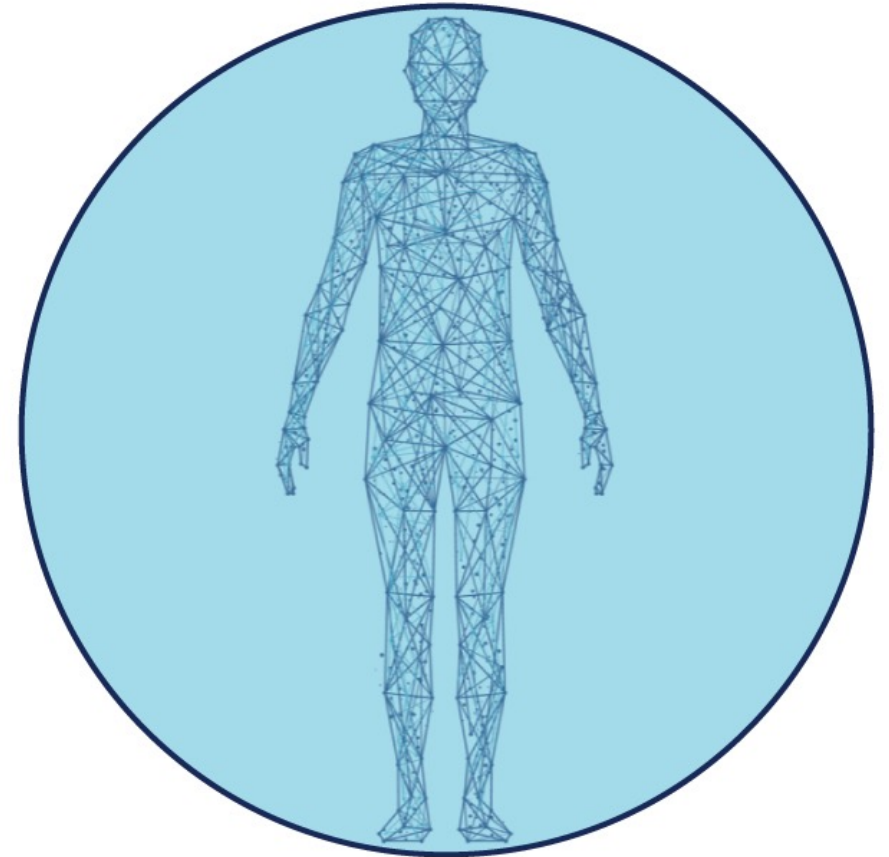


Trends in the Health of the US Population

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Trends in population health have not been uniform

- Convergence of health trends for infants / children between higher and lower SES groups
 - [Currie and Schwandt, 2016]
- Deaths of despair in middle age, esp. non-Hispanic Whites
 - [Case and Deaton, 2020]
- Health improvements for the elderly
 - Uniformity not entirely known

Our goal

- Examine trends in population health (and medical spending) over time, for different demographic groups.
 - Time period: 2000-2019 (so far)
 - 24 demographic groups: gender (M/F); race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other); education (\leq High School, Some college, College degree)
 - *Due to small samples, we don't examine all of these groups.*

Outline

- Conceptual underpinnings
- Data
- Results
- Implications

Conceptual underpinnings

- Two concepts: Quality-adjusted life expectancy (QALE) and lifetime medical spending.

$$QALE_{g,t}(0) = \sum_{k=0}^{\infty} S(\gamma_{t,g,k}) \cdot q_{t,g,k} \quad (1)$$

group time as of age Survival to t,
a function of mortality rates Quality of life Age group

$$S(\gamma_{t,g,k}) = (1 - \prod_{l=0}^k (1 - \gamma_{t,g,l})) \quad \text{Pr[Survive] to age} \quad (2)$$

Conceptual underpinnings

- Two concepts: Quality-adjusted life expectancy (QALE) and lifetime medical spending.

$$m_{g,t}(0) = \sum_{k=0}^{\infty} S(\gamma_{t,g,k}) \cdot m_{t,g,k} \quad (3)$$

medical spending



- No discounting in QALE or lifetime medical spending
- Note this is effectively a period life table concept.

Three empirical needs

$\gamma_{t,g,k}$	Mortality rate for group g at age k in year t
$q_{t,g,k}$	Quality of life for group g at age k in year t
$m_{t,g,k}$	Medical spending for group g at age k in year t

t =year; g =group; k =age

Data on mortality

- We use life tables when available.
 - Including some unpublished data.
 - For now, use 2000 and 2019.
 - Maximum age = 100

Data on mortality

- In forming life tables by education
 - Use micro data on deaths by (death-certificate) education combined with an adjustment from micro studies of self-reported education to death certificate reports (Hatfield et al., 2023).
 - Start education reporting at age 25
 - Assume no education differences in mortality after age 75 within race (samples too small)
 - (Generally) No education delineation for Blacks and Hispanics.

Adjustment for mis-reporting education

Extent of Death Certificate Mis-Reporting				
	Percent Reported in Death Certificate			
As self-reported	<=High School	Some College	College Grad	Total
<=High school	93%	6%	1%	100%
Some college	37%	57%	6%	100%
College grad	8%	14%	78%	100%

Note: Based on unpublished tabulations from NLMS; see Hatfield et al. (2023).

Data on quality of life

- MEPS data (full population) + MCBS data (ages 65+)
- Use our earlier methodology (Cutler et al., 2022)
 - Find all measures of symptoms and impairments (S/I)
 - Estimate regression of 100 point health rating in 2002 MEPS on S/I to back out disutility of each S/I
 - Hold these disutilities constant over time.
- Smooth QoL across ages using a spline model, with knots at ages 25, 45, and 65.

Table of Disutilities

<u>Symptom/Impairment</u>	<u>Decrement</u>
Self-care (ADL) limitation	-0.04
Primary activity: limited	-0.04
Primary activity: can't do	-0.07
Social activity limitation	-0.03
Routine needs (IADL) limitation	-0.01
Pain: moderate	-0.06
Pain: severe	-0.17
Low energy: moderate	-0.07
Low energy: severe	-0.15
Depressive symptoms: moderate	-0.03
Depressive symptoms: severe	-0.09
Anxious	-0.03
Walking: moderate difficulty	-0.03
Walking: severe difficulty	-0.04
Manual dexterity difficulty	-0.02
Lifting difficulty	-0.01
Vision impairment	-0.02
Hearing impairment	-0.01
Cognitive impairment	-0.03
Constant	0.92

From regression predicting 100-point self-rated health in 2002 Medical Expenditure Panel Survey (regression also includes interactions)

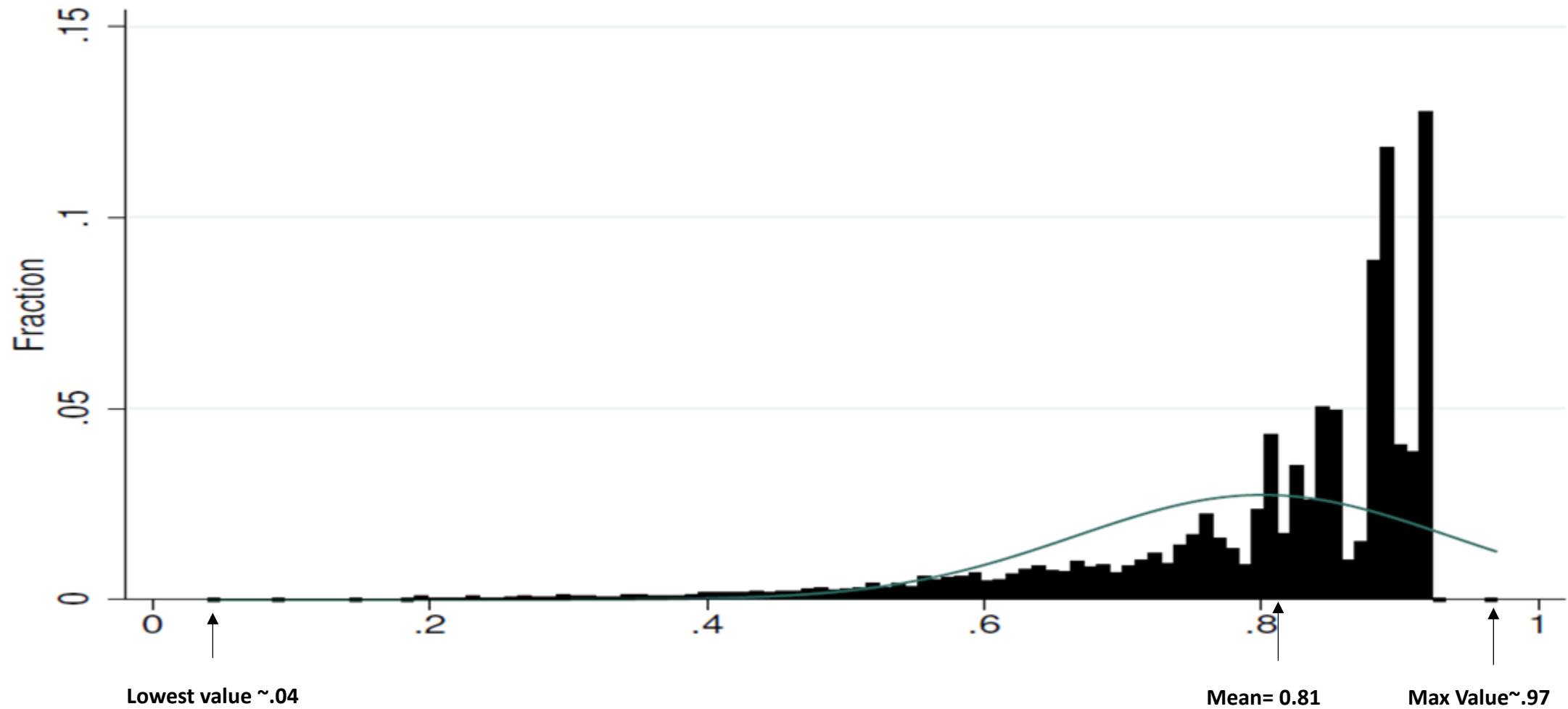
Subtract decrements for reported limitations from intercept (0.92, value with none of the limitations)

e.g.	Weight
Moderate pain:	-0.06
Social activity limitation:	-0.03
Moderate low energy:	-0.07

