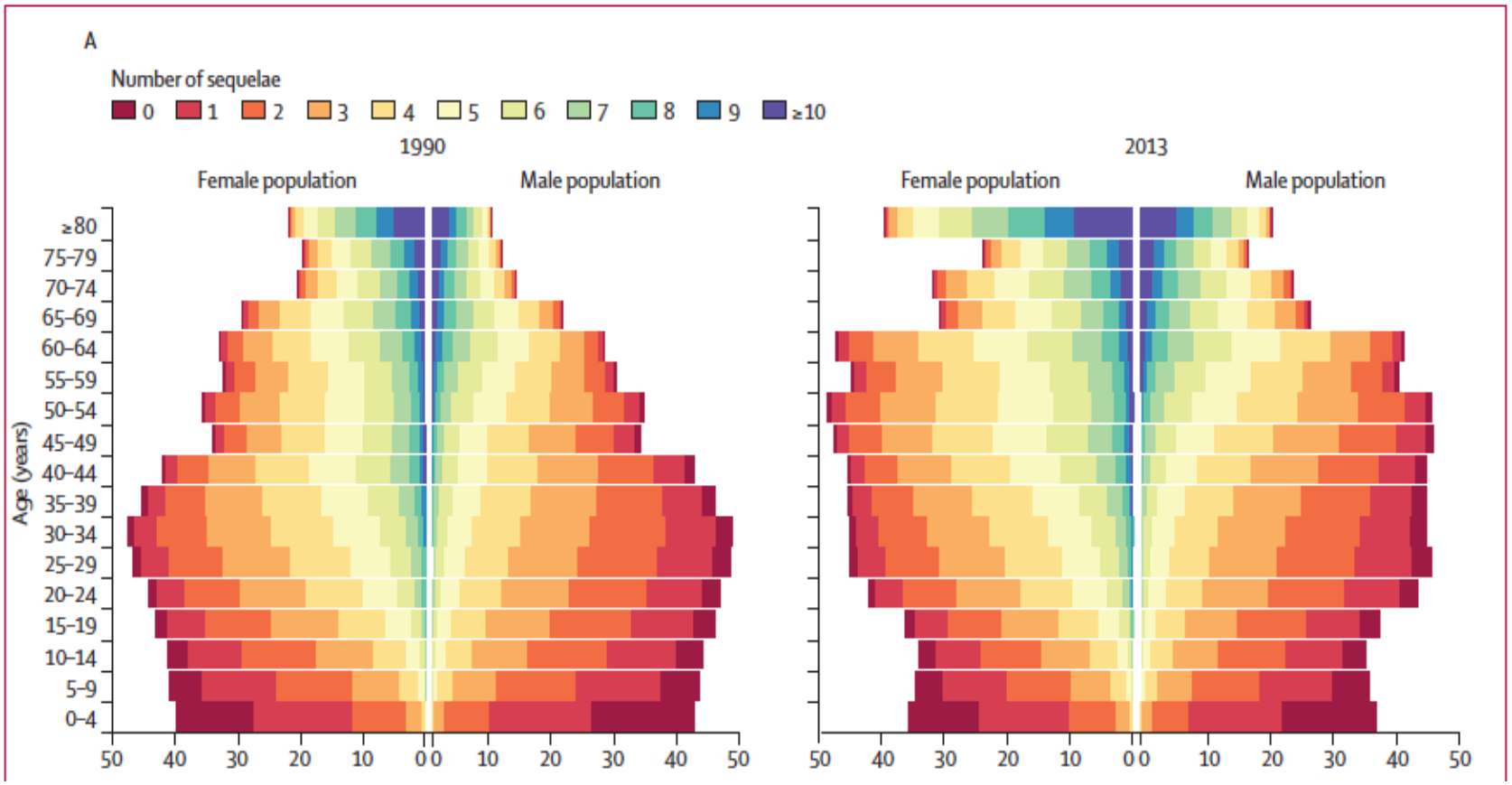
Sex Differences in Healthy Cardiovascular Aging

Andrea Z. LaCroix, PhD
Professor and Chief of Epidemiology
University of California San Diego

