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Adverse Childhood Experiences and Aging-Associated Functional Impairment in a National Sample of Older Community-Dwelling Adults

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ABSTRACT

BACKGROUND: Prior research on the health implications of adverse childhood experiences (ACEs) has focused on early or midlife adults, not older adults who bear the greatest burden of health-related functional impairment.

OBJECTIVE: To examine associations between ACEs, objectively measured physical mobility and cognitive impairment, and functional disability in older community-dwelling adults.

DESIGN: Cross-sectional analysis.

PARTICIPANTS: Community-dwelling older U.S. adults ages 50 years and older.

MAIN MEASURES: Participants completed structured questionnaires assessing history of ACEs (childhood experience of violence/abuse, witnessing of violence, financial insecurity, parental separation, or serious illness), underwent standardized physical performance testing (tandem balance, 3-m walk, chair stand test) and cognitive testing (survey adaptation of the Montreal Cognitive Assessment), and reported functional disability (difficulty with activities of daily living).

KEY RESULTS: Among the 3387 participants (aged 50 to 97 years; 54% female), 44% reported a history of one or more types of ACEs. Thirty-five percent met criteria for physical mobility impairment, 24% for cognitive impairment, and 24% for functional disability. After adjusting for age, gender, race, and ethnicity, participants reporting any ACE history were more likely to demonstrate physical mobility impairment (OR 1.30, 95% CI 1.11–1.52) and cognitive impairment (OR 1.26, 95% CI 1.03–1.54) and report functional disability (OR 1.69, 95% CI 1.38–2.07), compared to those with no ACE history. Childhood experience of violence was associated with greater physical mobility impairment (OR 1.38, 95% CI 1.11–1.71) and functional disability (OR 1.86, 95% CI 1.49–2.33).

CONCLUSIONS: Older adults with a history of ACEs are more likely to experience physical and cognitive functional impairment, suggesting that efforts to mitigate ACEs may have implications for aging-associated functional decline. Findings support the need for trauma-informed approaches to geriatric care that consider the potential role of early life traumatic experiences in shaping or complicating late-life functional challenges.

KEY WORDS: adverse childhood experiences; functional disability

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INTRODUCTION

Adverse childhood experiences (ACEs) are stressful and potentially traumatic experiences that occur in childhood such as exposure to violence, abuse, household instability, or severe illness[1] According to the U.S. Centers for Disease Control, nearly 60% of U.S. adults have experienced one or more type of ACEs, including childhood environmental exposures that can undermine sense of safety, stability, or bonding in early life.[2] A growing body of research suggests that ACEs have important implications for health later in life, including associations with chronic conditions such as cardiovascular disease, diabetes, autoimmune disease, and depression.[3–8]

To date, nine U.S. states have issued executive orders or commissioned plans for addressing ACEs,[9,10] including legislation in California mandating insurance policies providing coverage for pediatric services and preventative care to reimburse for ACEs screening.[11] However, screening for ACEs remains controversial due to its unclear impact on long-term health outcomes and possible burden on the healthcare system.[10] Further, efforts to screen for ACEs have focused on early or mid-life adults, rather than older adults who bear the greatest burden of chronic health conditions, costs, and consequences.

Currently, there is limited evidence to suggest that ACEs have implications for health or functioning across the full lifespan, such as in older age. Although a few studies have described associations between ACEs and physical functional impairment in older age,[12–15] most of these have relied on self-reported rather than objectively measured

physical health status, which may be susceptible to reporting bias.[16–20] Prior research examining ACEs in relation to cognitive impairment in older adults has yielded inconsistent results,[12,15,16,21–25] with most studies reporting relationships with only subjectively reported cognitive decline.

This study aimed to examine relationships between ACEs and both perceived and objectively measured functional impairment in a national sample of community-dwelling older adults. Our goal was to provide insight into potential longer-term sequelae of ACEs to evaluate their relevance to the future prevention or management of functional impairment and disability across the aging spectrum.

METHODS

Setting and Population

The National Social Life, Health and Aging Project (NSHAP) is a population-based study of social factors influencing health in community-dwelling older U.S. adults.[26–29] The original NSHAP cohort was assembled in 2005 based on multistage probability sampling of U.S. adults aged 57–85 years, with purposeful oversampling of African Americans and adults over 70 years.[27] In 2010, a second round of the cohort (NSHAP2) was initiated, involving 2552 returning respondents from the first round (74% retention) and a portion of their coresident partners.[28] The third round (NSHAP3), launched in 2015, included 2409 returning respondents (69% retention) and newly recruited participants born between 1948–1965 and their coresident partners.[29] For this report, analyses were restricted to participants who provided data on their history of ACEs in NSHAP3 or NSHAP2 and completed assessments of aging-associated functional status in NSHAP3.

