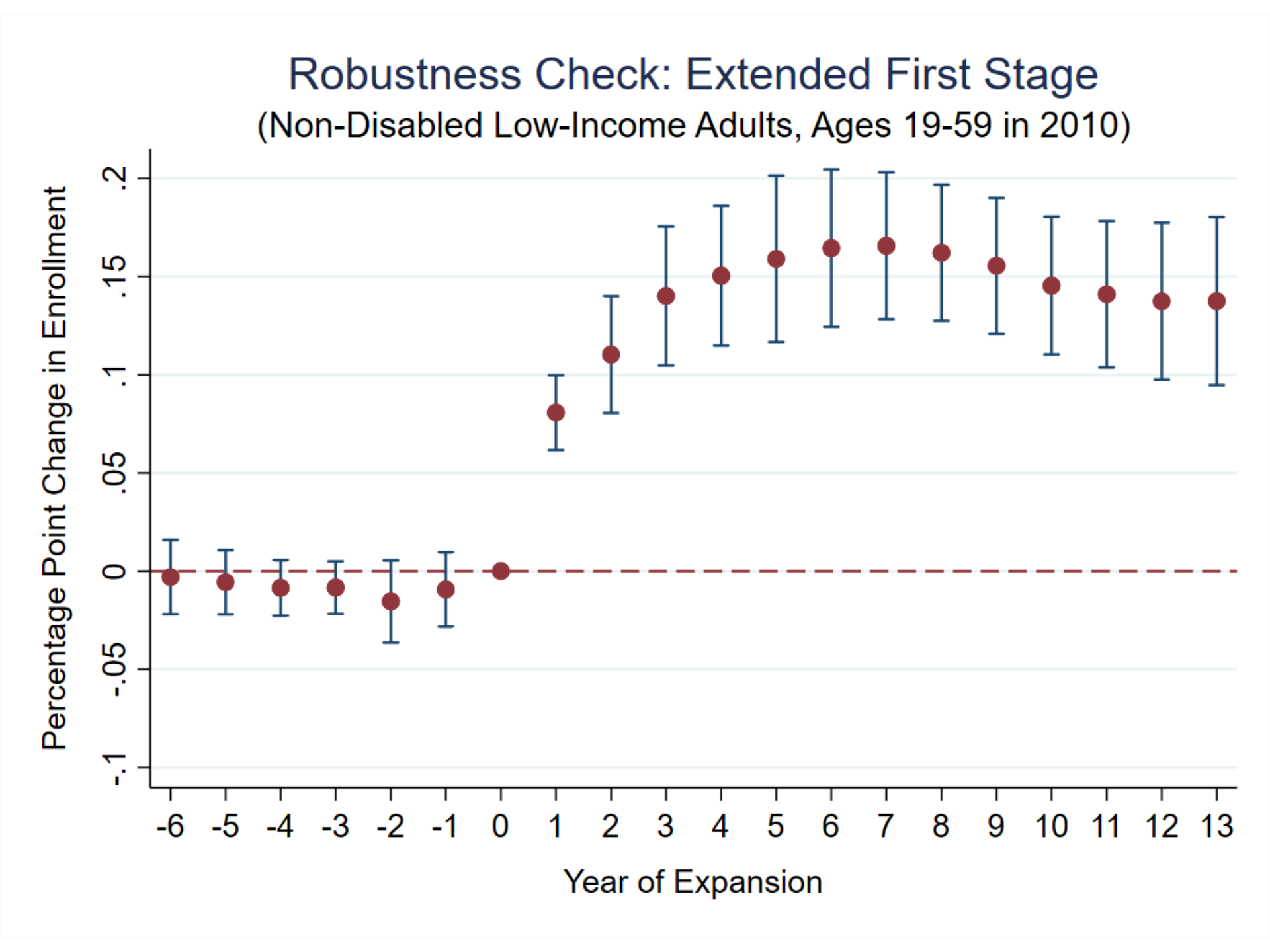
Effect of Medicaid Expansion on Mortality Difference in Differences Estimates and Triple Difference Estimates Comparing Low- and High-Income Individuals (Treatment on the Treated)

