# **Center for Asian Health** Promotion and Equity (CAHPE)



RUTGERS HEALTH Institute for Health, Health Care Policy and Aging Research



# Even low levels of secondhand smoke may harm memory and thinking in older adults who never smoked. Creating smoke-free spaces can help protect brain health in aging populations.

#### **Secondhand Smoke Exposure and Cognitive Function in U.S. Never-Smoking Older Adults**

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# **Background**

Secondhand smoke (SHS) is a pervasive environmental neurotoxin, yet evidence linking biomarker-measured SHS exposure to domain-specific cognitive decline in older never-smokers remains limited. This study investigates how serum cotinine-based SHS exposure associates with cognitive performance and explores sociodemographic/lifestyle modifiers.

## Objective

This study addresses these gaps to test two hypotheses:

1. Higher SHS exposure is associated with poorer performance in domain-specific cognitive tasks among never-smoking older adults.

2.Sociodemographic and lifestyle factors attenuate or exacerbate these associations.

### **Methods**

We analyzed 2011–2014 NHANES data from 1,211 neversmokers aged ≥60 years. SHS exposure was categorized into four groups (unexposed to high) using serum cotinine. Cognitive function was assessed via CERAD (immediate/delayed recall), Animal Fluency, and Digit Symbol Substitution. Survey-weighted linear regression models evaluated associations across three adjustment levels: demographics (age, sex, race), socioeconomic factors (education, income), and lifestyle (BMI, physical activity). Subgroup and sensitivity analyses tested effect modification and robustness to unmeasured confounding.

Moderate SHS exposure (0.02–0.04 ng/mL) was associated with deficits in delayed recall ( $\beta$  = -0.49, 95% CI: -0.99, -0.04) and executive function ( $\beta$  = -2.33, -4.45, -0.21) after full adjustment, whereas high exposure (>0.04 ng/mL) showed no consistency dose-response. Vulnerable subgroups included adults aged  $\geq 80$  ( $\beta$ = -1.10, -2.11, -0.09), married individuals ( $\beta$  = -0.58, -1.16, -0.002), and those with high school education ( $\beta = -0.96, -1.89, -0.04$ ). Physical activity moderated SHS effects on delayed recall (interaction p = 0.033).