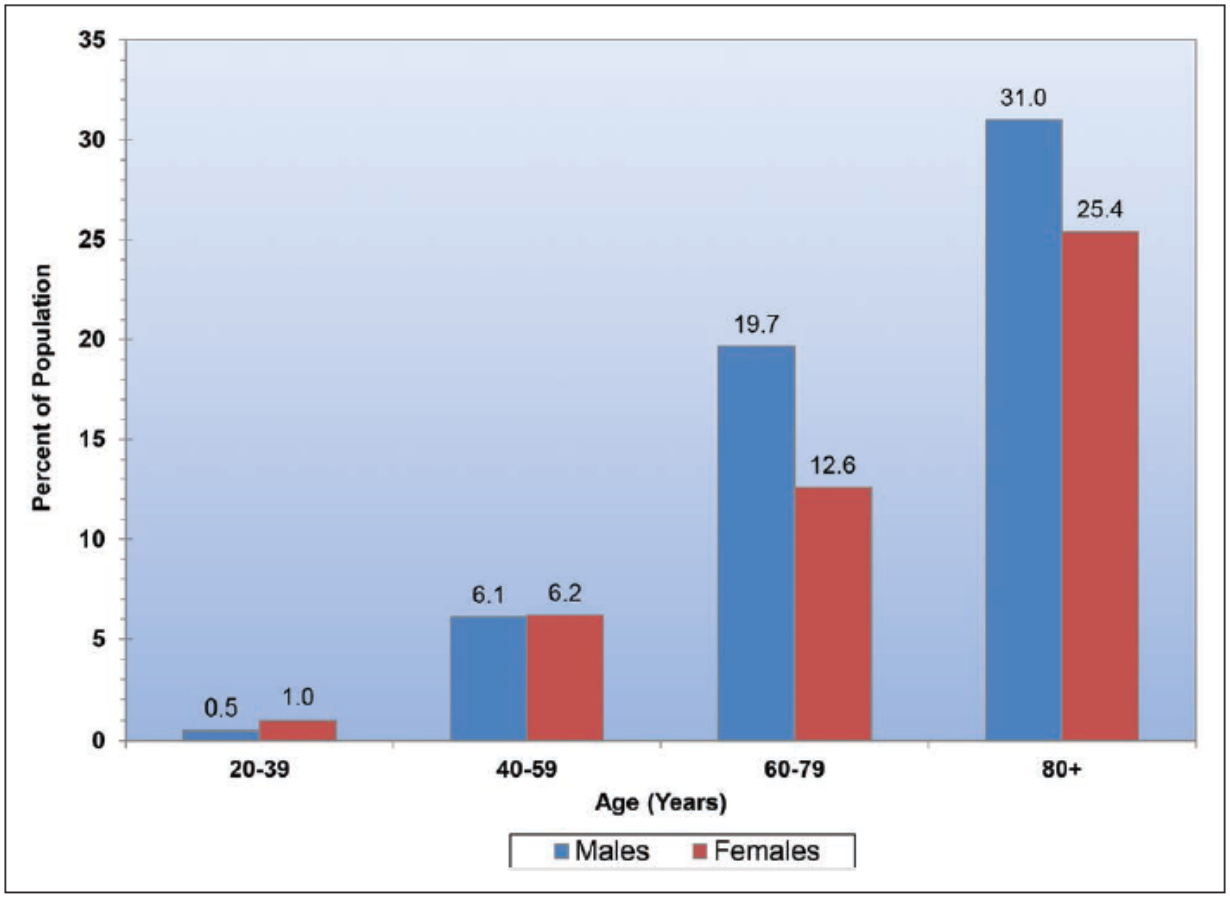
Presentation for the:
Research Centers Collaborative Network of the National Institute on Aging, NIH
Sex and Gender Differences in Aging
June 6-7, 2019 Los Angeles, CA