	Difference in Differences	Triple Differences
Treatment on the Treated	-21.02%	-17.69%
95% CI - Upper bound	-3.68%	-3.35%
95% CI - Lower bound	-38.00%	-31.82%

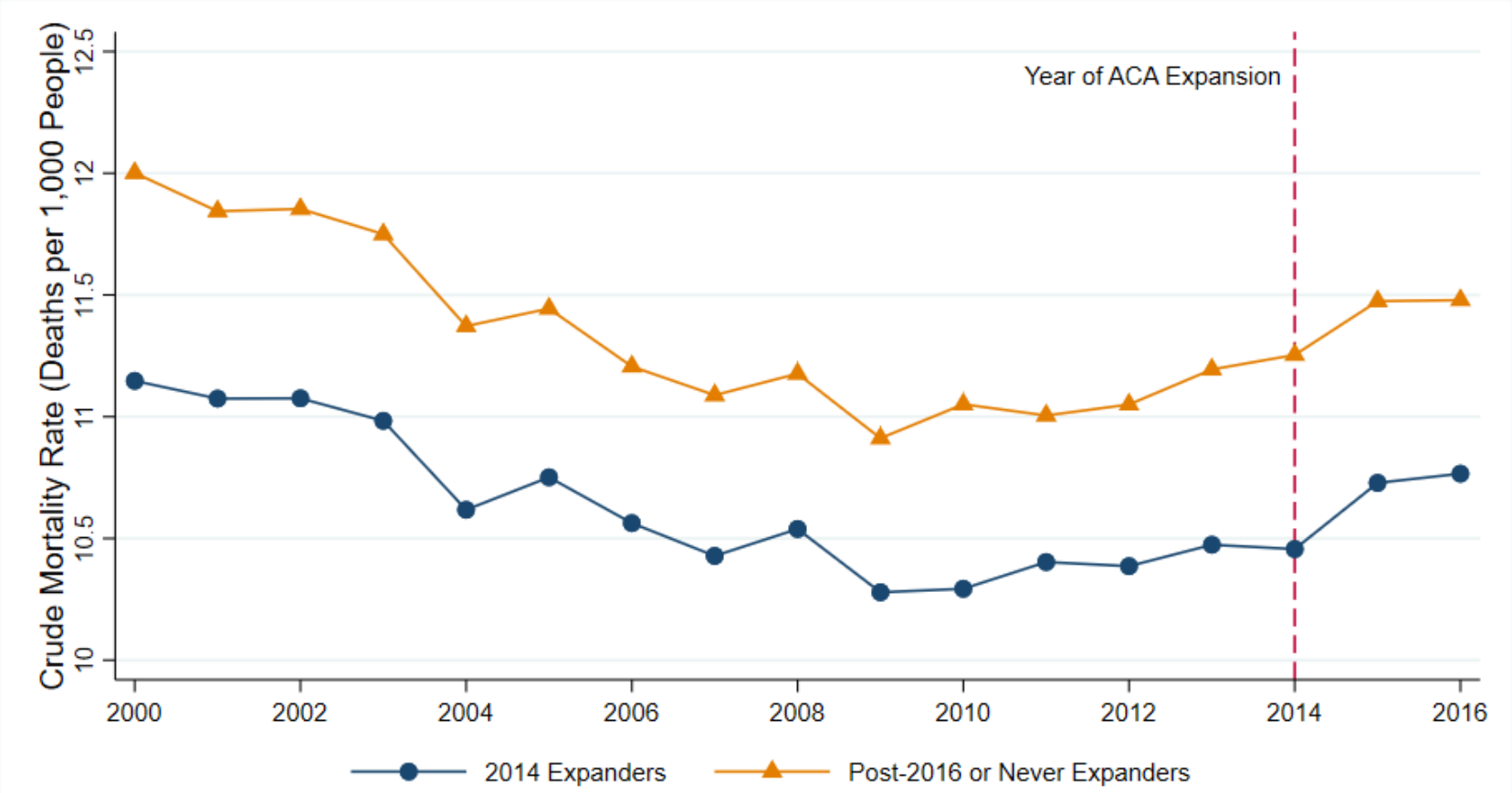
Note: Both columns report estimates of the average effect of treatment on the treated estimated on the sample of non-disabled adults, where the treatment is being enrolled in Medicaid in a year.