**Findings** 

Unweighted NHANES sample         N = 1,211         N = 596         N = 12         N = 131         N = 25.9 $P^{p \ early}$ Weighted NHANES sample         P = 23,978,3404         N = 3,23,742,10         P = 2,378,310,9991         N = 2,3778,2821         68.11 (6.47)         0.221 (201)         69.29 (6.81)         68.99 (6.63)         68.11 (6.47)         0.21 (201)         69.29 (6.81)         68.99 (6.63)         68.11 (6.47)         0.21 (201)         69.39 (7.01)         103 (41)         0.77 (7.25821)         0.77 (40)         103 (41)         0.77 (41)         103 (41)         0.77 (41)         113 (62)         108 (60)         1149 (59)         3.66 (7.01)         134 (7.01)         145 (5.50)         0.66 (7.01)         149 (59)         3.66 (7.01)         135 (5.0)         0.66 (7.01)         135 (7.01)         142 (23)         36 (20)         108 (43)         0.66 (7.01)         0.66 (7.01)         103 (41)         0.77 (7.01)         142 (7.01)         125 (5.0)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.66 (7.01)         0.67 (7.01)         0.71 (28)         0.60 (7.01)         0.66 (7.01)         0.67 (7.01)         0.66 (7.01)         0.66 (7.01) </th <th></th> <th>Overall</th> <th>Unexposed</th> <th>Low</th> <th>Moderate</th> <th>High</th> <th>n Value I</th>		Overall	Unexposed	Low	Moderate	High	n Value I					
Weighted MHANES sampleN = 2,278,3404N = 1,3,150,5991N = 3,272,3241N = 2,631,0571N = 3,772,5821Gender69.54 (6.87)70.38 (7.01)69.29 (6.81)68.91 (6.87)68.11 (6.47)0.21Gender437 (36)192 (32)69 (38)73 (40)103 (41)0.77Female774 (64)404 (68)113 (62)108 (60)149 (59)Race/ethnicity128 (11)77 (12)17 (9)25 (14)15 (5.50)Non-Hispanic128 (11)77 (12)17 (9)25 (14)15 (5.50)Non-Hispanic White559 (49)349 (59)83 (46)72 (40)85 (34)Other rispanic137 (11)47 (7.90)27 (15)34 (19)29 (12)Churdials)137 (11)47 (7.90)27 (15)34 (19)29 (12)Education level	Unweighted NHANES sample	N = 1,211	N = 596	N = 182	N = 181	N = 252	p-value					
Age (years)         69.54 (6.87)         70.38 (7.01)         69.29 (6.81)         68.99 (6.63)         68.11 (6.47)         0.21           Male         437 (36)         192 (32)         69 (38)         73 (40)         103 (41)         0.77           Male         477 (64)         404 (68)         113 (62)         108 (60)         1149 (59)         70.40         85 (34)         77           Race/ethnicity         128 (11)         77 (12)         13 (7)         14 (7)         15 (5.50)         P<<0.0           Other Hispanic         128 (11)         77 (12)         67 (11)         42 (23)         36 (20)         108 (83)         P<<0.0           Other race (including Multi-Racial         137 (11)         47 (7.90)         27 (15)         34 (19)         29 (21)         P<<0.0           Churat Individuals         137 (11)         47 (7.90)         27 (15)         34 (19)         29 (21)         P<<0.0           Churat Individuals         137 (11)         47 (7.90)         27 (15)         34 (19)         29 (20)         P<<0.0           Churat Individuals         137 (11)         47 (7.90)         27 (15)         36 (20)         110 (44)         P<<<0.0           Eustion Individuals         137 (12)         37 (63) <th10 (27)<="" t<="" td=""><td>Weighted NHANES sample</td><td>N = 22,978,3404</td><td>N = 13,150,9591</td><td>N = 3,423,7421</td><td>N = 2,631,0571</td><td>N = 3,772,5821</td><td></td></th10>	Weighted NHANES sample	N = 22,978,3404	N = 13,150,9591	N = 3,423,7421	N = 2,631,0571	N = 3,772,5821						
	Age (years)	69.54 (6.87)	70.38 (7.01)	69.29 (6.81)	68.99 (6.63)	68.11 (6.47)	0.219					
	Gender											
	Male	437 (36)	192 (32)	69 (38)	73 (40)	103 (41)	0.770					
Race/ethnicity         Image: Constraint of the second secon	Female	774 (64)	404 (68)	113 (62)	108 (60)	149 (59)						
$\begin{array}{l c c c c c c c c c c c c c c c c c c c$	Race/ethnicity											
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Mexican American	104 (8)	62 (10)	13 (7)	14 (7)	15 (5.50)						
Non-Hispanic White         SE9 (49)         349 (59)         83 (46)         72 (40)         85 (34)         P < 0.0           Non-Hispanic Black         253 (21)         67 (11)         42 (23)         36 (20)         108 (43) $100 (43)$ Other race (including Multi-Racial Individuals)         137 (11)         47 (7.90)         27 (15)         34 (19)         29 (12) $100 (43)$ Education level           40 (22)         43 (24)         71 (28) $P < 0.0$ Married         269 (22)         115 (19)         35 (19)         48 (27)         71 (28) $P < 0.0$ Married         693 (57)         372 (62)         105 (58)         91 (50)         127 (50)         0.04           Cherwise         518 (43)         224 (38)         77 (42)         90 (50)         127 (50)         0.04           Married         693 (57)         372 (62)         105 (58)         91 (50)         127 (50)         0.04           Employed         369 (30)         172 (29)         56 (31)         58 (32)         83 (33)         0.95           Mide         673 (56)         329 (55)         98 (54)         104 (57)         142 (56)         144 (17)         142 (56)	Other Hispanic	128 (11)	71 (12)	17 (9)	25 (14)	15 (5.50)						