Health-related quality of life score: 0.76

Separate models for children

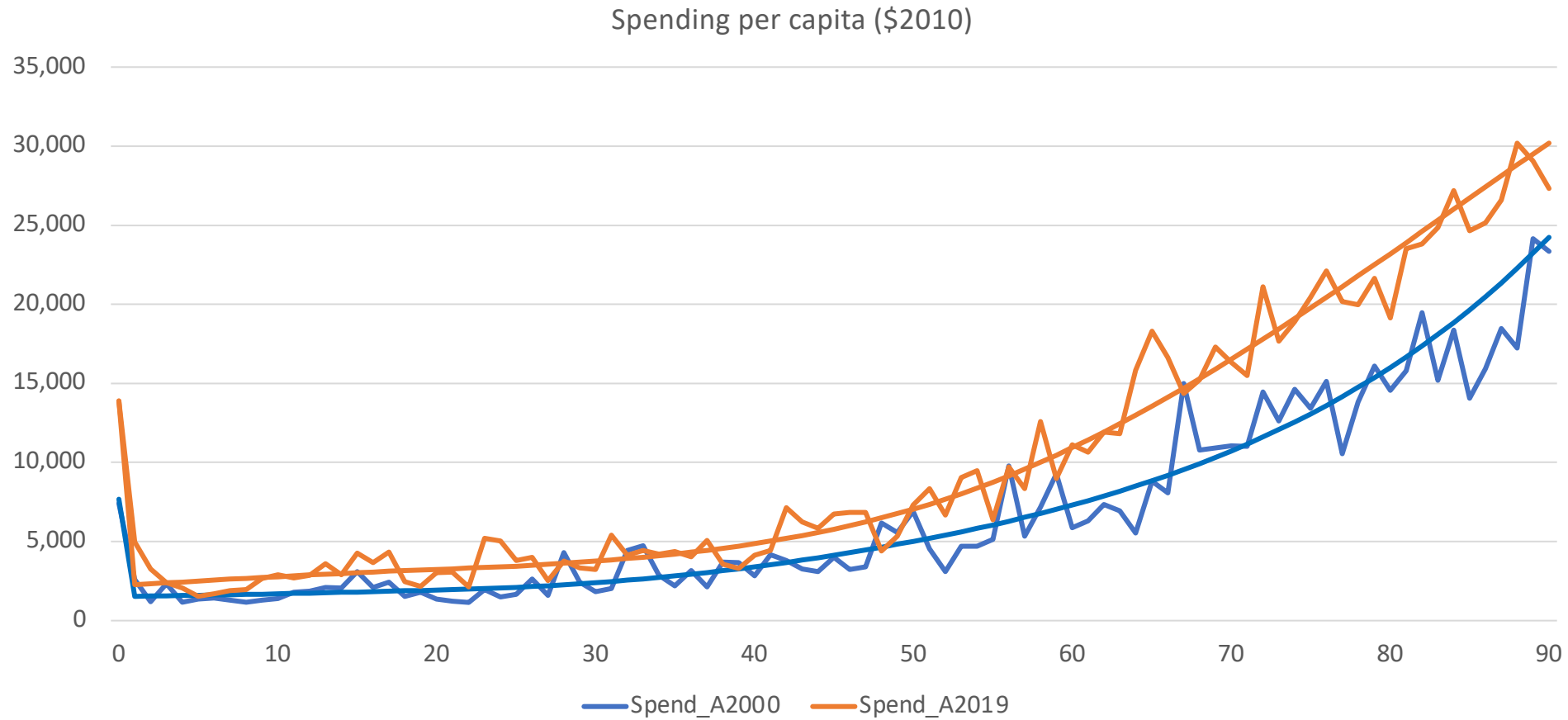
Predicted Quality of Life (2019)



Data on medical spending

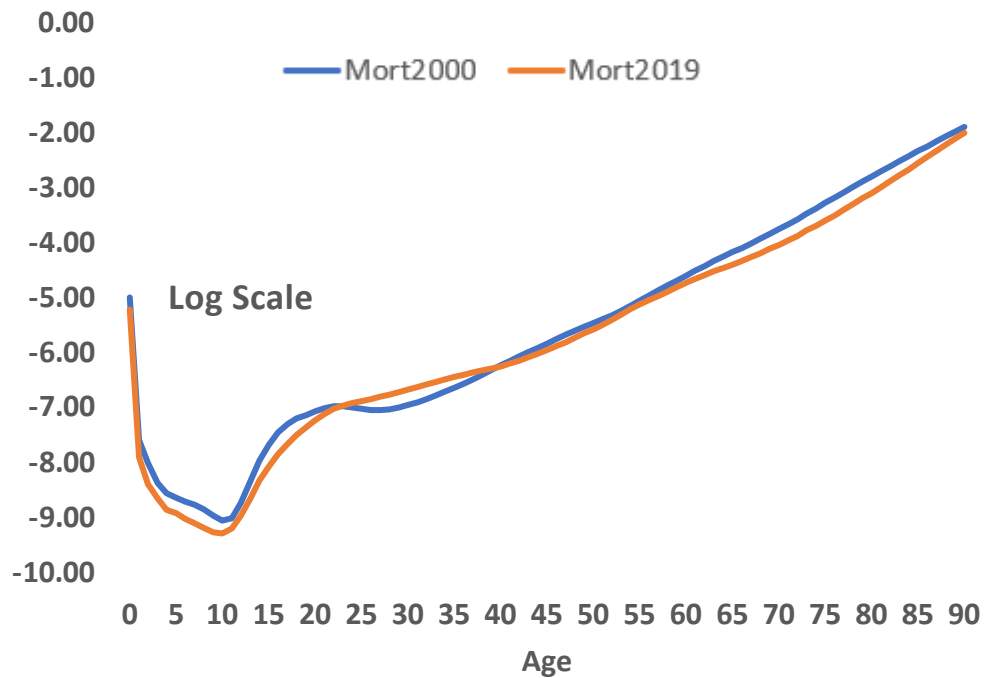
- MEPS data (full population) + MCBS data (ages 65+)
- Use our earlier methodology (Cutler et al., 2022)
 - Adjust for non-represented populations (institutionalized in MEPS)
 - Make totals add to national estimates
- Smooth medical spending across ages using a spline model, with knots at ages 1, 25, 45, and 65.