Women live longer than men…but



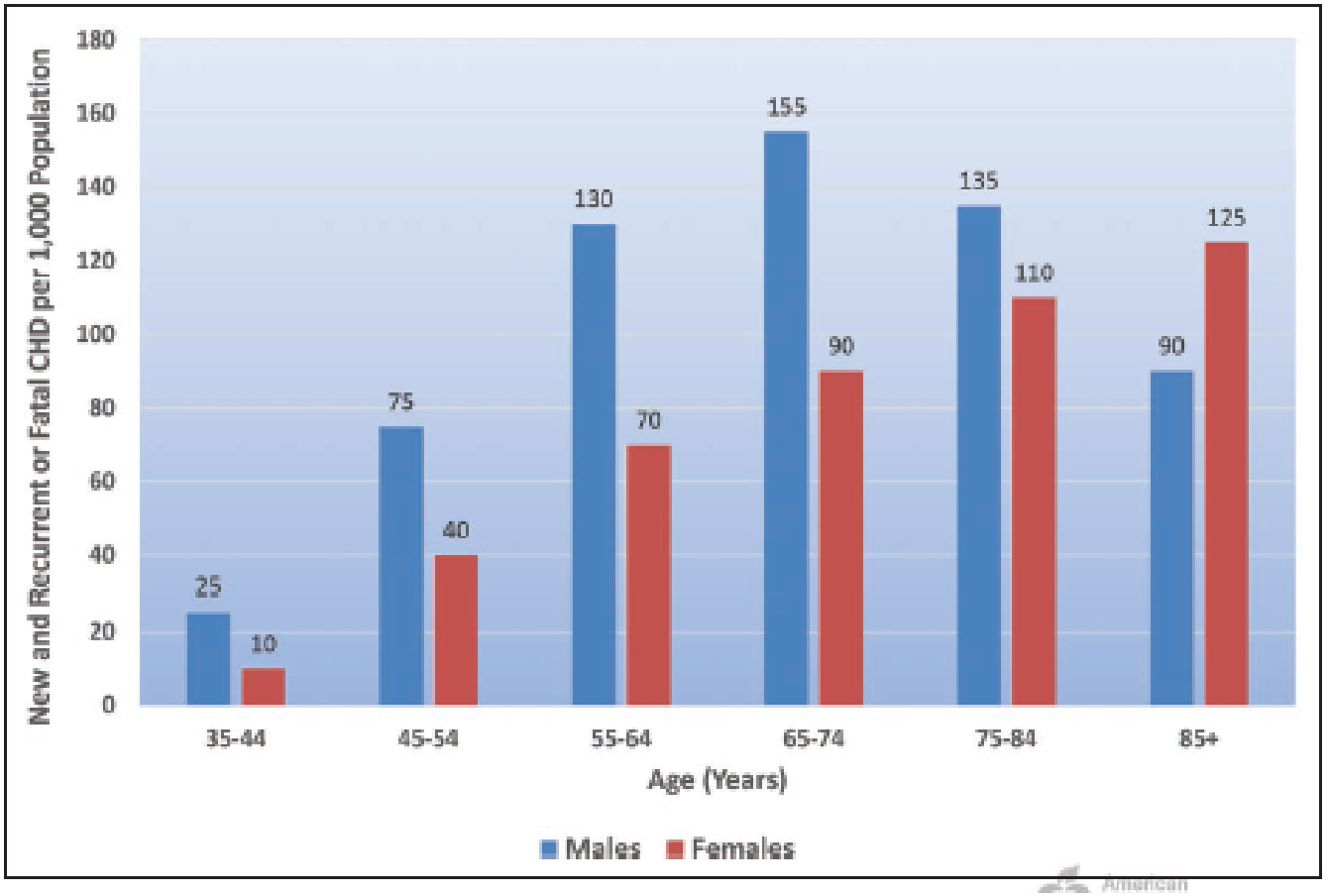
US Prevalence of CHD by Age and Sex

NHANES, 2013-2016)



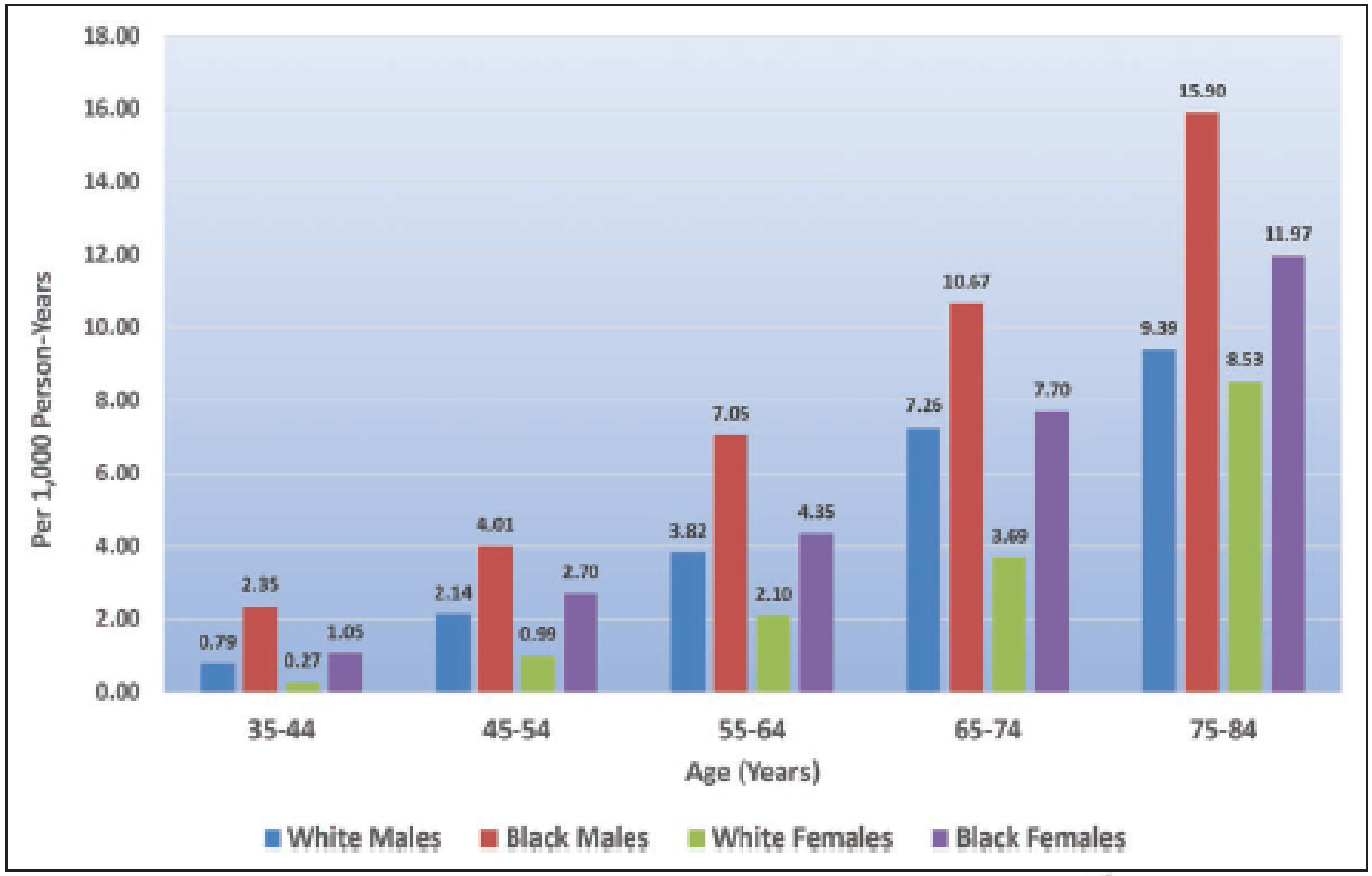
Rate per 1000 of adults diagnosed with MI or fatal CHD

