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Stressors in midlife and risk of dementia: The role of race and education

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Abstract

Background: Post-traumatic stress disorder is associated with increased dementia risk but less is known about stress due to everyday problems in diverse populations.

Methods: 9,605 healthcare plan members who provided information regarding midlife stressors in 1972–1973 (ages 40–55) were followed for dementia diagnosis between 1996–2017. Cox proportional hazard models evaluated associations between midlife stressors and dementia adjusting for demographics and lifecourse health indicators.

Results: 1 midlife stressor was associated with 17% greater dementia risk (HR=1.15, 95%CI: 1.07–1.27) versus 0 midlife stressors and 26% increased risk among those with   high school education (HR=1.26, 95% CI:1.09–1.44) adjusting for demographics. Compared to Whites without stressors, Whites with   1 stressor had 13% greater dementia risk (HR=1.13; 95% CI: 1.02–1.24), Blacks without stressors 19% greater risk (HR=1.19; 95% CI:1.08–1.32), and Blacks with   1 stressors 47% greater risk (HR=1.47; 95% CI:1.27–1.69) in fully-adjusted models. Resource problems were associated with 20% greater risk (HR=1.20; 95% CI:1.01–1.42) than interpersonal problems.

Conclusion: Reporting   1 serious midlife stressor was associated with elevated dementia risk, especially stressors related to resources problems and for those with   high school education. Everyday stressors can impact brain health over the long-term and may contribute to racial inequities in dementia rates, though education can be a mitigating factor.

Keywords

dementia; lifecourse; disparities; education; psychosocial

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Introduction

Prior work on negative/stressful life events, severe stress, and their consequences, such as post-traumatic stress disorder, have shown deleterious effects on health[1,2] including increased risk of dementia.[2–6] Evaluating whether everyday stress may influence dementia risk is challenging because of the possibility that subtle cognitive changes related to incipient dementia may influence experience or reporting of stress. To adequately address this, it is necessary to assess stress decades before late life.

The possible role of vulnerabilities or resilience factors that may exacerbate or offset the effects of stress on dementia risk has also received insufficient attention. For example, prior studies have not examined the role of educational attainment as a possible modifier of the stressor-dementia relationship. Furthermore, the majority of prior studies examining midlife stressors and dementia risk lack racial or socioeconomic diversity.[7–9] Additional research examining possible modification of the stressor-dementia relationship in diverse cohorts is important because individuals of a racial minority have been shown to experience higher levels of stress[10,11].

In a diverse cohort of 9,605 Black or White individuals we examined the association between prospectively collected midlife stressors, race, education, and late-life dementia risk. We investigated dementia risk associated with both quantity and type of stressor. We explored possible differences in the distribution of stressors and the stressor-dementia relationship by race. We also examine educational attainment as a possible modifier of stressors and dementia. We hypothesized a dose response relationship between number of midlife stressors and dementia risk and that the association would be greater among Blacks than Whites and among individuals with low educational attainment compared to high education attainment.

Methods

This study follows a cohort of members of Kaiser Permanente Northern California (KPNC), an integrated health care delivery system. KPNC membership is representative of the individuals in the geographic catchment area with the exception of those at the extremes of the income distribution.[12] Members were offered a series of optional check-ups called the Multiphasic Health Checkups (MHC) during the 1960s to 1990s. The MHC included health questionnaires and clinical measurements on a range of health indicators and health behaviors. This study includes 9,605 White and Black KPNC members who were 40–55 years old when they participated in the 1972–1973 MHC and were members in 1996 when comprehensive electronic medical records began. This study was approved by KPNC internal review board and patient informed consent was waived since analyses were conducted on preexisting data.

Midlife stressor.

During the 1972–1973 MHC participants were asked if they were "having serious or disturbing problems" in each of the following domains: "marriage, family, drug usage, job or employment, financial matters, [and] other worries". Participants indicated yes/no for each

domain, identifying all relevant types of stressors. Midlife stressors were operationalized in three ways: type of stressor, at least 1 stressors (binary), category of number of stressors (0 stressors, 1 stressor, 2 stressors, 3 stressors, or 4 stressors).

Dementia.