Medical spending by age, 2000 and 2019

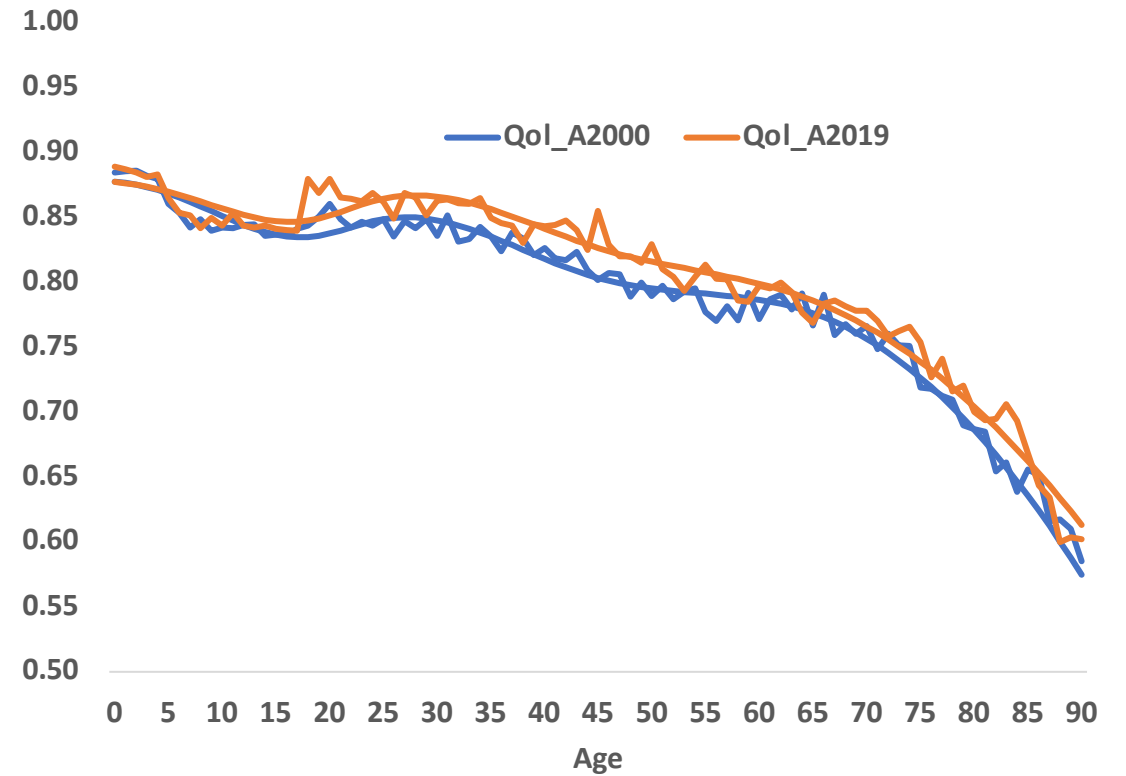


Results – population as a whole

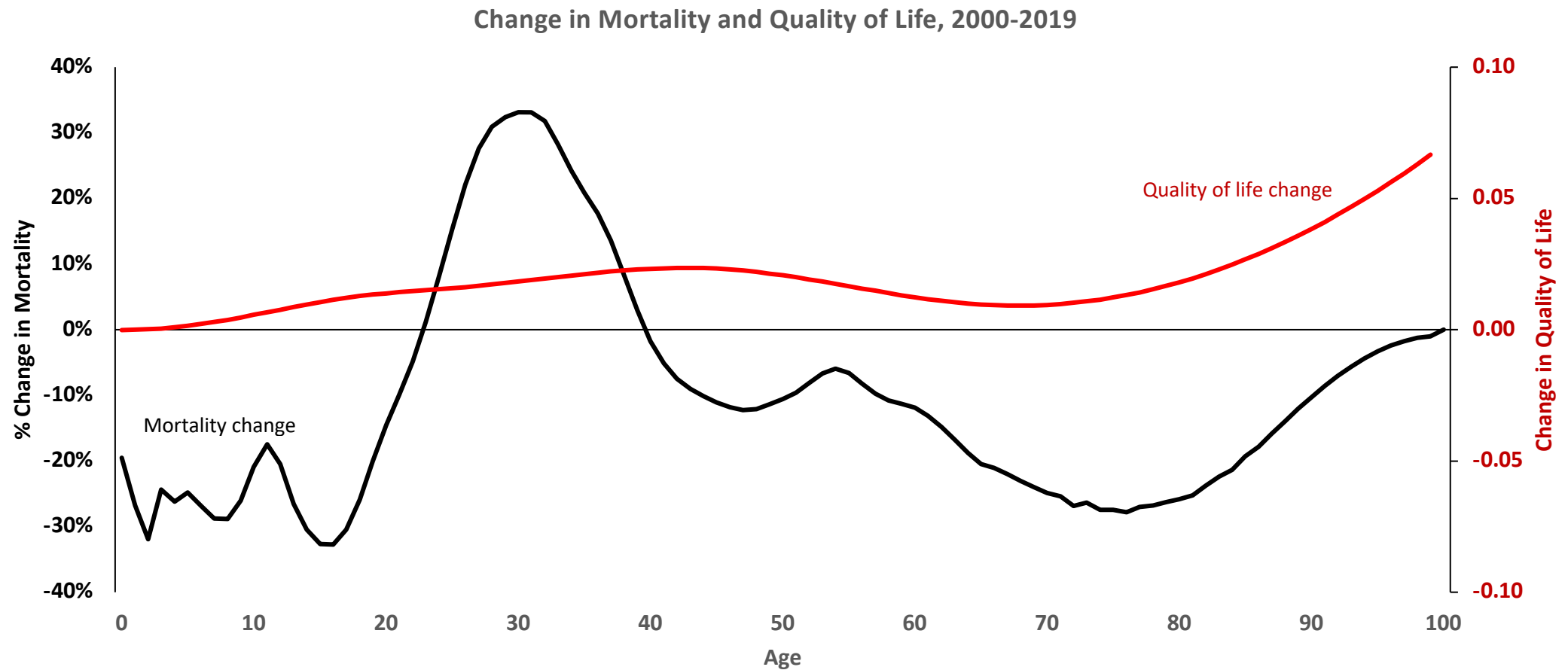
Mortality has fallen



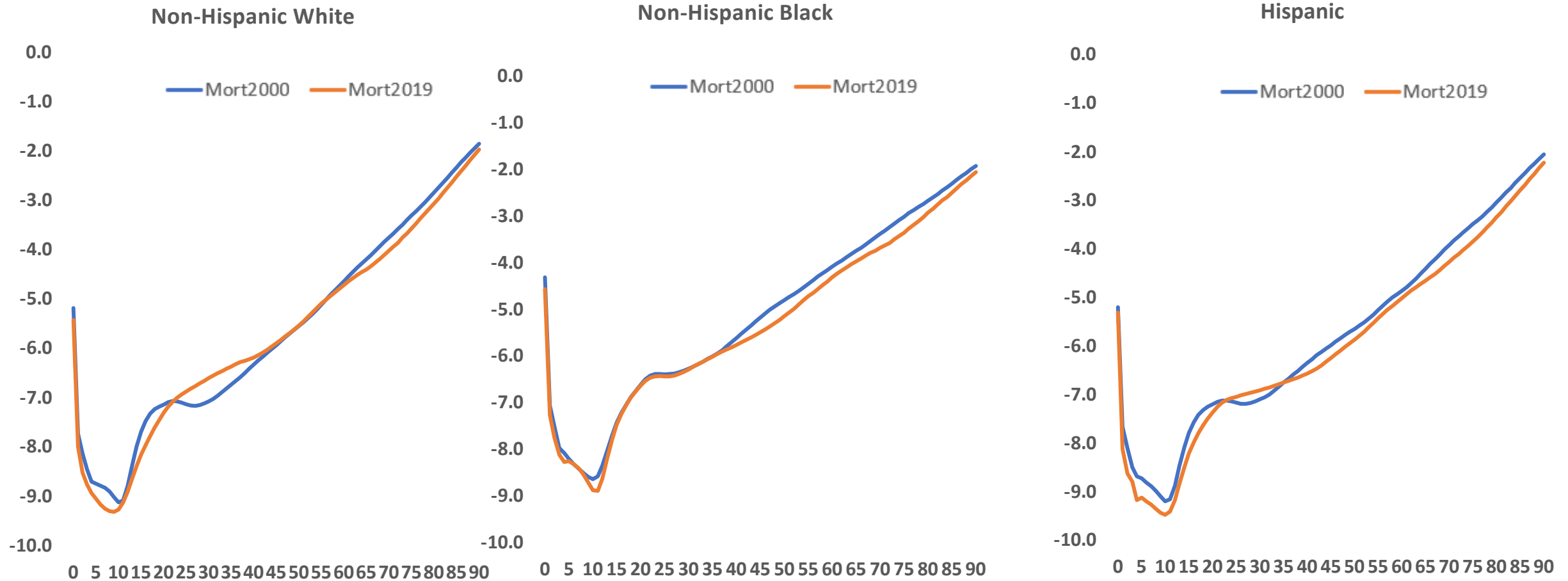
Quality of life has increased



Some more helpful metrics – Overall population



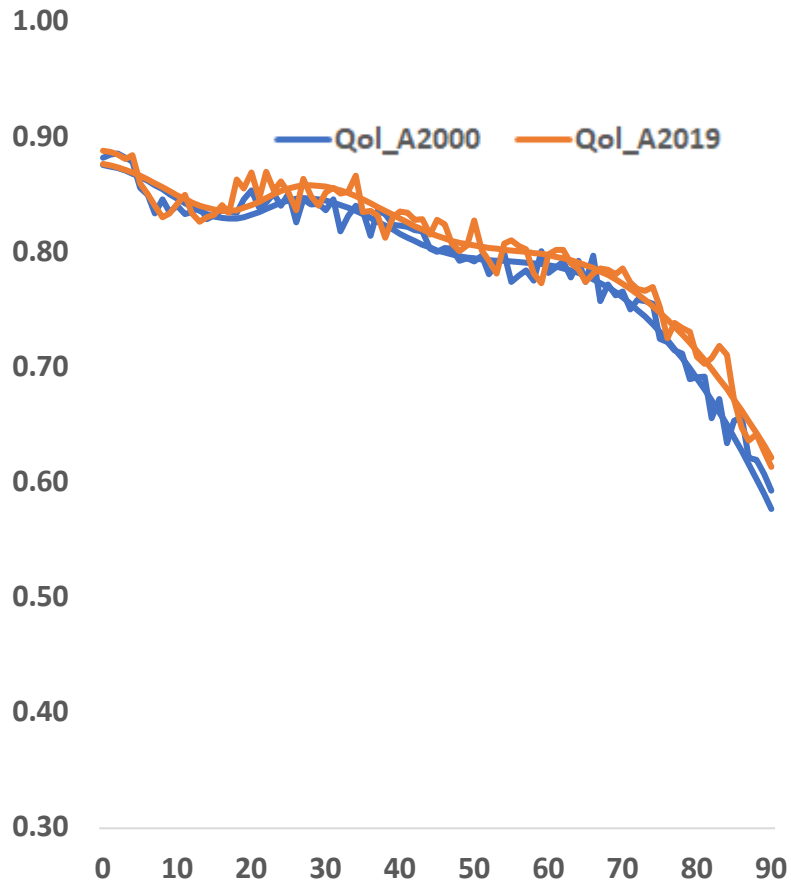
Mortality Rates by Race/Ethnicity (log scale)



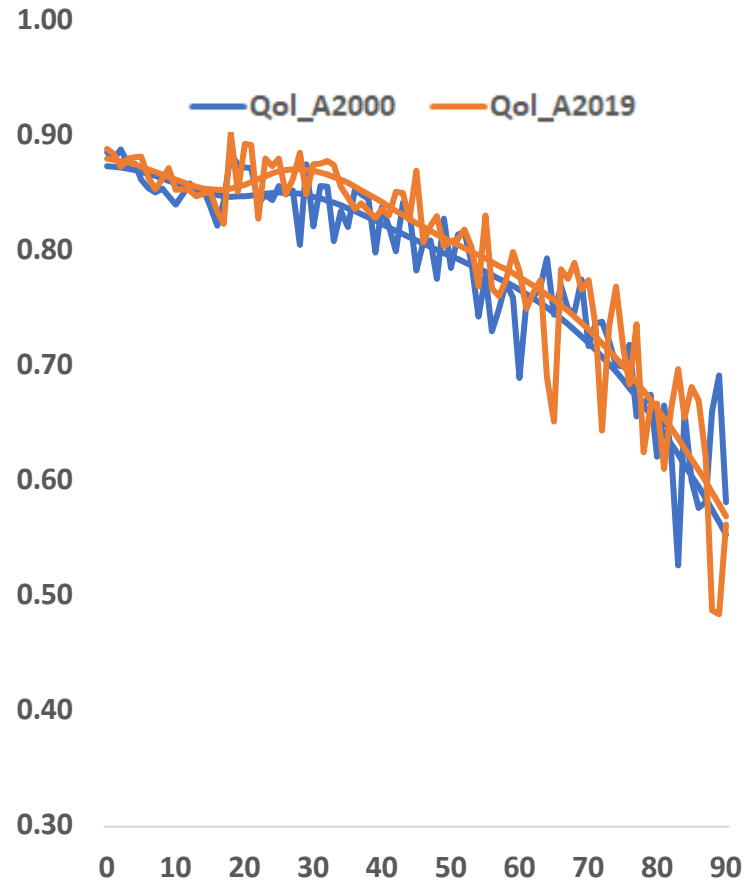
Mortality at older ages fell for all groups, but more for non-Hispanic Blacks and Hispanics.