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Non-Hispanic White	589 (49)	349 (59)	83 (46)	72 (40)	85 (34)	P < 0.001					
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Non-Hispanic Black	253 (21)	67 (11)	42 (23)	36 (20)	108 (43)						
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Marital status       Married       693 (57)       372 (62)       103 (69)       103 (69)       103 (17)         Married       693 (57)       372 (62)       105 (58)       91 (50)       125 (50)       0.04         Otherwise       518 (43)       224 (38)       77 (42)       90 (50)       127 (50)       0.95         Employed       369 (30)       172 (29)       56 (31)       58 (32)       83 (33)       0.95         Unemployed       842 (70)       424 (71)       126 (69)       123 (68)       169 (67)       0.95         Ratio of family income to poverty       186 (15)       61 (10)       24 (13)       35 (19)       66 (26) $p < 0.0$ Middle       673 (56)       329 (55)       98 (54)       104 (57)       142 (56) $p < 0.0$ High       352 (29)       206 (35)       60 (33)       42 (23)       44 (17) $q < 0.0$ No       103 (9)       42 (7)       14 (8)       16 (9)       31 (12) $q < 0.0$ No       103 (9)       42 (7)       14 (8)       16 (9)       31 (12) $q < 0.0$ Underweight (18.5-24.9)       306 (25)       166 (28)       37 (20)       50 (28)       53 (21)       0.14     <	Some college or above	681 (56)	374 (63)	107 (59)	90 (50)	110 (44)						
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$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Otherwise	518 (43)	224 (38)	77 (42)	90 (50)	127 (50)	0.0.12					
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Low       100 (12)       01 (13)       01 (14)       01 (15)       01 (12)       01 (14)	Low	186 (15)	61 (10)	24 (12)	25 (19)	66 (26)						
Induct0.53 (50)0.52 (53)0.53 (54)1.04 (57)1.44 (50)High352 (29)206 (35)60 (33)42 (23)44 (17)Health insurance </td <td>Middle</td> <td>673 (56)</td> <td>329 (55)</td> <td>98 (54)</td> <td>104 (57)</td> <td>142 (56)</td> <td>P &lt; 0.001</td>	Middle	673 (56)	329 (55)	98 (54)	104 (57)	142 (56)	P < 0.001					
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Teach Instruct         1,108 (91)         554 (93)         168 (92)         165 (91)         221 (88)         0.04           No         103 (9)         42 (7)         14 (8)         16 (9)         31 (12)         11011         1	Joalth insurance	332 (23)	200 (30)	00 (00)	42 (20)	44 (17)						
No       1108 (91)       334 (33)       108 (92)       103 (91)       221 (88)       000 (92)         No       103 (9)       42 (7)       14 (8)       16 (9)       31 (12)       000 (92) <t< td=""><td>Voc</td><td>1 108 (91)</td><td>554 (92)</td><td>168 (92)</td><td>165 (91)</td><td>221 (99)</td><td>0.049</td></t<>	Voc	1 108 (91)	554 (92)	168 (92)	165 (91)	221 (99)	0.049					
NO         103 (5)         42 (7)         14 (8)         10 (5)         31 (12)           Underweight (<18.5)	No	102 (9)	42 (7)	14 (9)	16 (9)	21 (12)	0.049					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	PMI (kg/mA2)	105 (5)	42 (7)	14 (0)	10 (5)	51 (12)						
Normal weight (18.5-24.9)       306 (25)       16 (2)       7 (1)       5 (2)       2 (1)       4 (2)         Overweight (25-29.9)       423 (35)       209 (35)       74 (41)       66 (36)       74 (29)         Obese (≥ 30)       466 (38)       214 (36)       68 (37)       63 (35)       121 (48)         PA recommendation <sup>c</sup> 7       7       7       7       7       7         Yes       610 (50)       307 (52)       88 (48)       100 (55)       115 (46)       0.43         No       601 (50)       289 (48)       94 (52)       81 (45)       137 (54)       0.05         CERAD-immediate recall score       19.17 (4.85)       19.46 (4.81)       19.07 (4.86)       18.78 (5.10)       18.85 (4.71)       0.05         CERAD-delay recall score       6.05 (2.42)       6.18 (2.43)       5.83 (2.62)       5.89 (2.38)       6.03 (2.27)       0.03         Animal fluency test score       16.74 (5.52)       17.33 (5.48)       16.77 (6.17)       16.20 (5.33)       15.69 (5.08)       0.00	Underweight (<18.5)	16 (2)	7 (1)	3 (2)	2 (1)	4 (2)						