Dementia cases occurring between 1/1/1996–9/30/2017 were identified in electronic medical records. The following International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10) codes were used: Alzheimer's disease (ICD-9: 331.0; ICD-10: G30.x), vascular dementia (ICD-9: 290.4x; ICD-10: F01.5x), and other/nonspecific dementia (ICD-9: 290.0, 290.1x, 290.2x, 290.3, 294.1, 294.2x, 294.8; ICD-10: F03.9x). This method of dementia ascertainment is consistent with previous studies in this population.[13–16] A prior study compared a similar set of ICD-9 codes to consensus dementia diagnosis found a specificity of 95% and sensitivity of 77%.[17]

Covariates and mortality.

Educational attainment and midlife health indicators (smoking status, hypertension, and body mass index (BMI)) were assessed during the 1972–1973 MHC visit. Educational attainment was captured as the highest grade completed and recoded as high school education versus >high school education. Self-reported smoking status was coded as never, past, or current smoker. Midlife hypertension was defined as clinical measures of systolic blood pressure 140 mmHg or diastolic blood pressure 90 mmHg. Clinical measurements of height and weight were combined to calculate midlife BMI. Late-life health indicators included stroke, diabetes, and heart failure. ICD-9 codes were used to identify late-life indicators occurring between 1/1/1996–1/1/1997 in electronic medicals records. Age and self-reported race were obtained from KPNC membership files. Missing indicator variables identified missing information on covariates. Deaths and date of death were obtained from KPNC electronic medical records, California State Mortality File, and Social Security Death Records.

Method of Analyses.

We examined the distribution of the number and type of stressors, demographics, midlife health indicators (smoking status, hypertension, and BMI), and late-life stroke, diabetes, and heart failure by race.

Cox proportional hazards models estimated associations between type and number of midlife stressors and dementia risk. In separate models, midlife stressors were operationalized as a binary variable (1 stressor vs no stressors) and a categorical variable (0 stressor, 1 stressor, 2 stressors, 3 stressor, 4 stressors). All models adjusted for demographics (age (as time scale), sex, race, education) and some models further adjusted for midlife health indicators (smoking status, hypertension, BMI) and late-life health indicators (stroke, diabetes, and heart failure). Individuals were followed until a dementia diagnosis, death, a membership gap greater than 90 days, or the end of the study period (9/30/2017).

In addition to the number of stressors, we examined possible differences in the association between type of stressors and dementia risk. A series of Cox proportional hazards models (age as the time scale) were used to examine the associations between each type of midlife stressor and dementia risk with covariates sequentially added as described above.

All models examining number and type of stressors were replicated among Whites and Blacks separately to allow for comparisons of estimates of the association between midlife stressors and dementia risk by race. Interaction terms comprised of the exposure of interest and race were implemented to assess if there were significant differences in the relative relationship between midlife stressors and dementia risk.

In subgroup analyses restricted to individual who reported 1 interpersonal problem (marital or familial problem) or 1 resource problem (financial or employment problem), we examined if individuals with resources problems were at greater dementia risk compared to individuals with interpersonal problems.

We concurrently examined the associations of race and stressors by grouping individuals into ten categories: 1) White and 0 stressors, 2) White and 1 stressor, 3) White and 2 stressors, 4) White and 3 stressors, 5) White and 4 stressors, 6) Black and 0 stressors, 7) Black and 1 stressor, 8) Black and 2 stressors, 9) Black and 3 stressors, 10) Black and 4 stressors. We examined the association of these race and stress categories with dementia risk in Cox proportional hazard models with Whites with 0 stressors as the reference group and adjusted for age (as time scale) and sex.

Parallel analyses were conducted to evaluate heterogeneity of effects of the number of stressors for high education (>high school) versus low education (high school) participants. Subgroup analyses examined the association between the number of stressors and dementia risk for each education group separately. We concurrently examined the association of stressors and education in the overall sample by grouping individuals into categories combining reporting at least 1 stressors and education level. The categories were: 1) high education and 0 stressors, 2) high education and 1 stressor, 3) low education and 0 stressors, and 4) low education and 1 stressor.

All analyses were conducted using SAS 9.4. P-values less than 0.05 were considered statistically significant and those less than 0.10 were considered marginally significant.