Quality of Life by Race/Ethnicity

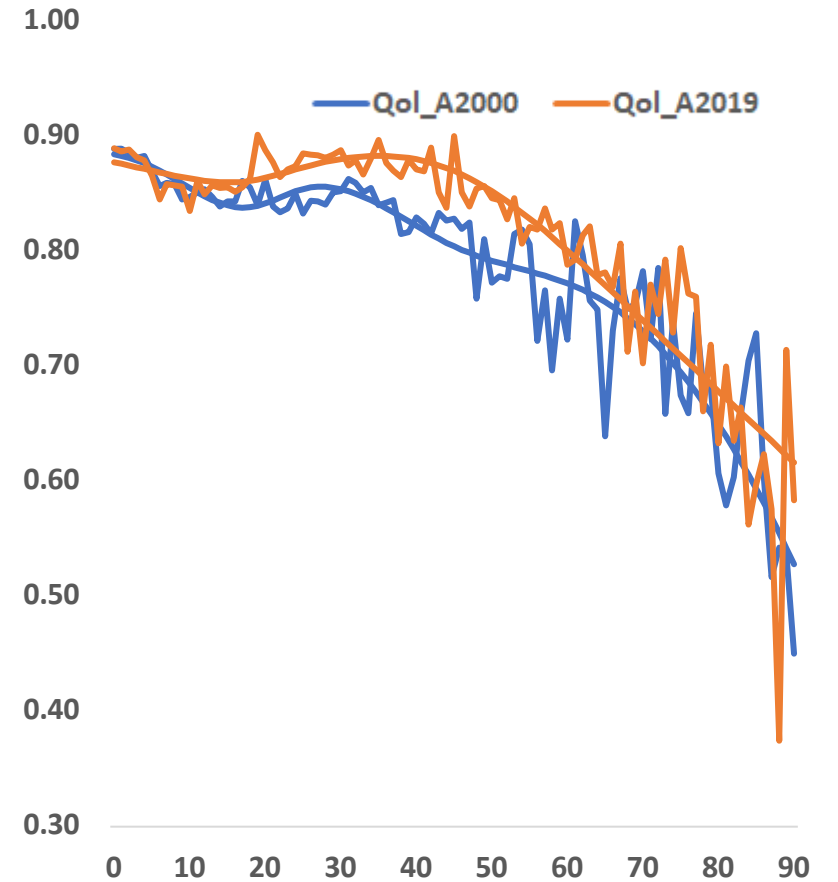
Non-Hispanic White



Non-Hispanic Black

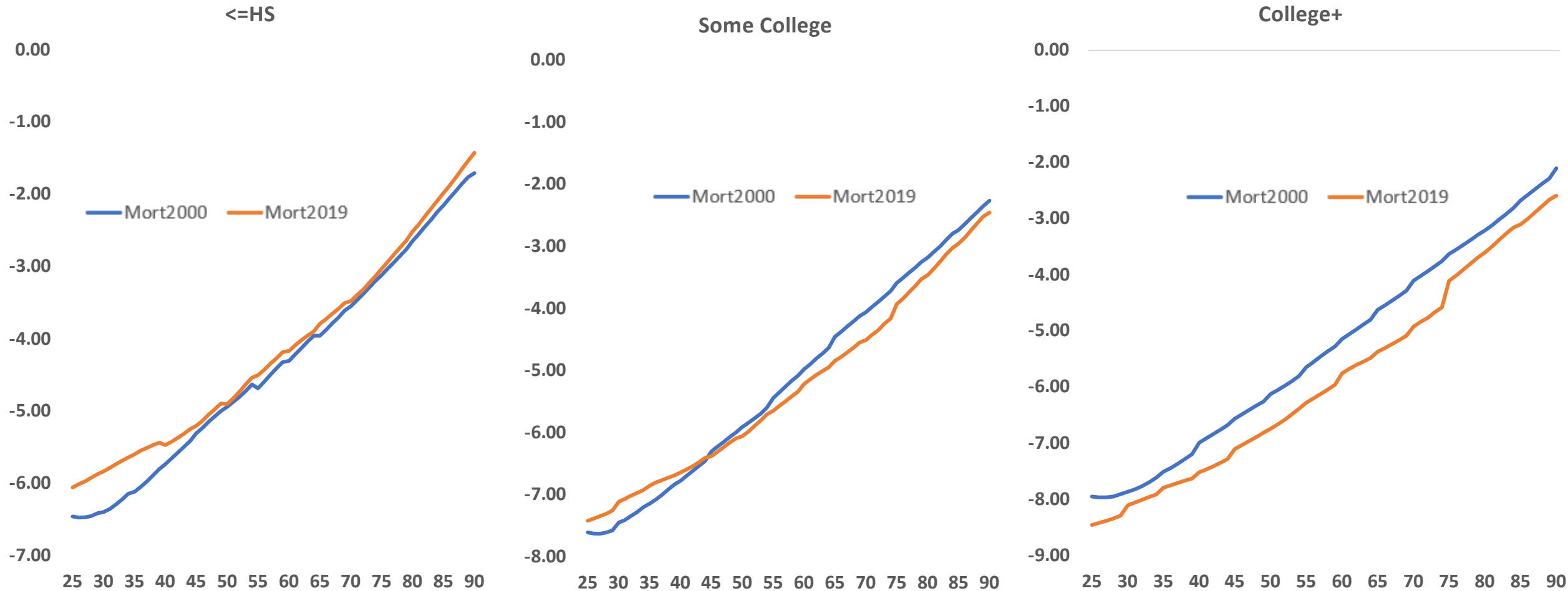


Hispanic



Quality of life improved for all groups, but most for Hispanics.

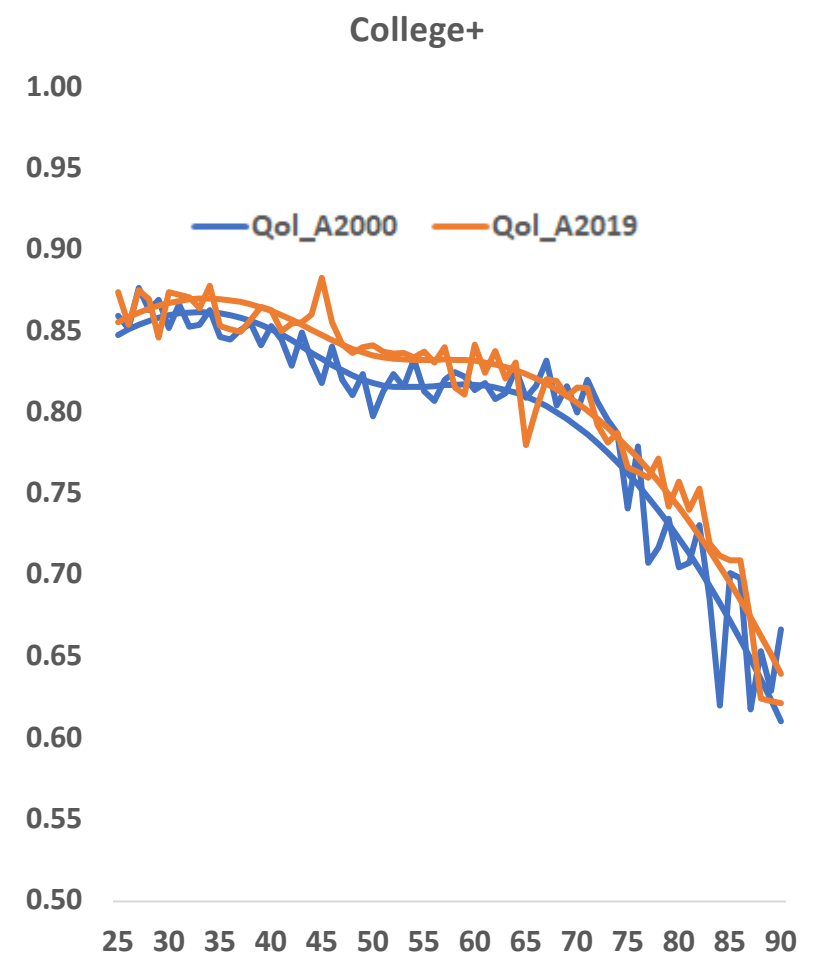
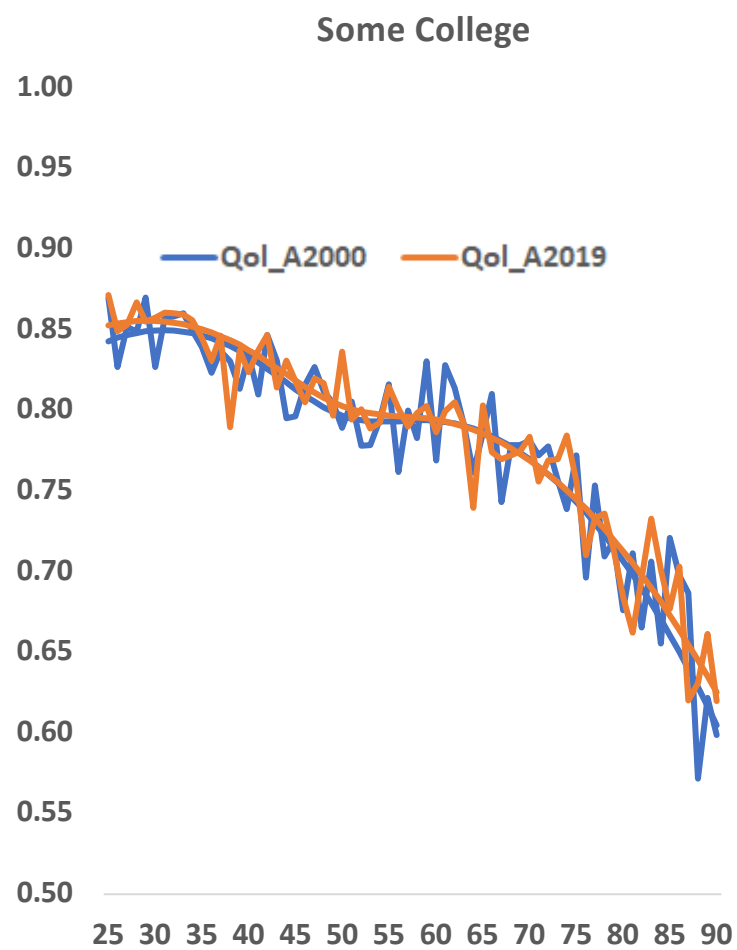
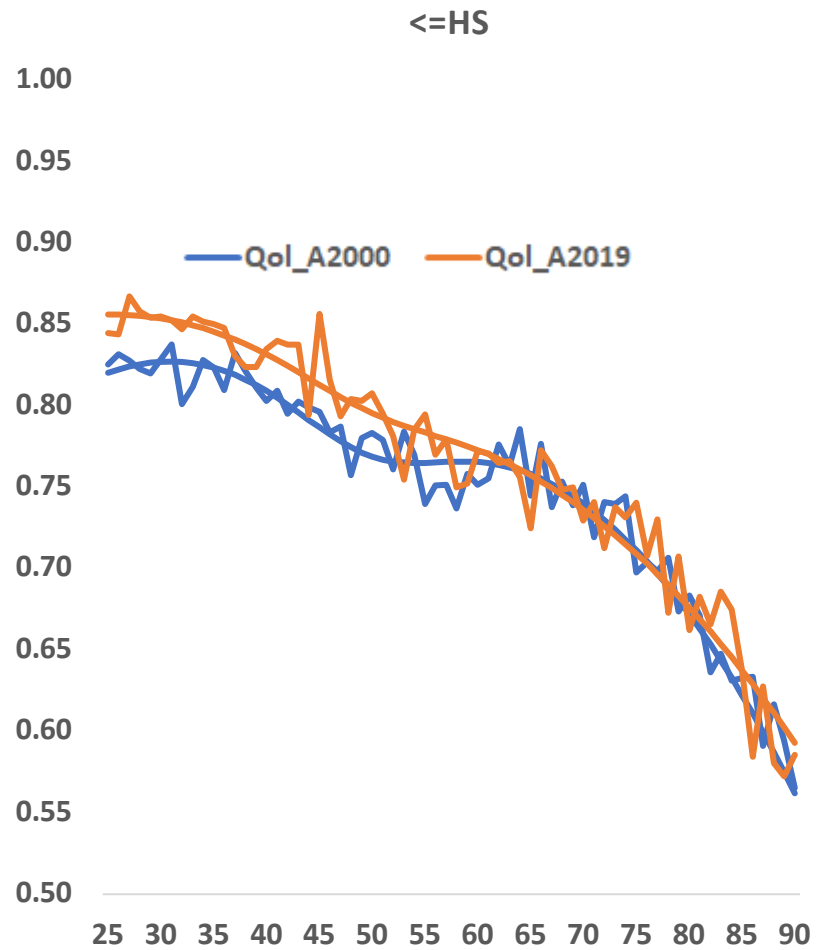
Mortality Rates by Education (log scale)



Education life tables start at age 25.