Adverse Childhood Experience Measures

Participants' history of ACEs was assessed using self-report measures developed by NSHAP investigators based on a conceptual model of the potential impact of stressful childhood physical, financial, and social experiences on the life course.[17,30] Structured questions assessed participants' exposure between ages 6 to 16 to: physical violence or abuse, witnessing of physical violence or abuse, family financial stress, separation from a parent, poor childhood health, and unhappy family life (Appendix Table 1). Prior NSHAP work has supported the validity of these measures by demonstrating associations between these ACE questions and selected subjective measures of well-being later in life, such as self-reported overall health and depressive symptoms.[17]

Questionnaire measures of ACE history were administered to all participants in NSHAP2 and to only new participants in NSHAP3. Therefore, participants provided information about ACE history in either NSHAP2 or NSHAP3, but not both, with overall response rates of 87% and 85%, respectively.

Physical Mobility Impairment Measures

Physical mobility impairment was assessed during in-home NSHAP3 visits using standardized physical performance tests, including assessments of static tandem balance, 3-m usual walking time, and repeated chair stand time.[31] In addition to recording participants' test performance, interviewers documented whether participants tried but were unable to do the test; did not attempt the test for a mobility or safety reason such as feeling that the test was unsafe; were unable to participate due to being wheelchair-bound or unable to stand unassisted; or failed to perform earlier, easier mobility tests.

For this analysis, participants were considered to show signs of clinically significant physical mobility impairment if their performance on the above tests fell within ranges of previous validated clinical cutoffs for increased risk of falls, hospitalization, or mortality (Appendix Table 2). This corresponded to inability to hold a tandem balance stand for ten seconds, usual walking speed of less than 0.6 m per second, or inability to complete five chair stands in less than 15 s.[31–39] Furthermore, participants were classified as being impaired if they could not attempt the test for safety reasons or failed to perform earlier, easier mobility tests.

Cognitive Impairment Measures

Cognitive function impairment was assessed in NSHAP3 using an 18-item adaptation of the Montreal Cognitive Assessment (MoCA-SA),[40] designed for administration in research survey settings. This instrument was designed to measure global cognitive function based on performance on the same six standard cognitive domains as the original MoCA. Following the precedent of previous work using this adapted instrument, MoCA-SA scores >22 were considered normal, scores of 18–22 were considered mild cognitive impairment, and scores <18 were considered screening positive for possible dementia.[41]

Functional Disability Measures

Functional disability was evaluated in NSHAP3 using standardized questions assessing participants' perceived difficulty completing seven standard types of activities of daily living (ADLs) and eight instrumental activities of daily living (IADLs) (Appendix Table 3). Responses followed a 4-point Likert scale ("unable to do", "much difficulty", "some difficulty", and "no difficulty"). Responses of "some difficulty" or greater were considered as functional disability.

Other Demographic and Clinical Covariates

Participant age, race, ethnicity, later-life partner status, educational attainment and financial assets were assessed

during in-home study interviews. Participants were asked to rate their overall mental health and physical health and to describe health-related habits such as alcohol consumption, tobacco use, and vigorous physical activity during interviews. Depressive and anxiety symptoms were assessed using adapted, interviewer-administered short forms of the Center for Epidemiologic Studies Depression Scale and Hospital Anxiety and Depression Scale's Anxiety Subscale, previously validated for use in the community setting.[42–45]

Statistical Analyses

Descriptive statistics were used to examine the distribution of demographic and clinical characteristics in the analytic sample of adults aged 50 years or older who provided ACE exposure data and completed at least one physical mobility, cognitive function, or functional disability measure in NSHAP3. The prevalence of each type of ACE was examined in the total analytic sample as well as across 10-year age groups (50–59, 60–69, or ≥ 70 years). Chi-square tests evaluated differences in the prevalence of each type of ACE exposure and a) any (at least one type of) ACE exposure, and b) two or more types of ACE exposure, by age group, compared to no ACE exposure as the reference group. P-value < 0.05 was considered statistically significant.