Results

The sample was 24.1% Black, 75.9% Whites, with a mean age 47.9 (SD=4.2 years) at MHC (Table 1). Blacks were more likely than Whites to report one stressor (18.1% vs 15.2%). Blacks were more likely than Whites to report the following types of stressors: marital problems (8.6% vs 6.7%), financial problems (10.0% vs 5.9%), and "other" problems (10.3% vs 8.8%). Blacks were more likely than Whites to have high school (51.4% vs 29.0%). By the end of follow-up, 30.4% of the sample had developed dementia, 35.2% had died, 17.0% had a lapse in membership, and 17.3% of the sample was still alive, members of KPNC, and dementia-free at the end of follow-up. The mean follow-up time was 11.8 years (SD=7.1 years).

In the overall sample, adjusting for demographics and lifecourse health indicators, reporting 1 stressor was associated with a 15% higher dementia risk (HR=1.15; 95% CI: 1.06–1.26) compared to reporting no stressors (Table 2, Overall group, Model 2). A dose-response relationship between number of stressors was not observed in the overall sample (Table 2, Overall group, Model 2). Among Whites, adjusting for demographics and lifecourse health indicators, reporting 1 stressor was associated with a 12% increased dementia risk (HR=1.12; 95% CI: 1.01–1.24) compared to no stressors (Table 2, Whites, Model 2). Among Whites, there was no evidence of a dose-response relationship such that dementia risk increased with an increasing number of stressors beyond one (Table 2, Whites, Model 2). Among Blacks, reporting 1 stressors was associated with a 23% increased dementia risk (HR=1.23; 95% CI: 1.05–1.43) compared to no stressors (Table 2, Blacks, Model 2). There was little evidence of a dose-response relationship between number of stressors and dementia risk among Blacks (Table 2, Blacks, Model 2).

In the overall sample adjusting for demographics and lifecourse health indicators, resource problems were associated with 22% increased dementia risk (HR=1.22; 95% CI: 1.09–1.37) and interpersonal problems were not associated with elevated risk (HR=1.02; 95% CI: 0.91–1.14) (Table 2, Overall group, Model 2). Employment problems were associated with a 27% increased dementia risk (HR=1.27, 95% CI: 1.10–1.48), financial problems were associated with a 16% increased risk (HR=1.16; 95% CI: 1.00–1.33), and "other" problems were associated with a 18% increased risk (HR=1.18; 95% CI: 1.04–1.33) adjusting for demographics and lifecourse health indicators (Table 2, Overall group, Model 2). Although the point estimates for type of stressors varied, interactions terms comprised of different types of stressors and race were non-significant.

In a subgroup analysis of 1,823 people who reported interpersonal problems or resource problems, those with resource problems had 20% greater dementia risk (HR=1.20; 95% CI: 1.01–1.42) than those with interpersonal problems adjusting for demographics.

In models examining joint effects of race and stress adjusting for demographics and lifecourse health indicators, with Whites with 0 stressors as the reference group, Blacks reporting 1 stressor had the highest dementia risk (HR=1.47, 95% CI: 1.27–1.69), followed by Blacks with 0 stressor (HR=1.19, 95% CI: 1.08–1.32), and Whites with 1 stressor (HR=1.13, 95% CI: 1.02–1.24) (Table 3, Model 2).

In subgroup group analyses, the dementia risk associated with reporting 1 stressor was greater among individuals with high school education (HR=1.26; 95% CI:1.09–1.44) compared to those with >high school education (HR=1.12; 95% CI: 1.01–1.24) (Supplemental Table 1). An interactions term comprised of reporting 1 stressor and education was non-significant (p=0.17).

In models examining joint effects of stressors and education in the overall sample adjusting for demographics and lifecourse health indicator, with high education and 0 stressors as the reference group, low education and reporting 1 stressor was associated with the highest dementia risk (HR=1.36, 95% CI: 1.19–1.55), followed by high education and 1 stressor (HR=1.11, 95% CI: 1.00–1.24), and low education and 0 stressors (HR=1.10, 95% CI: 1.00–

1.20) (Table 4, Overall group, Model 2). Among Whites, compared to high education and 0 stressors, low education and 0 stressor was associated with a 12% increased dementia risk (HR=1.12; 95% CI: 1.01–1.25) and low education and 1 stressor was associated with a 33% increased risk (HR=1.33; 95% CI: 1.12–1.58) (Table 4, Whites, Model 2). Among Blacks, low education and 1 stressor was associated with a 37% (HR=1.37; 95% CI: 1.10– 1.70) increased dementia risk compared to high education and 0 stressors; high education and 1 stressor had an elevated risk estimate but was not significantly associated with dementia risk (HR=1.16; 95% CI: 0.93–1.45) (Table 4, Blacks, Model 2).