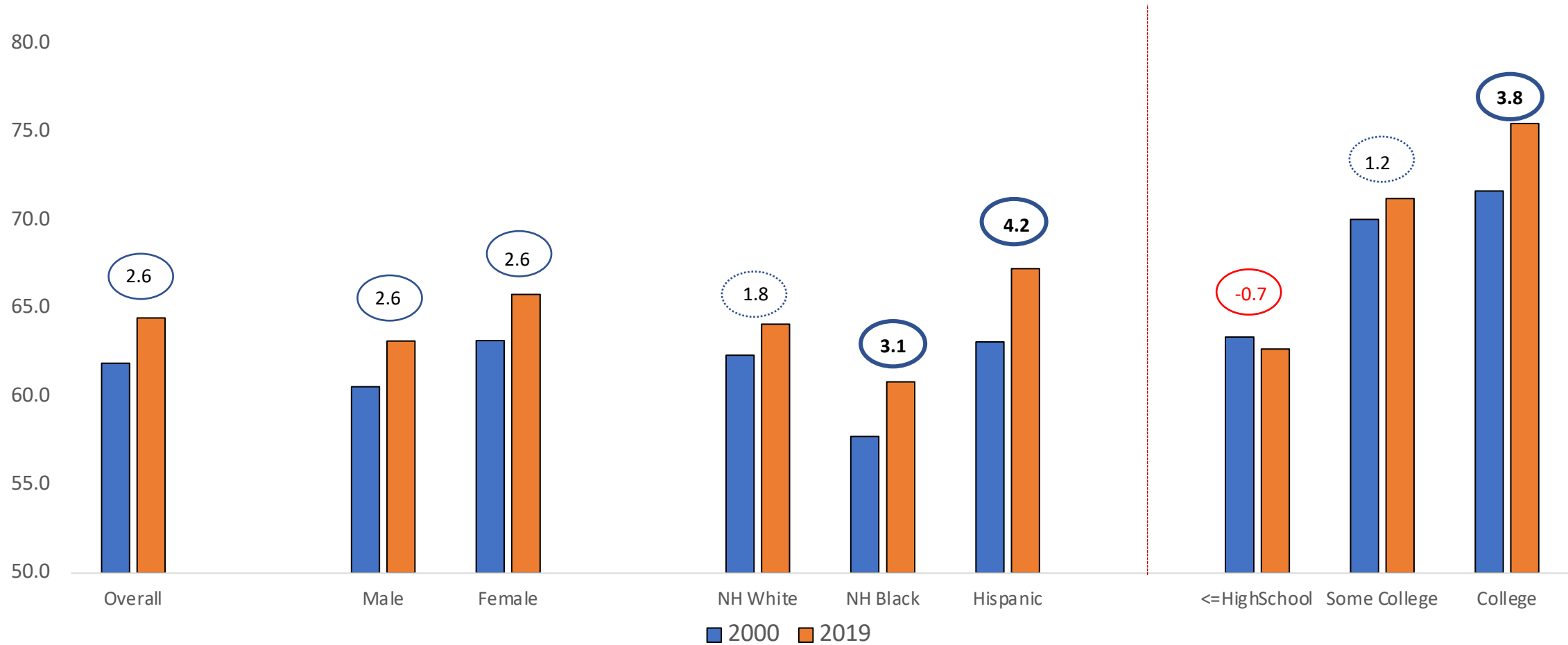
Mortality **increased** for the least educated group, fell for groups with more years of education

Quality of Life by Education



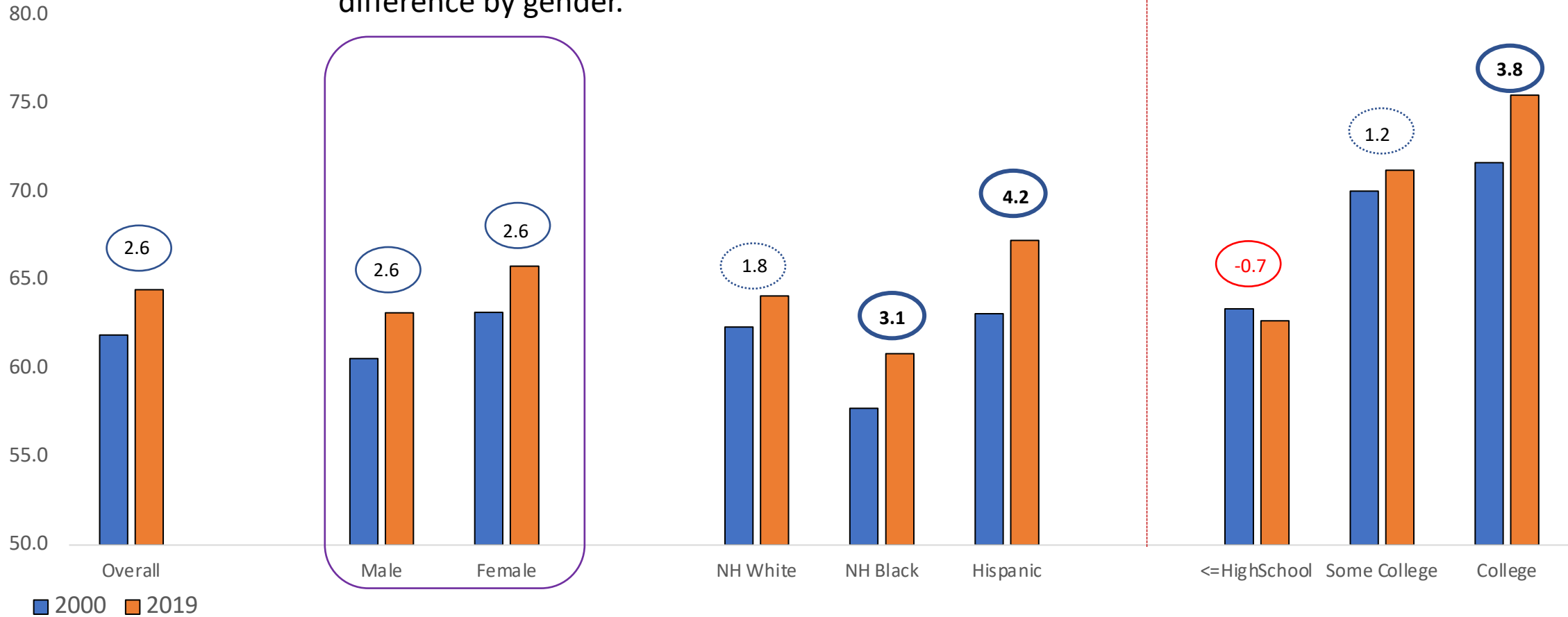
Quality of life increased for all education groups, more so for college grads.