Similarly, the distribution of physical mobility impairment, cognitive impairment, and functional disability was examined in the total analytic sample as well as across the above age groups. For physical mobility impairment, analyses examined the prevalence of impairment for each type of mobility test (static balance, 3-m walk, or repeated chair stand test), as well as impairment for any of the above tests. For cognitive impairment, analyses examined the presence of at least mild impairment defined by MOCA-SA score ≤ 22.[40,41] For functional disability, analyses examined the distribution of difficulty carrying out a) any ADL, and b) any IADL.

Multivariable logistic regression models examined the odds of each of the above physical, cognitive, or functional impairment outcomes predicted by the report of each type of ACE exposure, as well as by: a) any ACE exposure, and b) two or more types of ACE exposures compared to no history of ACE exposure. These included minimally adjusted models in which age was the only co-variate, as well as multivariable-adjusted models including age, gender, race, and Hispanic or Latino ethnicity as demographic factors previously reported to be associated with both ACE exposure and functional decline in older adults.[46–49]

We also developed another set of supplementary models to explore potential mediations of associations between ACE exposure and functional decline by other variables such as later-life health related habits (tobacco and alcohol use) and later-life sociodemographic factors (late-life partner status, educational attainment, financial assets). These models were designed to assess whether relationships between ACE exposure and functional decline might be attenuated by these other factors, suggesting that they may lie along the causal pathway.

All analyses were conducted using SAS (version 9.4) (SAS Institute, Inc., Cary, NC) and used nationally-representative sample weights distributed with the dataset accounting for non-response and over-sampling by age and race in NSHAP.

RESULTS

Background Participant Characteristics

Of the 4777 NSHAP3 participants, 170 were excluded for being under age 50 years, 545 for not completing the leave-behind questionnaire in either NSHAP2 or NSHAP3, and 285 for missing data for all ACEs questions (Appendix Fig. 1). An additional 390 were excluded for missing data for all outcome measures (physical mobility, cognitive function, or functional disability). In the final analytic sample of 3387, the average participant age was 64 years, and 1884 were women (Table 1). Approximately 10% self-identified as Black or African-American, and 8% as Hispanic or Latino, similar to the ethnic composition of the older U.S. adult population at the time of data collection.

Prevalence of ACE Exposures

Forty-four percent of participants reported at least one type of ACE, including 14% experiencing violence, 16% witnessing violence, 13% family financial stress, 16% separation from a parent, 6% poor or fair childhood health, and 17% unhappy family life during childhood. Twenty-one percent reported two or more types of ACEs (Table 2).

Older age was associated with a lower prevalence of four types of ACEs: experiencing violence, witnessing violence, separation from a parent, and unhappy family life in childhood ($P < 0.001$ for all four variables, Table 2). However, older age was associated with a higher prevalence of family financial stress as a child ($P < 0.001$).

Prevalence of Aging-Related Functional Impairment and Disability

Thirty-five percent of participants met criteria for physical mobility impairment (Table 3); 24% had cognitive impairment based on a MoCA-SA score of ≤ 22 (Table 3). Approximately 25% reported difficulty with one or more ADLs, and over 40% reported difficulty with one or more IADLs (Table 3, Appendix Table 3).

Twenty-four percent of participants aged 50–59, 33% aged 60–69, and 56% aged 70 or older were considered to have physical mobility impairment ($P < 0.001$, Table 3). Similarly, 19% aged 50–59, 22% aged 60–69, and 34% aged 70 or older demonstrated at least mild cognitive impairment

Table 1 Demographic and Clinical Characteristics of Participants in the Analytic Sample.

Demographic or Clinical Characteristic*	No. (%)
Gender	
Female	1884 (54.2)
Age in years	
Mean (SE)	64 (0.3)
Age 50–59	895 (39.1)
Age 60–69	1018 (34.4)
Age 70–79	960 (18.3)
Age 80–89	468 (7.6)
Age ≥ 90	35 (0.6)
Race	
American Indian or Alaskan Native	25 (0.9)
Asian	84 (2.7)
Black or African American	453 (9.8)
White	2593 (81.4)
Other	222 (5.1)
Ethnicity	
Hispanic or Latino	368 (7.7)
Educational attainment	
Less than high school	466 (11.8)
High school or equivalent	1219 (39.3)
Some college	452 (15.4)
Bachelor's or more	953 (33.5)
Later-life partner status	
Married or living with a partner	2390 (70.3)
Separated, divorced, never married, widowed	997 (29.7)
Later-life household assets	
< $100,000	757 (21.7)
$100,000–499,999	912 (27.7)
$500,000 or more	856 (25.4)
Declined to report	862 (25.2)
Self-reported physical health	
Poor or fair	695 (19.6)
Good	1148 (33.3)
Very good	1146 (34.4)
Excellent	394 (12.6)
Self-reported mental health	
Poor or fair	259 (8.4)
Good	728 (23.8)
Very good	1250 (38.8)
Excellent	879 (28.9)
NSHAP Depressive Symptoms Measure†	
Mean score (SE)	5.5 (0.1)
Score of 9 or higher	740 (22.1)
NSHAP Anxiety Symptoms Measure‡	
Mean score (SE)	4.6 (0.1)
Score of 8 or higher	638 (20.4)
Alcohol and tobacco consumption	
Weekly or more frequent alcohol use	1372 (44.3)
Current tobacco use	449 (15.7)
Vigorous physical activity in last month > 30 min	
Never	595 (14.9)
Less than 1 time per month	303 (9.2)
1–3 times per month	315 (9.8)
1–2 times per week	580 (17.2)
3 or 4 times per week	735 (22.4)
5 or more times per week	856 (26.4)