Normal weight (18.5 24.5)         300 (25)         100 (28)         37 (20)         30 (26)         33 (21)         0.14           Overweight (25-29.9)         423 (35)         209 (35)         74 (41)         66 (36)         74 (29)           Obese (≥ 30)         466 (38)         214 (36)         68 (37)         63 (35)         121 (48)           PA recommendation <sup>c</sup> Yes         610 (50)         307 (52)         88 (48)         100 (55)         115 (46)         0.43           No         601 (50)         289 (48)         94 (52)         81 (45)         137 (54)         0.05           CERAD-immediate recall score         19.17 (4.85)         19.46 (4.81)         19.07 (4.86)         18.78 (5.10)         18.85 (4.71)         0.05           CERAD-delay recall score         6.05 (2.42)         6.18 (2.43)         5.83 (2.62)         5.89 (2.38)         6.03 (2.27)         0.03           Animal fluency test score         16.74 (5.52)         17.33 (5.48)         16.77 (6.17)         16.20 (5.33)         15.69 (5.08)         0.00	Normal weight (18 5-24 9)	206 (25)	166 (29)	27 (20)	50 (28)	52 (21)	0 144					
Obse (≥ 30)         425 (35)         214 (36)         68 (37)         63 (35)         121 (48)           PA recommendation <sup>c</sup>	Quanuaght (25-29.9)	422 (25)	200 (26)	74 (41)	56 (26)	74 (20)	0.144					
Desc (2.57)         Cos (35)	Obeco (220)	425 (33)	203 (55)	59 (27)	62 (25)	121 (49)						
Yes         610 (50)         307 (52)         88 (48)         100 (55)         115 (46)         0.43           No         601 (50)         289 (48)         94 (52)         81 (45)         137 (54)         0.05           CERAD-Immediate recall score         19.17 (4.85)         19.46 (4.81)         19.07 (4.86)         18.78 (5.10)         18.85 (4.71)         0.05           CERAD-delay recall score         6.05 (2.42)         6.18 (2.43)         5.83 (2.62)         5.89 (2.38)         6.03 (2.27)         0.03           Animal fluency test score         16.74 (5.52)         17.33 (5.48)         16.77 (6.17)         16.20 (5.33)         15.69 (5.08)         0.00	Dese (2.50)	400 (38)	214 (50)	00 (37)	03 (33)	121 (+0)						
No         601 (50)         289 (48)         94 (52)         81 (45)         137 (54)           CERAD-immediate recall score         19.17 (4.85)         19.46 (4.81)         19.07 (4.86)         18.78 (5.10)         18.85 (4.71)         0.05           CERAD-delay recall score         6.05 (2.42)         6.18 (2.43)         5.83 (2.62)         5.89 (2.38)         6.03 (2.27)         0.03           Animal fluency test score         16.74 (5.52)         17.33 (5.48)         16.77 (6.17)         16.20 (5.33)         15.69 (5.08)         0.00	PATECONTINETINGATION Voc 610 (50) 207 (51) 99 (49) 100 (65) 116 (46)											
CERAD-immediate recall score         19.17 (4.85)         19.46 (4.81)         19.07 (4.86)         18.78 (5.10)         18.85 (4.71)         0.05           CERAD-delay recall score         6.05 (2.42)         6.18 (2.43)         5.83 (2.62)         5.89 (2.38)         6.03 (2.27)         0.03           Animal fluency test score         16.74 (5.52)         17.33 (5.48)         16.77 (6.17)         16.20 (5.33)         15.69 (5.08)         0.00	No	601 (50)	200 (32)	94 (52)	91 (45)	127 (54)	0.458					
CERAD-delay recall score         15.17 (4.57)         15.40 (4.61)         15.07 (4.60)         16.76 (5.10)         16.85 (4.71)         0.05           CERAD-delay recall score         6.05 (2.42)         6.18 (2.43)         5.83 (2.62)         5.89 (2.38)         6.03 (2.27)         0.03           Animal fluency test score         16.74 (5.52)         17.33 (5.48)         16.77 (6.17)         16.20 (5.33)         15.69 (5.08)         0.00	CERAD-immediate recall score	19 17 (4 85)	19 46 (4 81)	19.07 (4.86)	18 78 (5 10)	19 95 (4 71)	0.051					
Animal fluency test score 16.74 (5.52) 17.33 (5.48) 16.77 (6.17) 16.20 (5.33) 15.69 (5.08) 0.00	CERAD-delay recall score	6.05 (2.42)	6 18 (2 /2)	5 83 (2 62)	5 89 (2 38)	6.03 (2.27)	0.031					
Animal nuency test score 10.74 (3.32) 17.35 (3.46) 10.77 (0.17) 10.20 (3.33) 13.09 (3.08) 0.00	Animal fluonau tast score	16 74 (5 52)	17 22 (5 49)	16 77 (6 17)	16 20 (5 22)	15 60 (5.02)	0.038					
Digit cumbel substitution test score (17.25) (17.26) (17.24) (17.24) (17.21) (14.24 (17.22) 0.04	Digit cumbel substitution test soore	10.74 (3.32)	17.33 (3.48)	10.77 (0.17)	10.20 (3.33)	13.03 (3.08)	0.005					