QALE for different groups, 2000 and 2019

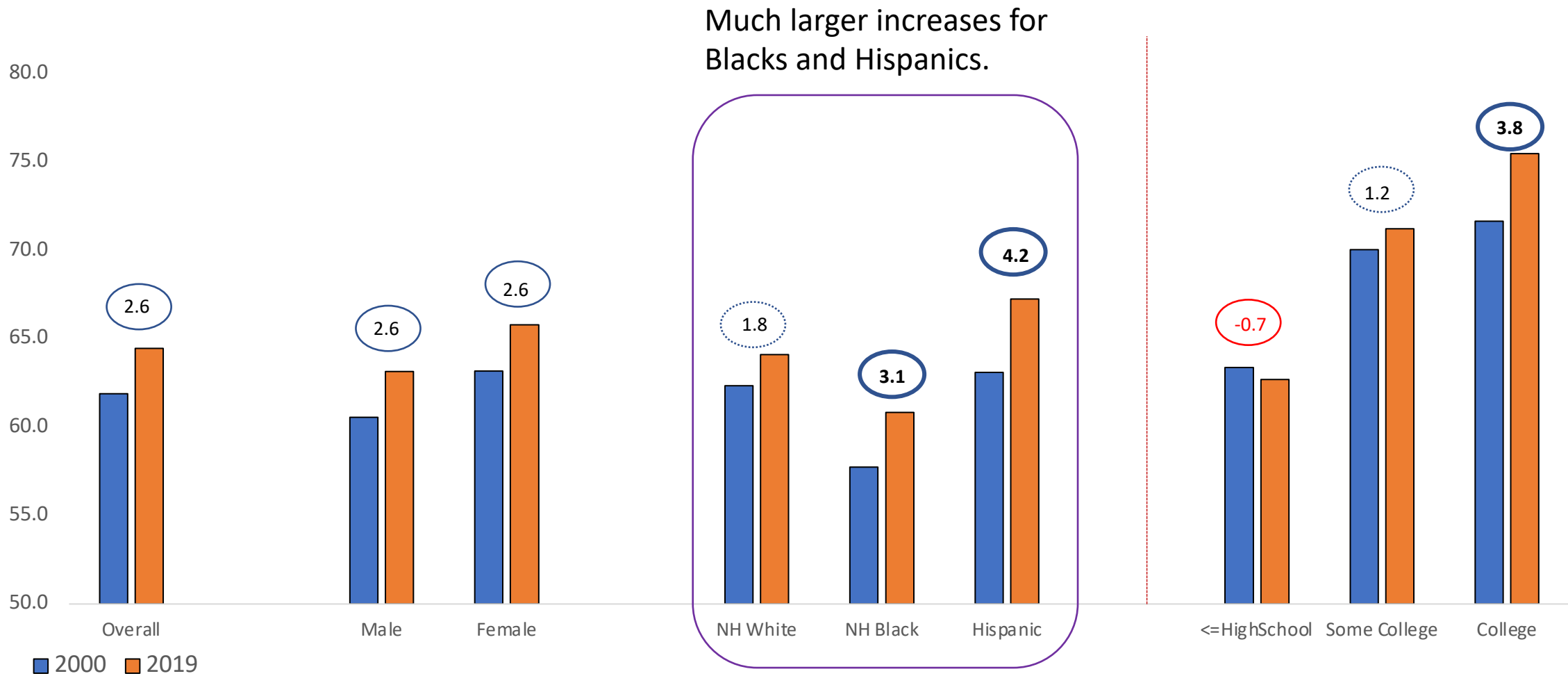


QALE for different groups, 2000 and 2019

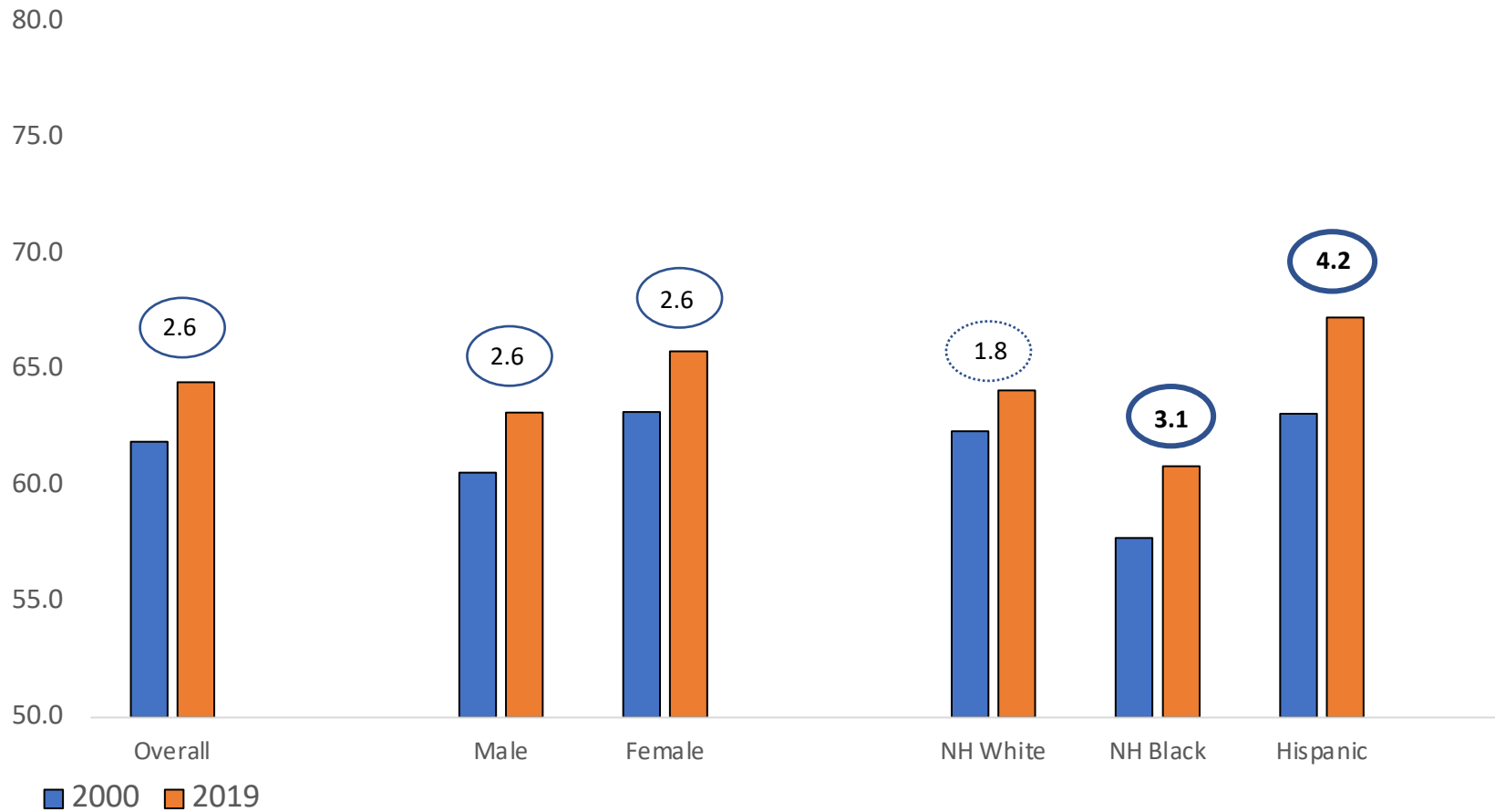
Essentially no
difference by gender.



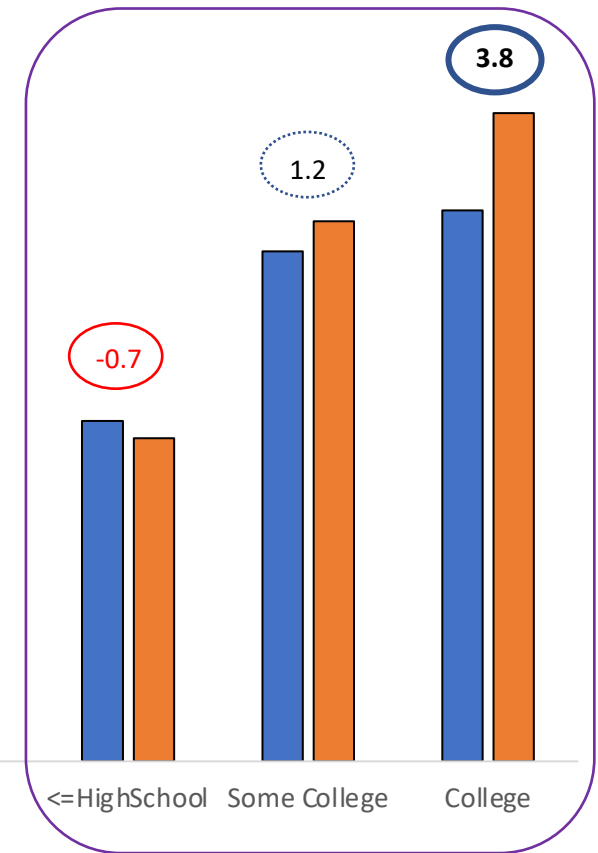
QALE for different groups, 2000 and 2019



QALE for different groups, 2000 and 2019



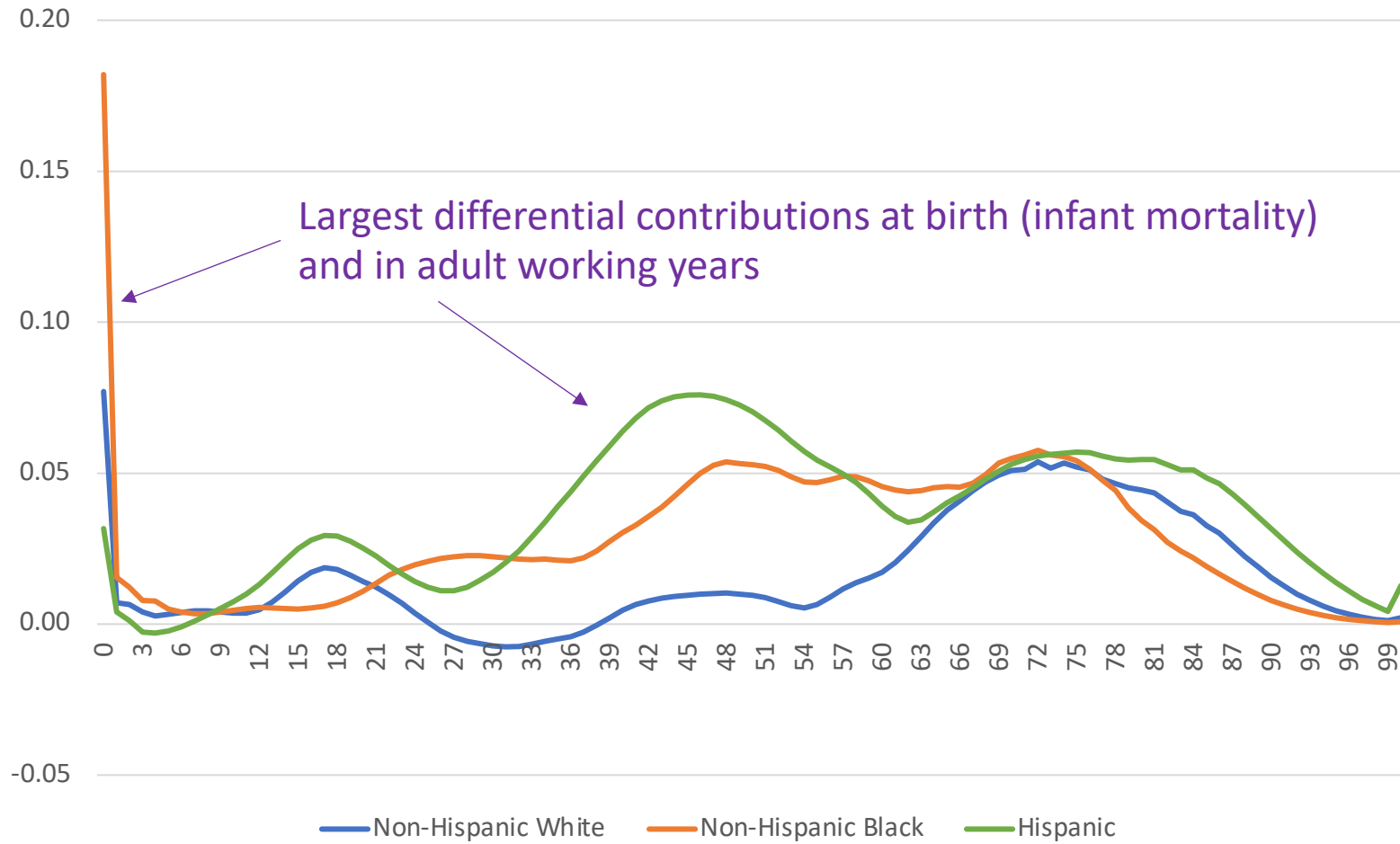
Much larger increases for people with more education



Convergence and Divergence

- Consider change in mortality and quality of life at each age.
- How much does each age contribute to White and Black QALE?
- Do same for \leq High School and College grad