Frequencies are unweighted. Percentages are weighted

*Data were missing for 11 participants for age, 10 participants for race, 7 participants for ethnicity, 297 participants for educational attainment, 4 participants for self-reported physical health, 271 participants for self-reported mental health, 205 participants for anxiety symptoms, 6 participants for alcohol use, 1 participant for tobacco use, and 3 participants for rigorous physical activity

Table 1 (continued)

† Depressive symptoms were assessed using an adapted, interviewer-administered short form of the Center for Epidemiologic Studies Depression Scale (CES-D), in which scores of 9 or greater indicate potentially clinically significant depressive symptoms[42–44]

‡ Anxiety symptoms were similarly assessed with an adapted, interviewer-administered short form Hospital Anxiety and Depression Scale's Anxiety Subscale (HADS-A), in which scores of 8 or higher indicate clinically significant anxiety symptoms[42,45]

($P < 0.001$). Twenty percent aged 50–59, 23% aged 60–69, and 34% aged 70 or older reported difficulty with one or more ADL ($P < 0.001$).

Associations Between ACEs and Functional Impairment and Disability

In models adjusting for age, gender, race, and ethnicity, participants with at least one ACE were more likely to demonstrate impairment in at least one physical mobility test compared to those without any ACE exposure (OR 1.30, 95% CI 1.11–1.52). In particular, physical mobility impairment was associated with childhood experience of physical violence (OR 1.38, 95% CI 1.11–1.71), separation from parent (OR 1.27, 95% CI 1.05–1.54), and poor or fair health (OR 1.73, 95% CI 1.21–2.48) (Table 4, Appendix Table 4). However, no significant associations were detected between childhood history of witnessing violence, family financial stress, or unhappy family life and physical mobility impairment in older age (Table 4).

Participants were more likely to demonstrate at least mild cognitive impairment if they reported a history of poor or fair childhood health (OR 1.74, 95% CI 1.20–2.53) or unhappy childhood family life (OR 1.42, 95% CI 1.08–1.86). However, no significant associations were detected between self-reported history of other ACEs assessed and at least mild cognitive impairment after age 50 (Table 4).

Additionally, participants who reported a history of any ACEs had an increased odds of experiencing difficulty with any ADL in older age, after adjustment for age, gender, race, and ethnicity. Notably, participants were more likely to experience difficulties with any ADLs if they reported a childhood history of experiencing violence (OR 1.86, 95% CI 1.49–2.33), poor or fair health (OR 1.65, 95% CI 1.10–2.48), or family financial stress (OR 1.48, 95% CI 1.14–1.94). Participants were more likely to have difficulty with any IADL if they reported experiencing violence (OR 1.71, 95% CI 1.31–2.23), family financial stress (OR 1.37, 95% CI 1.07–1.75), or unhappy family life in childhood (OR 1.31, 95% CI 1.06–1.62). However, no significant associations were detected between self-reported childhood history of witnessing of violence, separation from parent, or poor health and difficulty with any IADL in older age (Table 5).

In supplementary models that additionally adjusted for later-life alcohol and tobacco use, some associations

Table 2 Adverse Childhood Experiences (ACEs) Reported by Participants, by Age Group.