ed from Chi-square test and F-test using the survey-Participants were classified as either meeting or not meeting the Physical Activity recommendation (≥150 minutes of moderate-intensity or ≥75 minutes

		Model 1			Model 2			Model 3	
	β	95% CI	p-Values	β	95% CI	p-Values	β	95% CI	p-Values
CERAD-immed	liate recall								
Unexposed					Ref				
Low	-0.40	(-1.44, 0.65)	0.440	-0.47	(-1.38, 0.45)	0.303	-0.34	(-1.30, 0.61)	0.447
Moderate	-1.11	(-2.35, 0.13)	0.078	-1.13	(-2.21, -0.06)	0.039	-0.81	(-2.02, 0.40)	0.169
High	-0.92	(-1.67, -0.18)	0.016	-1.12	(-1.94, -0.29)	0.010	-0.52	(-1.42, 0.37)	0.227
CERAD-delay r	ecall								
Unexposed					Ref				
Low	-0.46	(-1.16, 0.23)	0.184	-0.53	(-1.17, 0.10)	0.093	-0.49	(-1.19, 0.17)	0.122
Moderate	-0.53	(-1.02, -0.04)	0.034	-0.61	(-1.05, -0.16)	0.009	-0.49	(-0.99, -0.04)	0.037
High	-0.33	(-0.69, 0.03)	0.071	-0.47	(-0.89, -0.05)	0.030	-0.24	(-0.79, 0.24)	0.268
Animal fluency	/ test				1	1			
Unexposed					Ref				
Low	-0.08	(-1.62, 1.46)	0.916	-0.03	(-1.55, 1.48)	0.965	0.08	(-1.33, 1.49)	0.905
Moderate	-1.59	(-3.01, -0.17)	0.030	-1.32	(-2.61, -0.04)	0.044	-0.92	(-2.23, 0.38)	0.148
High	-1.91	(-3.09, -0.73)	0.003	-1.79	(-3.02, -0.56)	0.006	-0.89	(-2.04, 0.27)	0.119
Digit symbol su	ubstitution	test							
Unexposed					Ref				
Low	-1.34	(-4.56, 1.87)	0.401	-1.34	(-3.88, 1.20)	0.286	-0.70	(-2.96, 1.56)	0.513
Moderate	-5.00	(-9.14, -0.87)	0.019	-4.40	(-6.61, -2.19)	< 0.001	-2.33	(-4.45, -0.21)	0.034
High	-4.39	(-9.12, 0.33)	0.067	-3.91	(-7.28, -0.54)	0.025	-0.49	(-3.60, 2.61)	0.735