ARIC surveillance, 2005-2014 and CHD



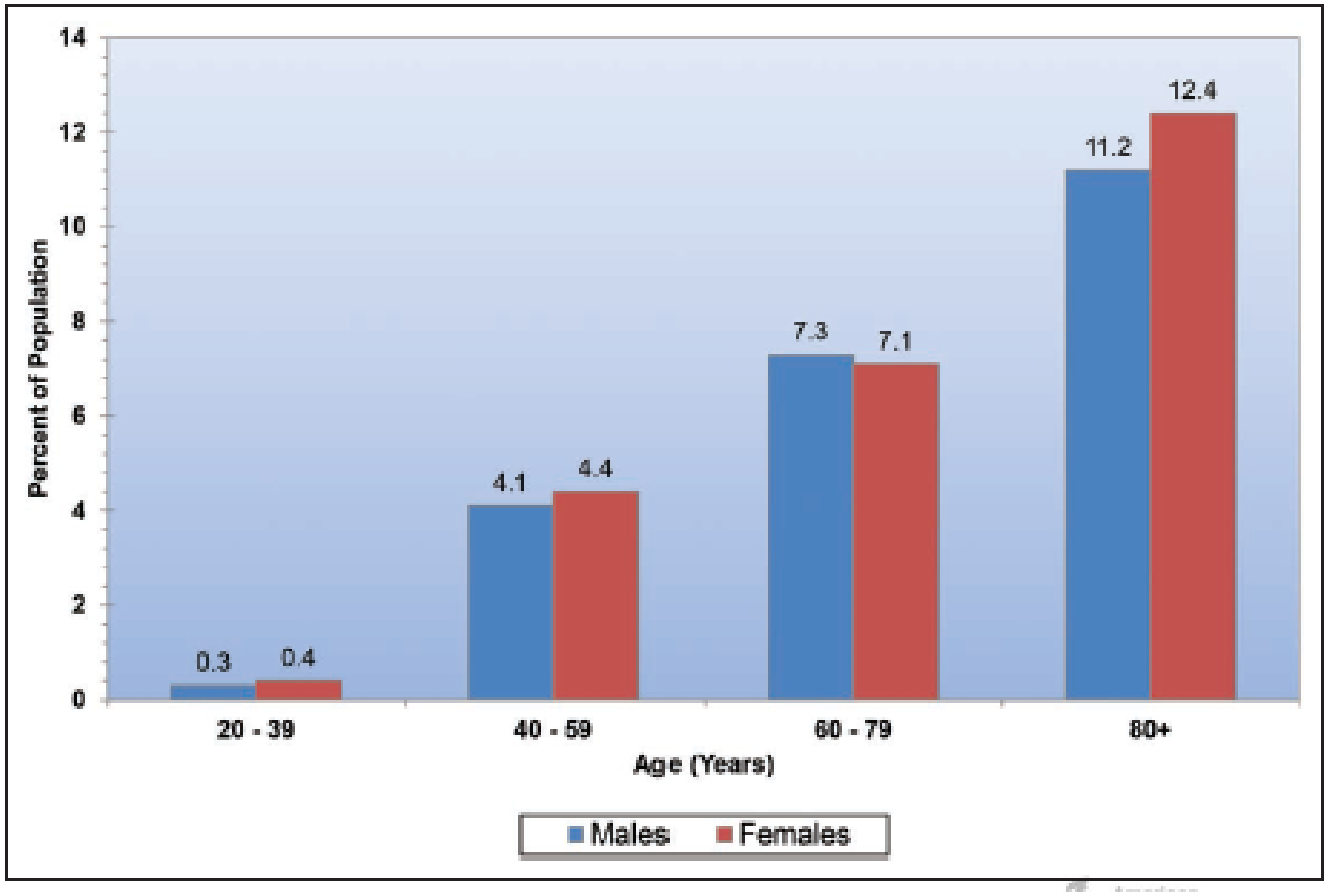
Incidence of MI by age, sex and race

ARIC Surveillance, 2005-2014

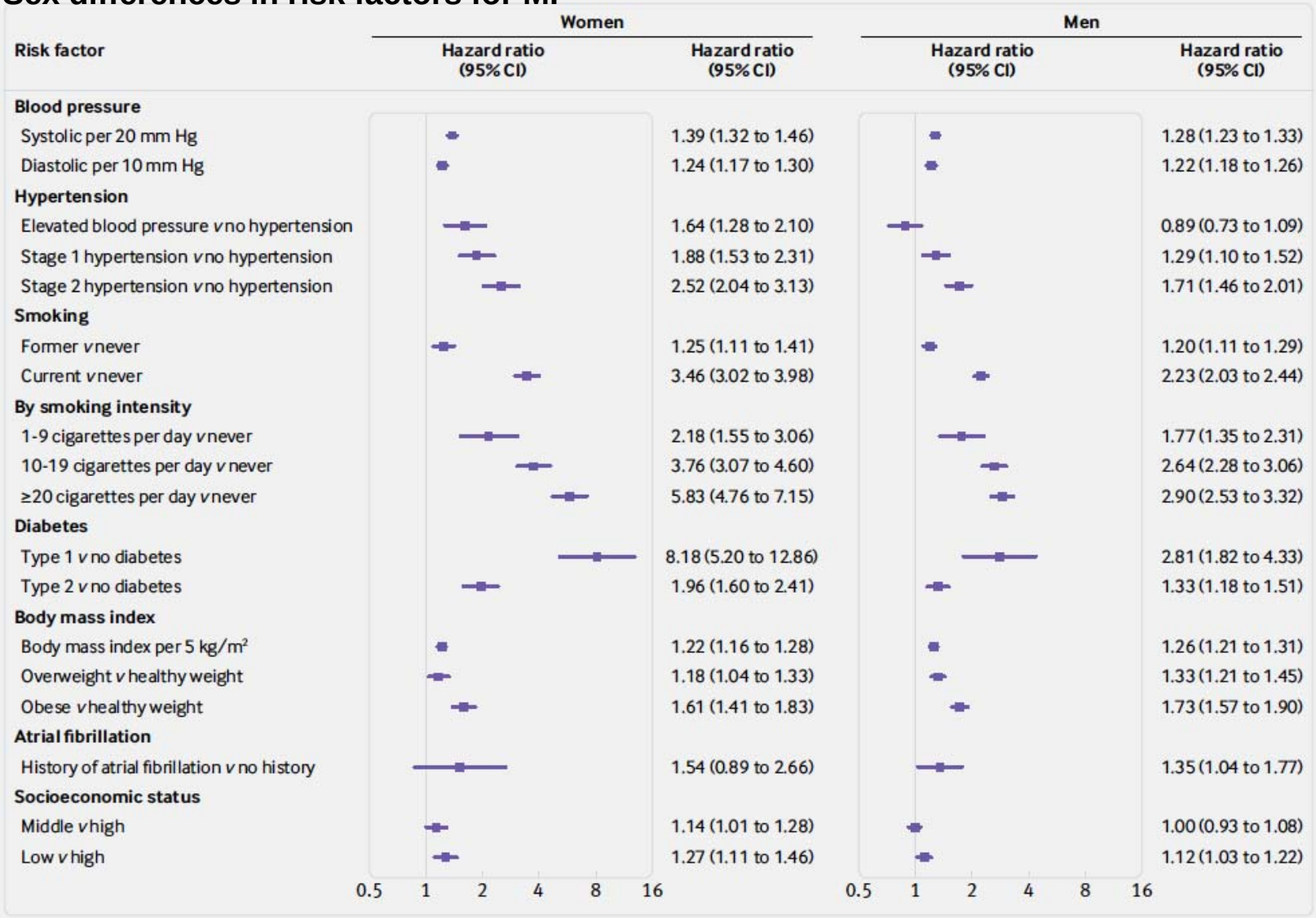


Prevalence of angina by age and sex

NHANES, 2013-2016

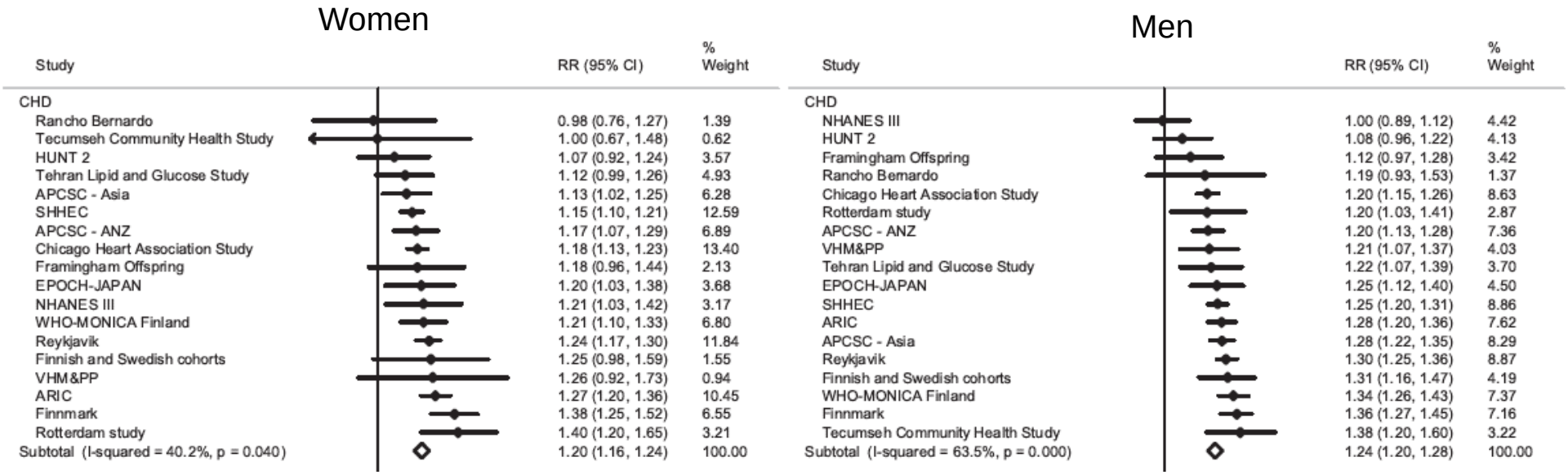


Sex differences in risk factors for MI



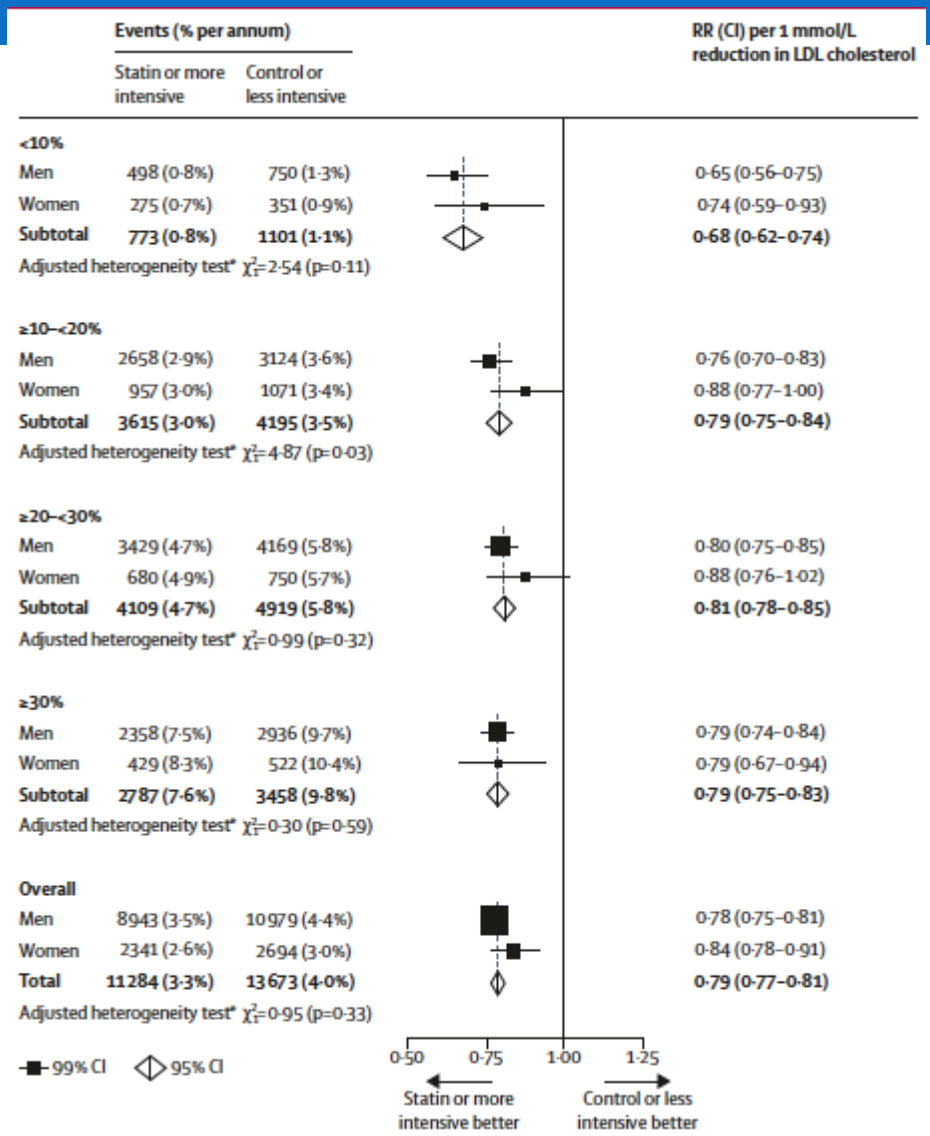
Meta-analysis of Total Cholesterol and Incident CHD per 1 mmol/L: 97 cohorts, N=1,022,276

Peters, 2016



Effects of LDL Lowering in Women vs. Men 22 Trials, n=174,149