Discussion

In a large diverse sample of men and women followed since midlife, we found evidence that midlife stressors are associated with elevated risk of dementia among Whites and Blacks. Reporting 1 midlife stressor was associated with a 12% increased risk of dementia among Whites and a 23% increased risk among Blacks. Compared to Whites with 0 stressors, Whites with 1 stressor were at 13% greater risk of dementia, Blacks with 0 stressors were at 19% greater risk, and Blacks with 1 stressors were at 47% greater risk. Obtaining greater than high school education appears to mitigate the effects of stressors; reporting 1 stressor among individuals with at least high school education was associated with less than a third of the dementia risk compared to their counterparts with low education (11% vs 36% increased risk).

Models examining the six different types of stressors suggests that the association between stressor and dementia risk may vary by stressor type. Indeed, resources problems (employment or financial problem) and "other" problems were significantly associated with dementia risk, but interpersonal problems (martial or familial problems) and drug problems were not associated with dementia risk after accounting for demographics and lifecourse health indicators. In sensitivity analyses among people who reported 1 interpersonal problems or resource problems, those with resource problems had 20% greater risk of dementia than those with interpersonal problems. In general, there was no evidence that the association between different types of stressors and dementia risk varied by race with the exception of employment problems, which was marginally larger among Blacks than Whites. Although equally present in both racial groups at baseline (6% prevalence) employment problems were associated with a 54% increased dementia risk among Blacks and a marginal 18% increased risk among Whites.

Our study is consistent with prior evidence that exposure to life stressors and education in the United States are patterned by race.[18,19] In our study, Blacks were more likely than Whites to report 1 stressor (27.2% vs 23.0%) and to report marital problems (8.6% vs 6.7%), financial problems (10.0% vs 5.9%), and other problems (10.3% vs 8.8%). Blacks were also more likely than Whites to have a high school education or less (51.4% vs 29.0%). At the national level, census data from 1970 also found that a greater proportion of Blacks had high school education or less compared to Whites (90% vs 78%).[20] Although outside the scope of this study, there may also be differences in the quality of education by race. Segregated schools were supported by some state laws until the Supreme Court's ruling on *Brown vs Board of Education* deemed these laws unconstitutional in 1954, after which *de*

facto racial segregation of schools remained common. Indicators of education quality, such as term length, student teacher ratios, funding, were worse among segregated schools designated for Black children compared to those designated for White children.[21]

Our findings add to a growing body of evidence that everyday midlife stressors are associated with dementia risk.[7,8] A prior study among females ages 38 to 54 examined exposure to 18 possible stressors and found that each additional stressor was associated with a 15% increased risk of dementia during a 38-year follow up.[7] Our study builds on this prior work by including a more diverse cohort (both in sex and race) and looking at possible non-linear associations between stressors and dementia risk in a diverse cohort with a narrower baseline age range.

Our findings are consistent with prior work on employment related stress with dementia[9,22] and worse cognitive function in late-life[23]. A previous study among 1,343 participants ages 39–64 at baseline found that work-related stress showed a 53% greater odds of dementia and 25% greater odds of mild cognitive impairment 21 years later.[9] Specific job characteristics such as low job control[22,24] and time pressure[9] have been associated with dementia risk but replication is needed in larger, diverse samples. Additional research is also needed on employment related stress and dementia allowing for possible difference by race/ethnicity. Our study found that although Blacks were not more likely to report employment problems, the association between employment problems and dementia risk was three-folds greater among Blacks than Whites though this difference was only marginally significant. This may be due to possible differences in the type of employment problems faced by Blacks compared to Whites. For example, Blacks have historically had higher levels of unemployment[1,25] and face discrimination in obtaining[26–28] and advancing in jobs[27]. Another possible reason employment problems may have a stronger association with dementia among Blacks versus Whites is the higher percentage of low education attainment among Blacks. Education may mitigate dementia risk through biological changes in the brain, as posited by the cognitive reserve hypothesis[29], or by affecting trajectories of income and wealth. The lower percentage of Blacks benefiting from the protective effect of education may contribute to possible race differences in the risk of dementia associated with employment problems.