Robustness Check:
Effect of Medicaid Expansion on Medicaid Enrollment
(Non-Disabled Low- and High-Income Adults, Ages 19-59 in 2010)
Percentage Point Change in Enrollment
-.1
-.05
0
.05
.1
.15
.2
-2
-1
0
1
2
3
4
5
6
7
8
9
Year of Expansion
4-6 x FPL
< 1.38 x FPL (Main Sample)


Robustness Check:
Effect of Medicaid Expansion on Mortality Hazard
(Non-Disabled Low- and High-Income Adults, Ages 19-59 in 2010)
Percent Change in Mortality Hazard
10
5
0
-5
-10
-2
-1
0
1
2
3
4
5
6
7
8
9
Year of Expansion
4-6 x FPL
< 1.38 x FPL (Main Sample)


Robustness Check: Extended First Stage
(Non-Disabled Low-Income Adults, Ages 19-59 in 2010)
Percentage Point Change in Enrollment
-.1
-.05
0
.05
.1
.15
.2
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Expansion

Aggregate mortality rates by expansion status in 2000-2016 (Ages 19-59)



Sources: Compressed Mortality File 2000-2016 on CDC WONDER Online Database, released June 2017. Centers for Disease Control and Prevention, National Center for Health Statistics.

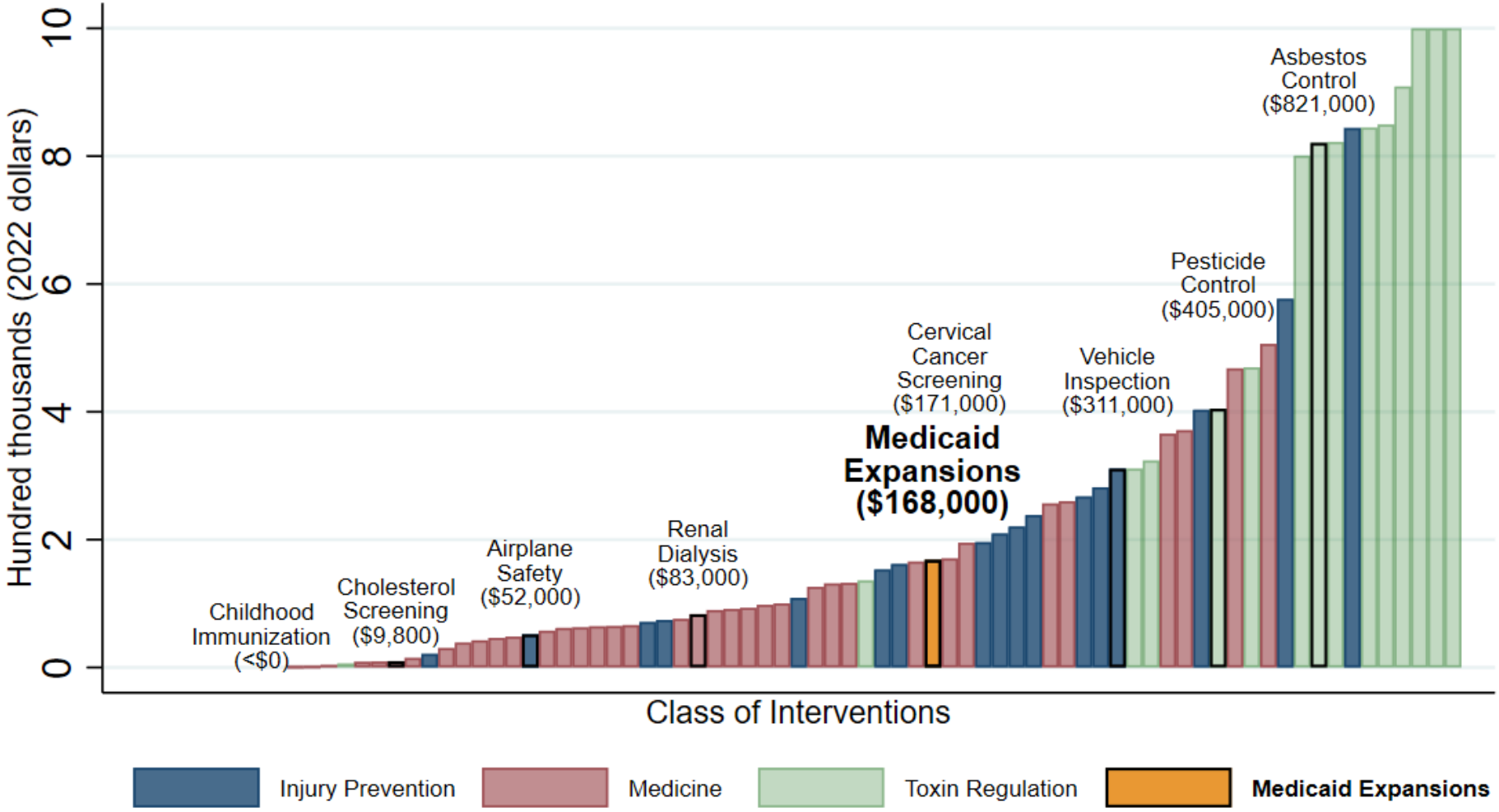
Interpreting the Magnitude and Cost-Effectiveness of Estimates