Cholesterol Treatment Trialists Collaboration, 2015



Multinomial logistic regression assessing LDL and survival to age 90 with and without intact mobility

Maihofer, 2019; under review.

	Mobility lost , OR (CI)			Mobility Intact, OR (CI)		
Model	**Q2 125-149 mg/dL**	**Q3 149-173 mg/dL**	**Q4 173+ mg/dL**	**Q2 125-149 mg/dL**	**Q3 149-173 mg/dL**	**Q4 173+ mg/dL**
Age, Ethnicity	0.97 (0.21 - 4.5)	1.22 (0.3 - 4.91)	0.98 (0.1 - 9.95)	1.25 (0.32 - 4.94)	1.4 (0.36 - 5.49)	1.26 (0.06 - 24.8)
+ Medical factors*	0.98 (0.21 - 4.63)	1.19 (0.29 - 4.9)	0.96 (0.09 - 9.8)	1.26 (0.31 - 5.06)	1.37 (0.34 - 5.46)	1.21 (0.82 - 1.79)
+ Lifestyle factors**	0.96 (0.33 - 2.83)	1.2 (0.48 - 2.97)	0.96 (0.16 - 5.9)	1.26 (0.52 - 3.05)	1.39 (0.58 - 3.34)	1.27 (1.05 - 1.53)

*Medical factors include antihypertensives, past or current hormone therapy, and diabetes requiring treatment
** Lifestyle factors include alcohol, BMI, blood pressure (SBP and DBP), general health, smoking, and total physical activity per week