smoke exposure and cognitive function test scores. Model 2 was adjusted for age, gender, and race. Model 3 was further adjusted for education, poverty ratio, marital status, employment status, BMI, and physical activity.

#### Conclusions

Moderate SHS exposure is associated with domain-specific cognitive impairment in older never-smokers, independent of socioeconomic confounders. The lack of a monotonic dose-response may indicate threshold effects Clinicians should prioritize cotinine screening for cognitively impaired older adults in high-exposure settings. Policy interventions enforcing smoke-free environments, paired with longitudinal studies using biomarker studies, are critical to mitigate dementia risk.

#### **Findings**

	low			Moderate				p for interaction b		
	β	95% CI	p-Values	β	95% CI	p-Values	β	95% CI	p-Values	
Age Group										
60-69	-0.65	(-1.64, 0.34)	0.179	-0.16	(-0.86, 0.53)	0.614	0.47	(-1.11, 0.18)	0.143	0.135
70-79	- <mark>0.06</mark>	(-0.99, 0.88)	0.898	-0.73	(-1.72, 0.25)	0.131	0.32	(-0.30, 0.95)	0.284	
>= 80	-0.28	(-1.24, 0.68)	0.515	-1.10	(-2.11, -0.09)	0.037	0.27	(-1.09, 1.63)	0.653	
Gender Group										
Male	-0.65	(-1.75, 0.46)	-0.647	-0.61	(-1.52, 0.30)	0.170	0.56	(-1.48, 0.35)	0.208	0.403
Female	-0.43	(-1.19, 0.33)	0.244	-0.39	(-1.03, 0.25)	0.211	0.03	(-0.48, 0.42)	0.897	
Education Group										
Less than high school	0.52	(-0.31, 1.34)	0.199	0.52	(-0.41, 1.45)	0.245	0.30	(-1.01, 0.42)	0.386	
High school	-0.76	(-2.11, 0.60)	0.241	-0.96	(-1.89, -0.04)	0.043	0.10	(-1.14, 0.95)	0.839	0.489
Some college or above	-0.57	(-1.34, 0.19)	0.130	-0.48	(-1.03, 0.07)	0.081	- 0.21	(-0.87, 0.45)	0.508	
Marital status										
Married	-0.61	(-1.56, 0.33)	0.183	-0.58	(-1.16, -0.002)	0.049	0.63	(-1.16, -0.10)	0.023	0.118
Otherwise	-0.23	(-0.96, 0.51)	0.519	-0.15	(-0.84, 0.53)	0.639	0.37	(-0.17, 0.92)	0.162	
Employment status										
Employed	-0.17	(-1.19, 0.85)	0.719	-0.66	(-1.65, 0.33)	0.174	0.53	(-1.47, 0.41)	0.242	0.255
Unemployed	-0.69	(-1.45, 0.07)	0.072	-0.38	(-1.13, 0.36)	0.288	0.13	(-0.69, 0.42)	0.606	
PA recommendation										
Yes	0.30	(-0.51, 1.11)	0.436	-0.60	(-1.16, -0.03)	0.04	0.05	(-0.55, 0.66)	0.86	0.033
No	-1 38	(-2.15 -0.62)	0.002	-0.26	(-1.07.0.55)	0.50	0.59	(-1.20.0.11)	0.09	