Stress can be defined as a person's perception that demands exceed their capacity to respond or cope.[1] The cognitive experience of stress caused by the stressor can trigger physiological changes, such as increased levels of glucocorticoids due to activation of the hypothalamic-pituitary-adrenal (HPA) axis[3] and increased neuroinflammation[3]. Midlife stressors may affect dementia risk through these physiological changes. Stressors may also be linked to dementia through separate but not mutually exclusive pathways independent of the stress it produces. Our study found that stressors associated with limited resources were associated with dementia risk while interpersonal stressors were not. Midlife resources may protect against dementia risk by enabling access to healthy housing and balanced nutrition.

Strengths of this study include prospectively collected data from midlife on a range of stressor enabling us to examine specific stressor types. This diverse cohort had equal access to healthcare and high stability in health plan membership allowing for a long follow-up

period during which mid- and late-life health indicators were assessed. Midlife stressors were assessed a minimum of 23 years prior to the beginning of dementia follow-up greatly diminishing the likelihood of reverse causation. Compared to those who individuals remained alive, dementia-free, and members throughout the study period, individuals who had a lapse in membership or died during follow-up were significantly more likely to have reported at least one midlife stressor (21% vs 24%). Assuming stress is associated with dementia risk, this would bias our results towards the null. Unfortunately, we do not have information regarding chronicity of stressors, which has been shown to influence dementia risk[8], or the severity of perceived stress. Therefore, we are unable to disentangle how the type, severity, and duration of stressor impact dementia risk. Experiences of interpersonal discrimination, a source of stress likely encountered by Blacks in this cohort, were not explicitly measured in this study. Prior work has demonstrated an association between perceived discrimination and cognitive function.[26] Social desirability may result in individuals under reporting stressors, which in turn would lead to an underestimate of the association between midlife stressors and dementia risk. Given the small number of individuals who reported midlife drug problems, analyses examining the association between midlife drug problem and dementia risk are likely underpowered. Dementia develops slowly over time and the use of dementia diagnoses captures dementia at a later stage (i.e. when it becomes clinically apparent) then would have been captured through other means such as cognitive screenings. Brain imaging or cognitive data weren't collected so the association between stressors and other indicators of brain health is unknown.

In this diverse cohort of healthcare plan members, Blacks were more likely to report midlife stressors than Whites and midlife stressors were associated with an elevated risk of dementia among both groups. Employment and financial problems were associated with dementia risk overall. Though not more common, the association between employment and dementia risk was larger among Blacks. Problems related to sparse resources can impact brain health over the long-term and may contribute to racial inequities in rates of dementia, though education can be a mitigating factor.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Conflicts of Interest and Sources of funding:

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Table 1.