Impact on QALE(0) due to changes in mortality and QOL at each single age



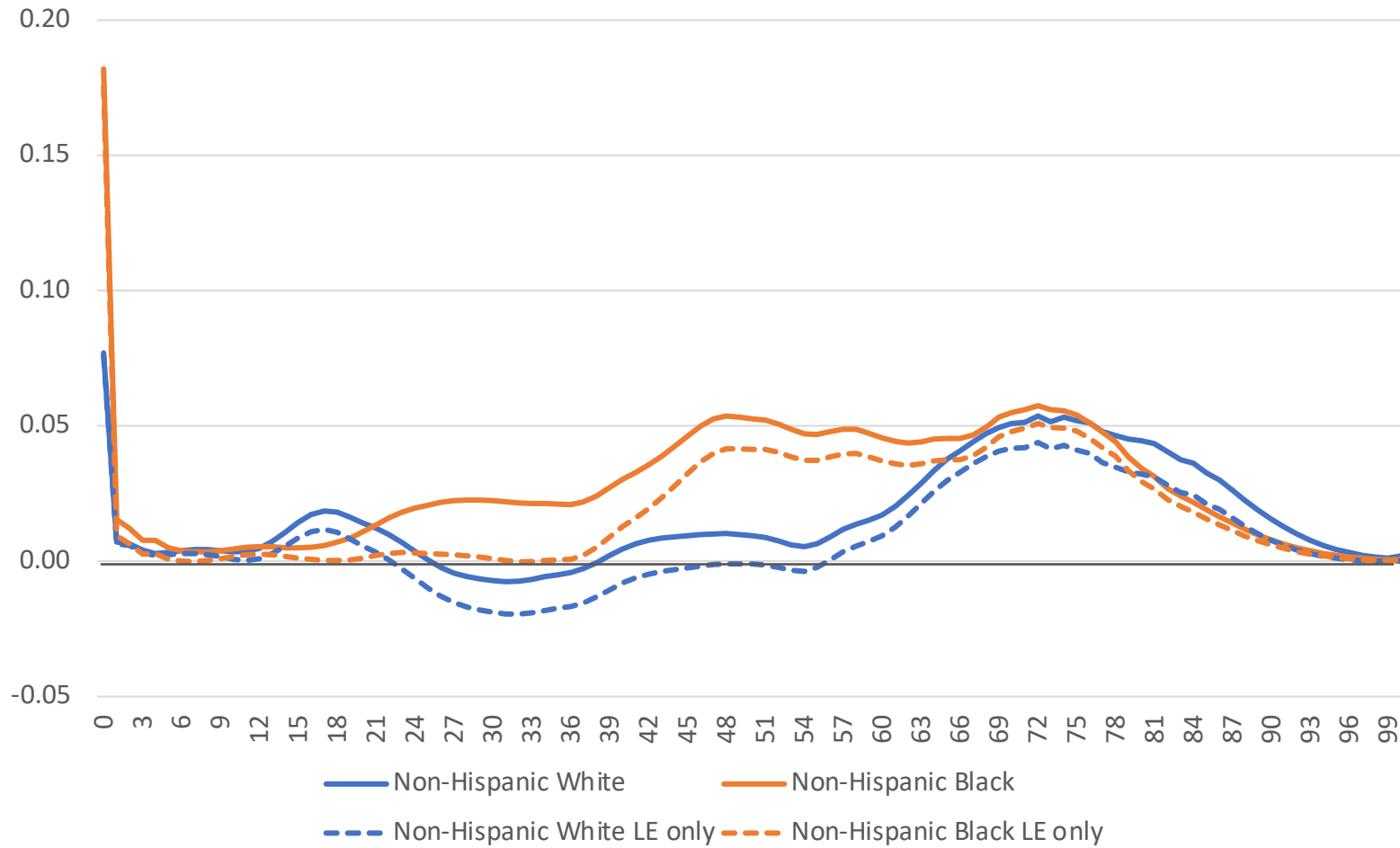
Total change in QALE

- NH Black = 3.1

- NH White = 1.8

- Hispanic = 4.1

Impact on QALE(0) due to changes in mortality and QOL at each single age



Total change in QALE

- NH Black = 3.1

- NH White = 1.8

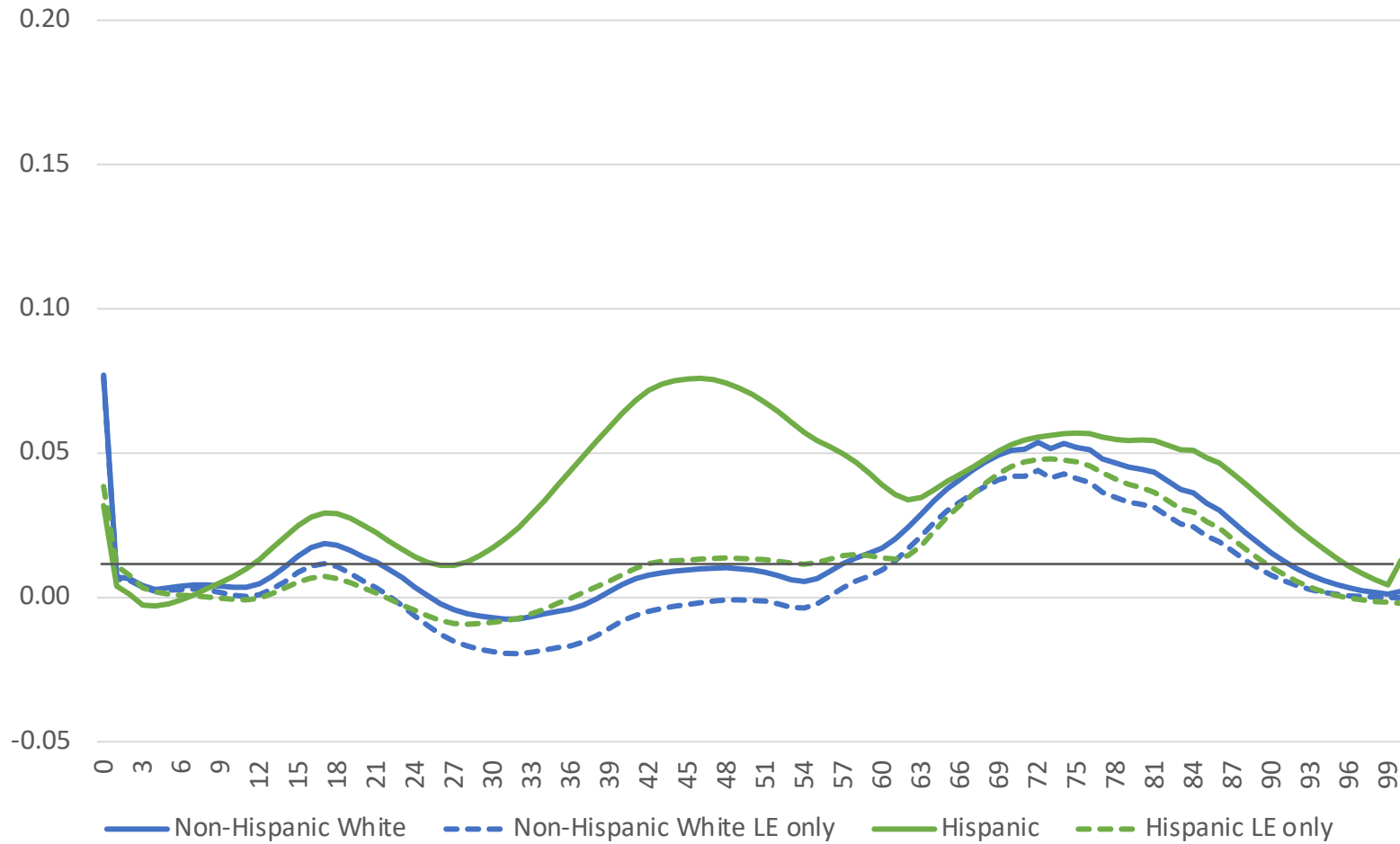
Total change in LE

- NH Black = 3.2

- NH White = 1.4

Vast bulk of closing in racial gap is due to differential change in life expectancy.