#### Table 3b: Stratified associations between secondhand smoke (SHS) exposure and digit symbol substitution test score by demographic and lifestyle factors<sup>a</sup>

	Low			Moderate				P for interaction <sup>b</sup>		
	β	95% CI	p-Values	β	95% CI	p-Values	β	95% CI	p-Values	
Age Group										
60-69	-0.47	(-5.29, 4.34)	0.834	-1.68	(-5.06, 1.70)	0.300	0.02	(-4.17, 4.20)	0.99	0.230
70-79	1.58	(-2.90, 6.07)	0.457	-3.13	(-8.02, 1.75)	0.188	2.22	(-2.62, 7.05)	0.34	
>= 80	- <mark>2.95</mark>	(-10.35, 4.45)	0.378	-0.81	(-5.45, 3.83)	0.692	- <mark>4.</mark> 04	(-12.95, 4.87)	0.319	
Gender Group										
Male	0.22	(-2.69, 3.13)	0.873	- <mark>2,5</mark> 8	(-5.64, 0.48)	0.092	-1.83	(-6.87, 3.21)	0.446	
Female	-0.90	(-4.19, 2.40)	0.567	-2.14	(-5.86, 1.58)	0.236	0.51	(-2.35, 3.37)	0.708	0.557
Education Group										
Less than high school	4.51	(-0.26, 9.28)	0.062	-2.37	(-6.45, 1.72)	0.230	-3.89	(-7.85, 0.06)	0.053	
High school	-1.44	(-5.85, 2.97)	0.483	0.41	(-4.22, 5.04)	0.848	4.73	(-3.82, 13.28)	0.246	
Some college or above	-1.04	(-4.33, 2.25)	0.509	-3.23	(-6.05, -0.41)	0.028	-1.40	(-4.71, 1.91)	0.379	0.169
Marital status										
Married	-0.82	(-3.68, 2.04)	0.546	-2.09	(-4.71, 0.52)	0.108	-0.79	(-5.11, 3.52)	0.698	
Otherwise	-0.66	(-4.84, 3.51)	0.736	-1.42	(-5.58, 2.74)	0.475	0.20	(-4.24, 4.64)	0.924	0.982
Employment status										
Employed	2.08	(-3.15, 7.30)	0.404	-3.44	(-7.78, 0.91)	0.111	1.06	(-3.77, 5.89)	0.641	
Unemployed	-1.48	(-4.93, 1.97)	0.371	-1.96	(-5.79, 1.88)	0.290	- <mark>1.5</mark> 0	(-5.61, 2.60)	0.443	0.544
PA recommendation										
Yes	0.20	(-3.25, 3.64)	0.904	-3.20	(-5.71, -0.70)	0.016	0.10	(-2.57, 2.77)	0.937	
No	-1.40	(-5.32, 2.520	0.455	-1.13	(-5.36, 3.10)	0.574	-0.94	(-6.38, 4.51)	0.716	0.732
Abbreviation: CI: Confidence <sup>a</sup> All models adjusted for cov variables. The unexposed SH <sup>b</sup> p-Values for interaction der	interval; R ariates fror S group wa rived from V	ef: Reference. n Model 3 (age, se s used as the refe Wald test from we	ex, race, educa erence group ir eighted regres	ation, pove n the analy sion analys	rty ratio, marital st sis. es.	atus, employ	ment, BN	II, and PA), except	for the strati	fication