Sample characteristics by race

	Overall N (%) or Mean (SD)	Whites N (%) or Mean (SD)	Blacks N (%) or Mean (SD)	p-value[*]
Individuals	9,605 (100%)	7,294 (75.9%)	2,311 (24.1%)	
Dementia cases	2,922 (30.4%)	2,095 (28.7%)	827 (35.8%)	
Number of stressors				
Mean (SD)	0.35 (0.73)	0.34 (0.7)	0.40 (0.8)	<0.01
0 stressors	7,302 (76.0%)	5,619 (77.4%)	1,683 (72.8%)	<0.01
1 stressor	1527 (15.9%)	1,109 (15.2%)	418 (18.1%)	<0.01
2 stressors	551 (5.7%)	403 (5.5%)	148 (6.4%)	0.11
3 stressors	155 (1.6%)	115 (1.6%)	40 (1.7%)	0.61
4 stressors	70 (0.7%)	48 (0.7%)	22 (1.0%)	0.15
Type of Stressor				
Marital problems[**]	625 (7.2%)	441 (6.7%)	184 (8.6%)	<0.01
Family problems	616 (6.4%)	478 (6.6%)	138 (6.0%)	0.32
Drug problems	26 (0.3%)	19 (0.3%)	7 (0.3%)	0.73
Employment problems	590 (6.1%)	454 (6.2%)	136 (5.9%)	0.55
Financial problems	650 (6.8%)	428 (5.9%)	221 (10.0%)	<0.01
Other problems	878 (9.1%)	639 (8.8%)	239 (10.3%)	0.02
Female	5385 (56.1%)	3988 (54.7%)	1397 (60.5%)	<0.01
Age at				
MHC (mean (SD))	47.9 (4.2)	48.0 (4.2)	47.6 (4.2)	<0.01
1996	71.0 (4.2)	71.1 (4.2)	70.7 (4.2)	<0.01
Education				
High School	3,302 (34.4%)	2,115 (29.0%)	1,187 (51.4%)	<0.01
Missing	22 (0.2%)	19 (0.3%)	3 (0.1%)	0.25
Midlife hypertension	4005 (41.7%)	2733 (37.5%)	1272 (55.0%)	<0.01
Midlife body mass index				
Mean (SD)	26.4 (3.9)	26.1 (3.6)	27.6 (4.4)	<0.01
Missing	2,000 (20.8%)	1685 (23.1%)	315 (13.6%)	<0.01
Midlife smoking status				
Current	2638 (27.5%)	1,943 (26.6%)	695 (30.1%)	<0.01
Past	2973 (31.0%)	2,369 (32.5%)	604 (26.1%)	<0.01
Never	3785 (39.4%)	2840 (38.9%)	945 (40.9%)	0.09
Missing	209 (2.2%)	142 (2.0%)	67 (2.9%)	0.01
Late-life stroke	261 (2.7%)	193 (2.7%)	68 (2.9%)	0.45
Late-life diabetes	1034 (10.8%)	579 (7.9%)	455 (19.7%)	<0.01
Late-life heart failure	370 (3.9%)	244 (3.4%)	126 (5.5%)	<0.01

[*]
p-value obtained from chi-square or t-test comparing proportions or means in Blacks vs Whites

[**]
Among individuals who are married, separated, or divorced

Table 2.

Cox proportional hazard models of midlife stressors and dementia

N	Overall 9,605		Whites 7,294		Blacks 2,311	
	Model 1 HR (95% CI)	Model 2 HR (95% CI)	Model 1 HR (95% CI)	Model 2 HR (95% CI)	Model 1 HR (95% CI)	Model 2 HR (95% CI)
# of stressors						
1 stressor (binary)	1.17 (1.07, 1.27)	1.15 (1.06, 1.26)	1.14 (1.03, 1.26)	1.12 (1.01, 1.24)	1.24 (1.06, 1.44)	1.23 (1.05, 1.43)
0 stressor	Ref	Ref	Ref	Ref	Ref	Ref
1 stressor	1.17 (1.06, 1.29)	1.17 (1.06, 1.28)	1.15 (1.03, 1.29)	1.14 (1.02, 1.28)	1.21 (1.01, 1.44)	1.21 (1.01, 1.44)
2 stressors	1.15 (0.98, 1.34)	1.12 (0.96, 1.31)	1.07 (0.88, 1.28)	1.04 (0.86, 1.26)	1.38 (1.03, 1.84)	1.34 (1.01, 1.79)
3 stressors	1.23 (0.93, 1.63)	1.20 (0.90, 1.59)	1.32 (0.93, 1.86)	1.27 (0.90, 1.79)	1.13 (0.69, 1.83)	1.14 (0.70, 1.85)
4 stressors	1.12 (0.73, 1.72)	1.10 (0.71, 1.69)	1.04 (0.62, 1.76)	0.95 (0.54, 1.68)	1.32 (0.63, 2.79)	1.14 (0.54, 2.43)
Type of Stressor						
Marital problems[*]	0.94 (0.80, 1.09)	0.92 (0.79, 1.07)	0.92 (0.76, 1.11)	0.90 (0.74, 1.09)	0.99 (0.76, 1.29)	0.98 (0.75, 1.27)
Family problems	1.11 (0.96, 1.29)	1.11 (0.96, 1.29)	1.05 (0.88, 1.24)	1.04 (0.88, 1.23)	1.32 (1.00, 1.75)	1.27 (0.96, 1.68)
Drug problems	1.15 (0.55, 2.42)	1.12 (0.53, 2.35)	1.19 (0.49, 2.86)	1.14 (0.47, 2.74)	1.07 (0.27, 4.30)	1.03 (0.26, 4.17)
Employment problems	1.27 (1.09, 1.47)	1.27 (1.10, 1.48)	1.18 (0.99, 1.40)	1.18 (0.99, 1.40)	1.54 (1.17, 2.02)	1.55 (1.18, 2.04)
Financial problems	1.20 (1.04, 1.38)	1.16 (1.00, 1.33)	1.20 (1.01, 1.44)	1.14 (0.96, 1.37)	1.19 (0.95, 1.50)	1.16 (0.92, 1.47)
Other problems	1.19 (1.05, 1.34)	1.18 (1.04, 1.33)	1.21 (1.05, 1.39)	1.20 (1.04, 1.38)	1.15 (0.92, 1.44)	1.15 (0.91, 1.44)
Interpersonal problems	1.03 (0.92, 1.15)	1.02 (0.91, 1.14)	0.99 (0.86, 1.14)	0.98 (0.85, 1.12)	1.12 (0.91, 1.38)	1.10 (0.89, 1.35)
Resource problems	1.24 (1.11, 1.39)	1.22 (1.09, 1.37)	1.19 (1.03, 1.36)	1.15 (1.00, 1.33)	1.36 (1.12, 1.65)	1.35 (1.11, 1.64)