Impact on QALE(0) due to changes in mortality and QOL at each single age



Total change in QALE

- NH White = 1.8

- Hispanic = 4.2

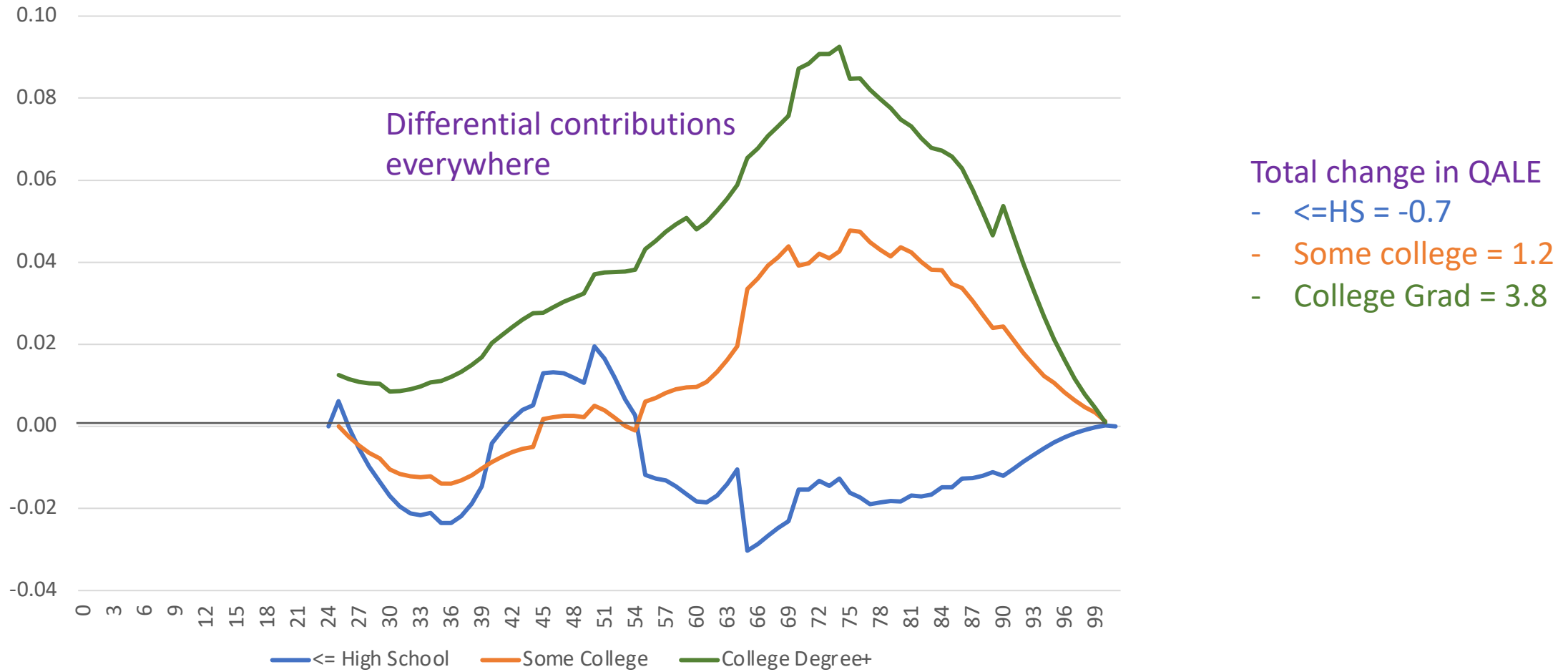
Total change in LE

- NH White = 1.4

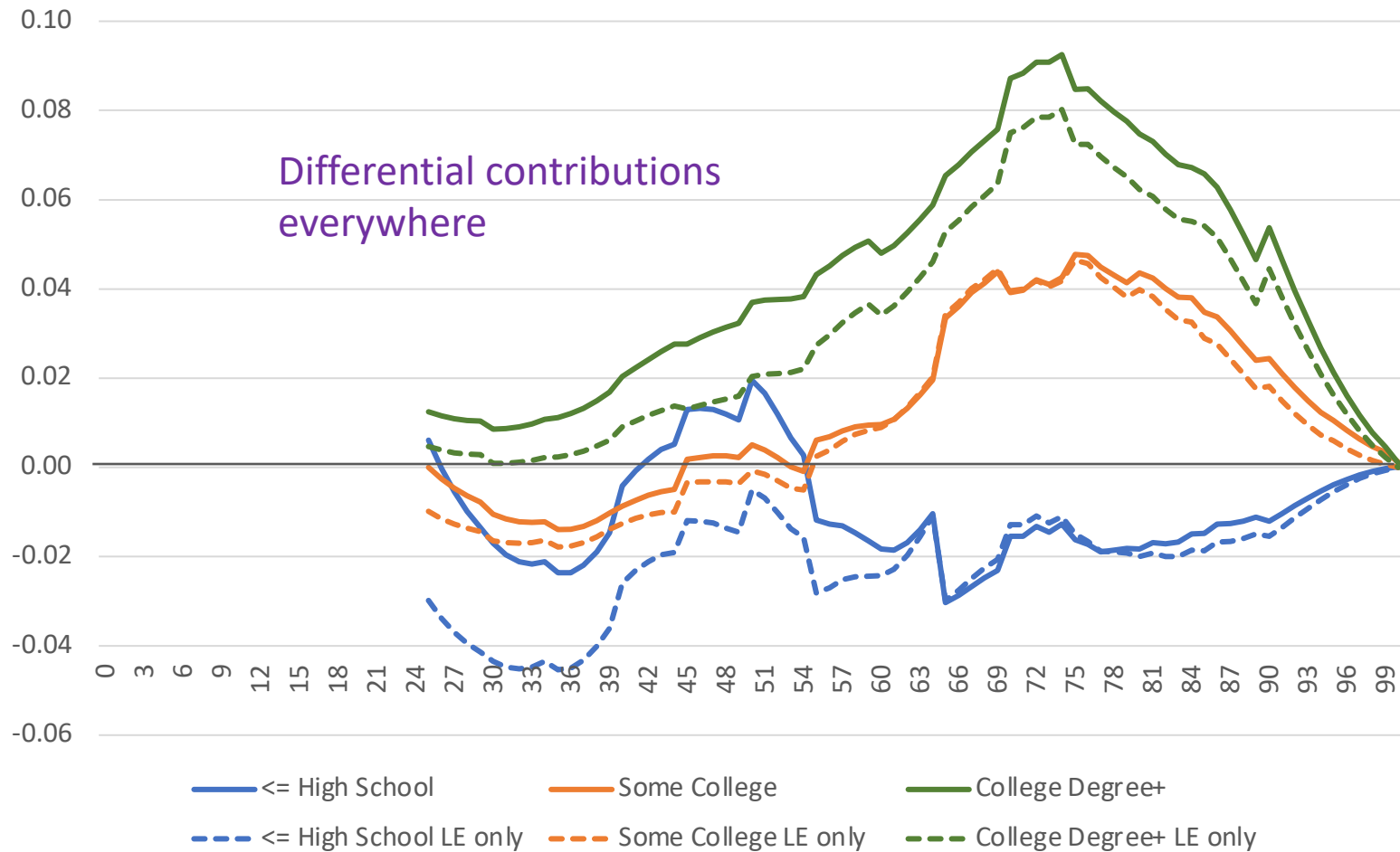
- Hispanic = 2.6

Though for middle-aged Hispanics, QOL contributes more.

Impact on QALE(0) due to changes in mortality and QOL at each single age



Impact on QALE(0) due to changes in mortality and QoL at each single age



Total change in QALE

- <=HS = -0.7
- Some college = 1.2
- College Grad = 3.8

Total change in LE

- <=HS = -2.1
- Some college = 1.5
- College Grad = 4.4

Vast bulk of widening in education gap is due to differential change in life expectancy.

QoL improved a lot for survivors <=High School.

Contribution of different ages to QALE change at birth

Contribution of Different Ages to QALE Increase at Birth / Age 25					
	Total	Ages 0-24	Ages 25-44	Ages 45-64	Ages 65+
NH White	1.8	0.3	0.0	0.3	1.2
NH Black	3.1	0.4	0.5	1.0	1.1
Hispanic	4.1	0.4	0.8	1.2	1.7
<=High School	-0.7	--	-0.2	-0.2	-0.4
Some college	1.2	--	-0.2	0.3	1.1
College grad	3.8	--	0.4	1.0	2.3

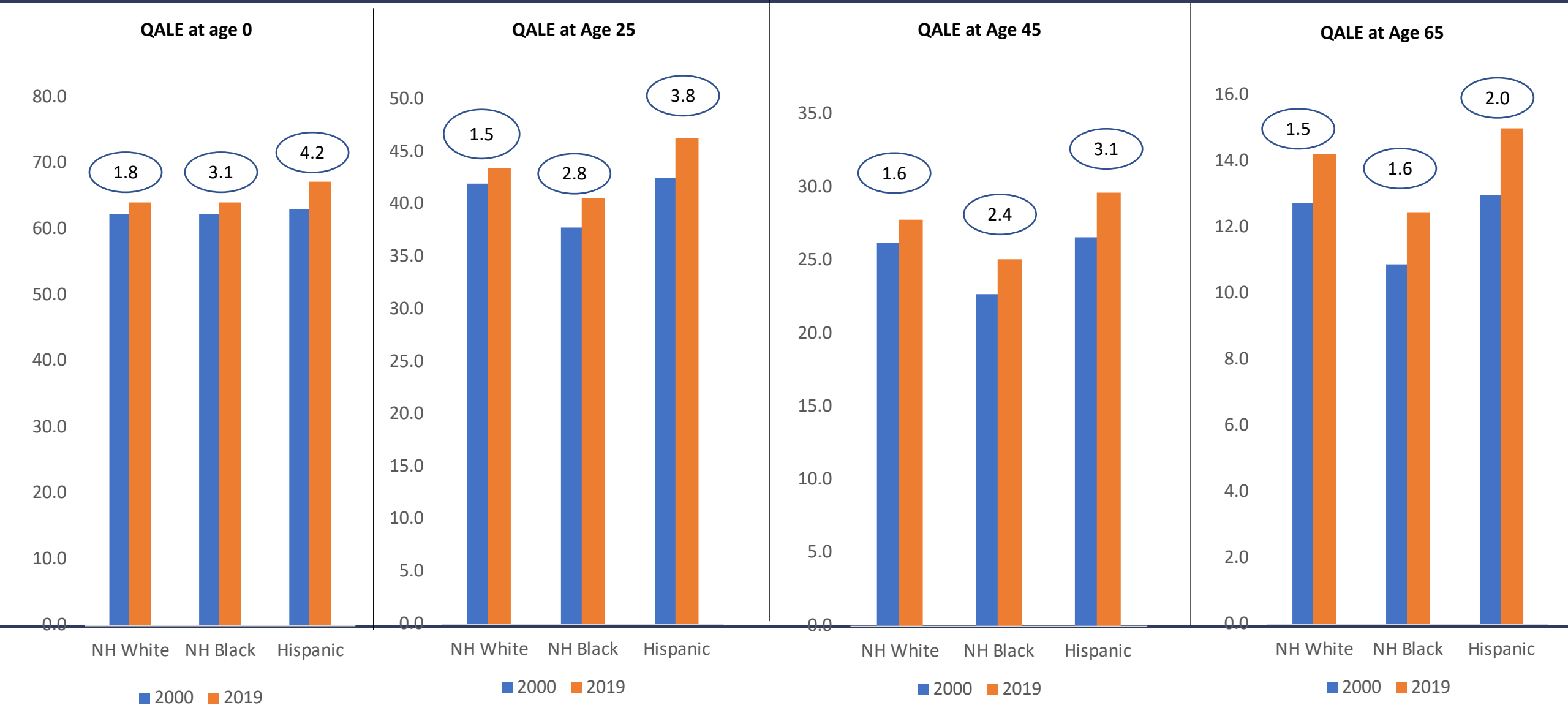
By race/ethnicity:

- Large contributions for all groups at ages 65+;
- Large differential from ages 25-64

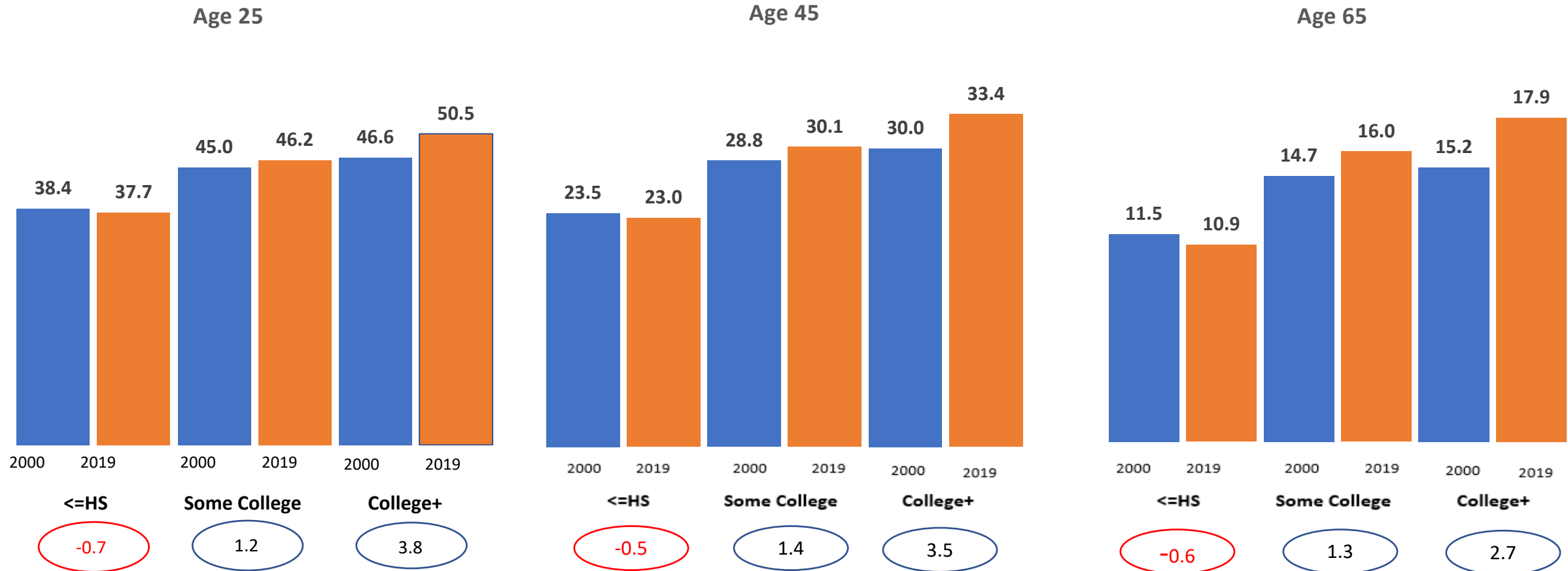
By education:

- Big differential at all ages, including 65+

QALE at different ages by race/ethnicity



QALE at different ages by education



Implications

- Educational outcomes radically affect health outcomes. Race is less related to health outcomes than in the past.
 - Need to consider race and education jointly.
- Both length and quality of life are important.
 - Quality of life relative more important in non-elderly population.
- Changes at birth and 'middle age' are very important for narrowing of B-W mortality differences.
- By education, changes are at every age.