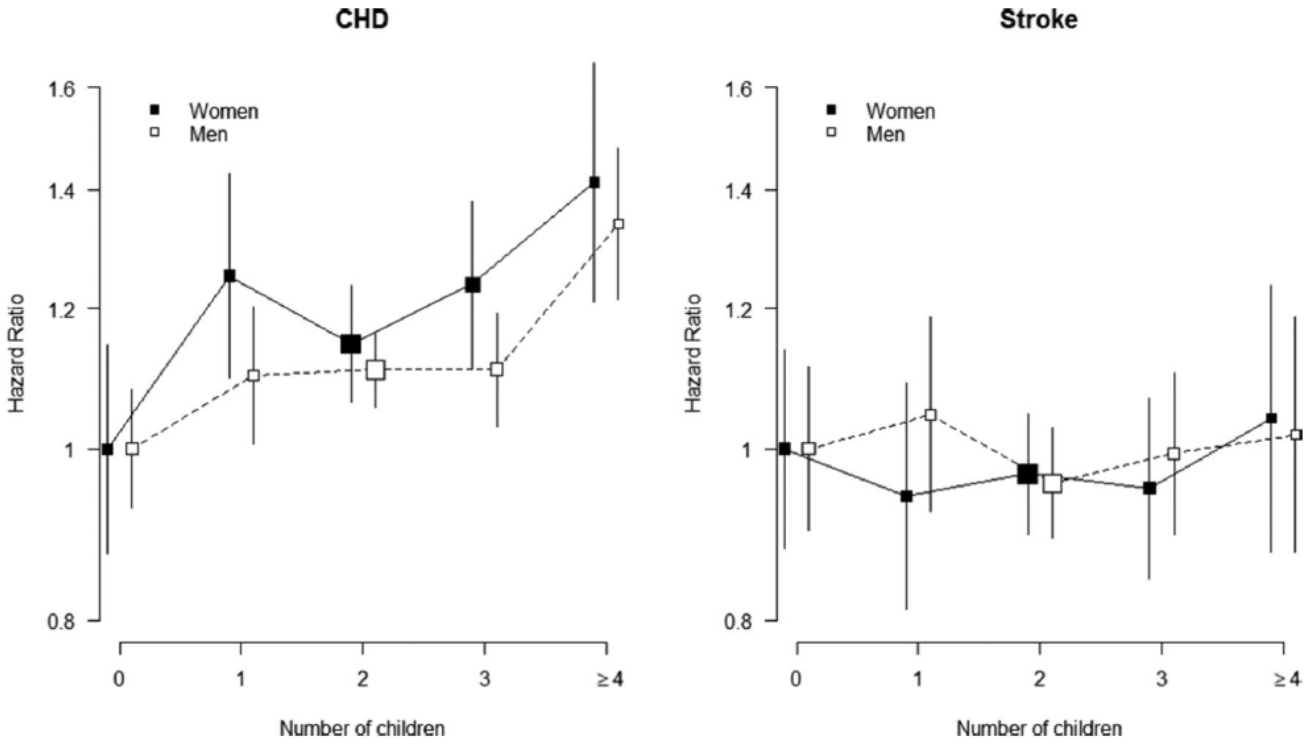
Meta-analysis of Pregnancy Complications and CVD in Women

Circulation, Grandi, 2019

		Primary Analysis			
Pregnancy Complication	**Study Design**	**No. Studies**	**Pooled Odds Ratio (95% ICI)**	**I^2, %**	**Tau^2**
Cardiovascular-related morbidity*					
Gestational hypertension	Cohort	9	1.67 (1.28–2.19)	83.9	0.102
Moderate preeclampsia	Cohort	16	2.24 (1.72–2.93)	95.0	0.176
Severe preeclampsia	Cohort	6	2.74 (2.48–3.04)	0	0
Preterm birth	Cohort	12	1.63 (1.39–1.93)	91.1	0.036
Stillbirth	Cohort	4	1.49 (1.08–2.06)	85.0	0.061