Notes: Model 1 adjusts for demographics (age (as time scale), sex, race, and education); Model 2 adjusts for demographics, midlife health indicators (body mass index, smoking status, hypertension), and late-life health indicators (stroke, diabetes, and heart failure); Interpersonal problems encompass martial or familial problems; Resource problem encompass employment or financial problems;

[*] Among individuals who are married, separated, or divorced

Table 3.

Cox proportional hazards models of race, midlife stressors, and dementia risk

	Model 1 HR (95% CI)	Model 2 HR (95% CI)
White & 0 stressors	Ref	Ref
White & 1 stressor	1.14 (1.03, 1.25)	1.13 (1.02, 1.24)
Black & 0 stressors	1.30 (1.18, 1.43)	1.19 (1.08, 1.32)
Black & 1 stressor	1.62 (1.40, 1.86)	1.47 (1.27, 1.69)

Notes: Model 1 adjusts for demographics (age (as time scale), sex, and education); Model 2 adjusts for demographics, midlife health indicators (body mass index, smoking status, hypertension), and late-life health indicators (stroke, diabetes, and heart failure);

Table 4.

Cox proportional hazards models of education and stress overall and by race

N	Overall 9,583		Whites 7,275		Blacks 2,308	
	Model 1 HR (95% CI)	Model 2 HR (95% CI)	Model 1 HR (95% CI)	Model 2 HR (95% CI)	Model 1 HR (95% CI)	Model 2 HR (95% CI)
High education & 0 stressors	Ref	Ref	Ref	Ref	Ref	Ref
High education & ≥1 stressors	1.12 (1.01, 1.25)	1.11 (1.00, 1.24)	1.10 (0.98, 1.24)	1.09 (0.97, 1.23)	1.18 (0.95, 1.47)	1.16 (0.93, 1.45)
Low education & 0 stressors	1.14 (1.04, 1.24)	1.10 (1.00, 1.20)	1.17 (1.05, 1.30)	1.12 (1.01, 1.25)	1.10 (0.93, 1.29)	1.05 (0.89, 1.24)
Low education & ≥1 stressors	1.43 (1.26, 1.63)	1.36 (1.19, 1.55)	1.42 (1.20, 1.68)	1.33 (1.12, 1.58)	1.43 (1.16, 1.77)	1.37 (1.10, 1.70)

Notes: Model 1 adjusts for demographics (age (as time scale), sex, and race in overall models); Model 2 adjusts for demographics, midlife health indicators (body mass index, smoking status, hypertension), and late-life health indicators (stroke, diabetes, and heart failure)