Our estimates suggest:

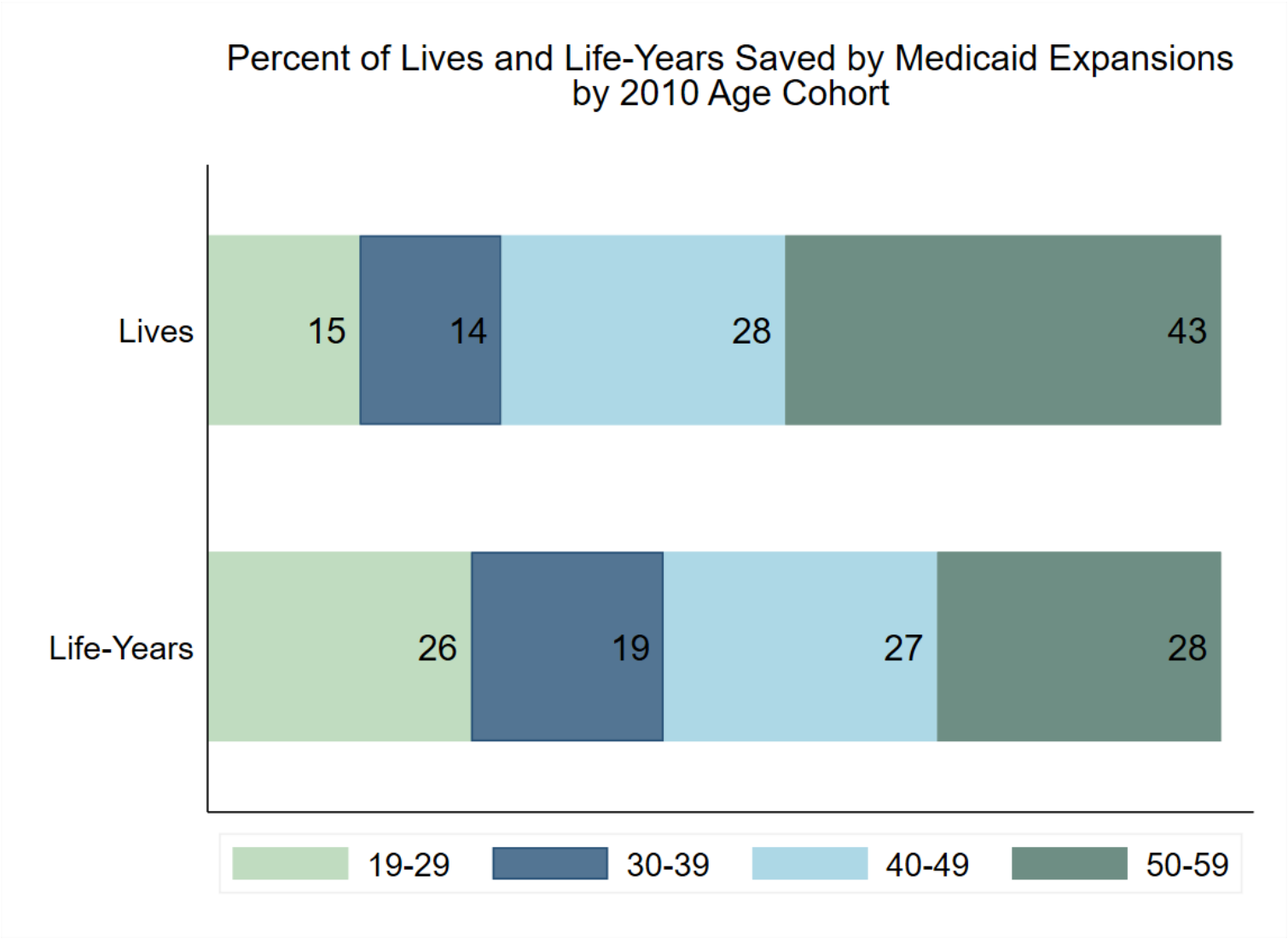
- **27,400 lives** and **890,000 life-years** were saved by Medicaid expansions between 2010 and 2022
  - **3,200 avoided deaths per year** in expansion states, close to the annual non-elderly deaths from HIV/AIDS
- **18,300** deaths in non-expansion states and an additional **7,100 deaths in expansion states** would have been avoided if all states had expanded in 2010
- The **cost per life saved** was about **$5.5 million**
  - Well below the $10-11 million value of a statistical life used in federal government cost-benefit analyses
- The **cost per life-year saved** was about **$168,000**
  - Well below estimates of societal willingness-to-pay for additional life years from Braithwaite et al. (2008)

Cost-Effectiveness of Medicaid Expansions and Other Life-Saving Interventions: Average Cost Per Life-Year Saved

Injury, Medicine, and Toxin estimates from Tengs et al. (1995)



Note: Costs are top-coded at $1 million and bottom coded at $0. Bars indicate average cost per life-year saved across specific interventions within a given class of interventions, e.g. "Airplane safety" includes several types of fire-prevention interventions and floor lighting.


Percent of Lives and Life-Years Saved by Medicaid Expansions by 2010 Age Cohort
Lives
15
14
28
43
Life-Years
26
19
27
28
19-29
30-39
40-49
50-59

Spillovers

- Key assumption of treatment-on-the-treated estimates is no effect of Medicaid expansion on the mortality risk of those not induced to enroll in Medicaid due to the expansions, i.e. no spillovers
- Spillovers could be positive (e.g. increased investment in health infrastructure, prevention of rural hospital closures) or negative (e.g. diversion of resources to Medicaid patients) (Garthwaite 2012, Einav et al. 2020)
- People residing in non-expansion states may have been induced to obtain insurance through subsidies for insurance purchase on ACA exchanges at higher rates than those in expansion states

Conclusions

Conclusions

- We estimate that Medicaid reduces the mortality risk of enrollees by about 21%, adding to a growing body of evidence that insurance, and Medicaid in particular, improves health
- Unlike prior studies, our estimates are general to the entire population of potential beneficiaries under recent expansions and suggest health improvements for broad subsets of this population, not just older adults
- Our estimates suggest a direct cost of $5.5 million per life saved and $168,000 per life-year saved, well below frequently used valuations of a life and life-year