Number of children and CVD

UK Biobank - Peters, 2017



Disability before and after Stroke and MI

Cardiovascular Health Study, 2017

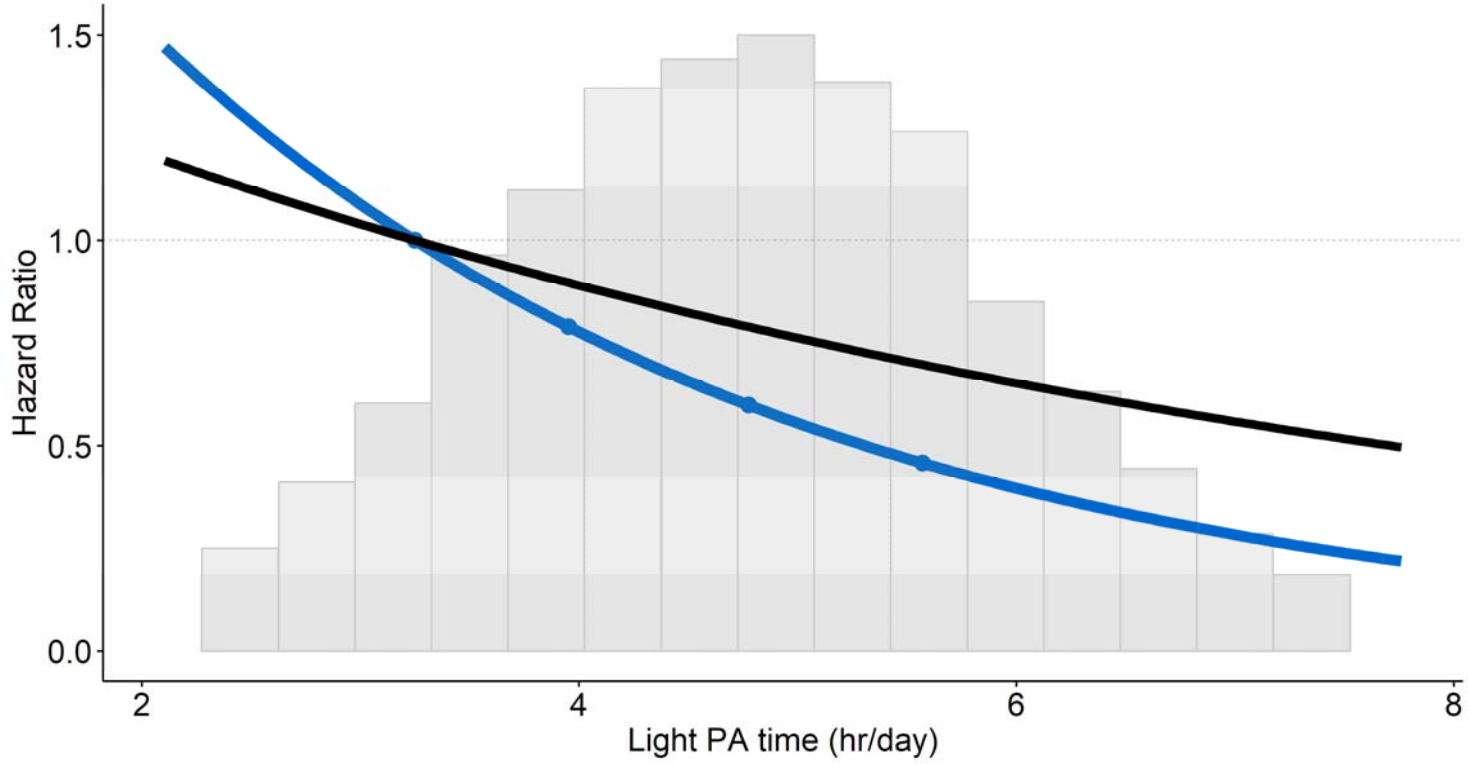
Table 4. Trajectories of Disability Before and After Stroke and MI in the Entire Cohort of 5888 Participants

Variable	Change in Disability Score (95% CI)	*P* Value
Annual change	0.11 (0.10 to 0.12)	<.001
Change in disability score around time of stroke	0.88 (0.57 to 1.20)	<.001
Change in disability score around time of MI	0.20 (0.06 to 0.35)	.006
Additional annual change after stroke	0.14 (0.09 to 0.20)	<.001
Additional annual change after MI	0.01 (−0.02 to 0.04)	.42

Abbreviation: MI, myocardial infarction.

Light PA time and risk for incident CHD events

Continuous dose-response relationship, Model 4



HR (95% CI) for 1hr/day of light PA time	
Model 1 **minimally adjusted**	**0.71** (0.62-0.82)
Model 2 **fully adjusted**	**0.80** (0.69-0.93)
Model 3 **adjusting for cvd-risk biomarkers**	**0.84** (0.71-0.98)
Model 4 **adjusting for MVPA***	**0.86** (0.73-1.00)

***MVPA = moderate-to-vigorous physical activity**

Summary of Results

- Burden of CVD substantial in both sexes; at ages 85+ greater in women
- Risk factors similar, but relative risks for women greater for hypertension, smoking and diabetes, lower for cholesterol
- Pregnancy complications an important risk factor for women
- SPPB predicts future CVD events even in low risk women
- Light PA associated with a 42% reduced risk of MI or coronary death and a 22% reduced risk of new CVD events.
- Much more research needed on sex differences in healthy CVD aging especially in risk factor-disease associations in different age groups.


Aging is not lost youth but a **new stage** of opportunity and strength.
- Betty Friedan
THE heart TRUTH
HeartTruth.gov

Hazard Ratios (95% CI) for CHD and CVD

	Light Physical Activity Quartiles				P-trend[c]
CHD rate per 100	59 [11.8]	36 [7.0]	28 [5.4]	20 [3.8]	
Model 1	1 (ref)	0.67 (0.44-1.01)	0.55 (0.35-0.87)	0.42 (0.25-0.70)	<0.001
Model 2	1 (ref)	0.71 (0.47-1.08)	0.60 (0.38-0.96)	0.46 (0.28-0.78)	<0.001
Model 3	1 (ref)	0.79 (0.51-1.20)	0.72 (0.45-1.15)	0.58 (0.34-0.99)	0.004
Model 4	1 (ref)	0.82 (0.54-1.26)	0.79 (0.49-1.27)	0.68 (0.39-1.18)	0.03
CVD rate per 1000	183 [37.9]	161 [32.3]	124 [24.3]	102 [19.7]	
Model 1	1 (ref)	0.93 (0.75-1.15)	0.73 (0.58-0.92)	0.63 (0.49-0.81)	<0.001
Model 2	1 (ref)	0.96 (0.78-1.19)	0.77 (0.61-0.97)	0.66 (0.52-0.85)	<0.001
Model 3	1 (ref)	1.02 (0.82-1.27)	0.88 (0.69-1.11)	0.78 (0.60-1.00)	0.004
Model 4	1 (ref)	1.05 (0.84-1.30)	0.90 (0.71-1.14)	0.82 (0.63-1.07)	0.02