	No. (%) of participants				
	All participants (n = 3387)	**50–59 years old (n = 895)**	**60–69 years old (n = 1018)**	**70 years and older (n = 1474)**	***P*- value**
Violence, rape, abuse*					
Experienced violent event from age 6–16 (beating, assault, shooting, rape)	420 (14.3)	174 (19.1)	128 (13.7)	118 (8.1)	*< 0.001*
Witnessed violent event from age 6–16 (beating, assault, shooting, rape)	483 (15.9)	192 (20.8)	139 (14.6)	152 (10.3)	*< 0.001*
Household stability*					
Family not well off at all from age 6–16	462 (12.5)	87 (9.3)	133 (13.3)	242 (16.3)	*< 0.001*
Did not live with both parents from age 6–16	555 (16.2)	182 (19.3)	145 (13.7)	228 (14.7)	*< 0.001*
Other childhood background measures*					
Poor or fair health from age 6–16	204 (5.6)	52 (5.4)	62 (5.8)	90 (5.8)	*0.92*
Unhappy family life growing up	503 (16.7)	173 (19.9)	168 (17.0)	162 (11.6)	*< 0.001*
Number of ACE exposures					
No ACEs reported	1897 (55.9)	449 (51.5)	586 (57.4)	862 (60.3)	*< 0.001*
At least one type of ACE reported	1490 (44.1)	446 (48.5)	432 (42.6)	612 (39.7)	
Two or more ACEs reported	668 (20.5)	215 (23.6)	192 (19.4)	261 (17.2)	

Frequencies are unweighted. Percentages are weighted

*Data were missing for 24 participants for experiencing violent event, 21 participants for witnessing violent event, 73 participants for family financial stress, 81 participants for separation from parents, 12 participants for childhood health, 81 participants for family life happiness

Table 3 Prevalence of Physical Impairment, Cognitive Function Impairment, and Functional Disability, by Age Group.

	No. (%) of participants				
	All participants (n = 3387)	**50–59 years old (n = 895)**	**60–69 years old (n = 1018)**	**70 years and older (n = 1474)**	***P*- value**
3A. Physical mobility measure					
Tandem balance					
Held for at least 10 s	2682 (87.0)	832 (94.5)	871 (88.4)	979 (73.3)	*< 0.001*
Held > 0 but < 10 s	329 (8.2)	27 (3.3)	84 (8.4)	218 (15.8)	
Failed earlier tests, did not attempt for safety reasons	218 (4.8)	23 (2.2)	36 (3.3)	159 (10.8)	
3-m usual walk					
Completed in 5 s or less	2662 (83.1)	799 (89.6)	870 (86.2)	993 (69.4)	*< 0.001*
Completed but required > 5 s	725 (16.9)	96 (10.4)	148 (13.8)	481 (30.6)	
Failed earlier tests, did not attempt for safety reasons	0 (0)	0 (0)	0 (0)	0 (0)	
Repeated chair stand					
Completed in 15 s or less	2557 (79.2)	746 (84.6)	815 (81.3)	996 (68.5)	*< 0.001*
Completed but required > 15 s	598 (14.7)	108 (11.2)	157 (13.8)	333 (20.9)	
Failed earlier tests, did not attempt for safety reasons	232 (6.1)	41 (4.2)	46 (4.9)	145 (10.6)	
Difficulty with any physical mobility test	1410 (35.3)	219 (23.8)	341 (32.5)	850 (55.9)	*< 0.001*
3B. Cognitive function measure					
Adapted Montreal Cognitive Assessment (MoCA-SA)					
MoCA-SA score > 22 (normal)	2353 (76.0)	692 (81.0)	763 (78.3)	898 (65.6)	*< 0.001*
MoCA-SA score 18–22 (mild cognitive impairment)	722 (18.4)	159 (15.4)	201 (18.2)	362 (23.0)	
MoCA-SA score < 18 (screen positive for dementia)	312 (5.6)	44 (3.6)	54 (3.5)	214 (11.4)	
3C. Functional disability metric					
Difficulty with one or more activities of daily living	934 (24.4)	180 (19.4)	230 (22.7)	524 (34.0)	*< 0.001*
Difficulty with one or more instrumental activities of daily living	1583 (41.6)	351 (38.2)	392 (36.2)	840 (53.5)	*< 0.001*

Frequencies are unweighted. Percentages are weighted

were attenuated, but most were still significant. However, in exploratory models that additionally adjusted for later-life sociodemographic factors (partner status, educational attainment, and household assets), fewer associations were still significant (Appendix Tables 5 and 6).

DISCUSSION

In this national sample of community-dwelling older U.S. adults, over 40% reported a history of at least one type of ACE, and 20% reported exposure to multiple types of ACEs. Older adults reporting ACE exposure were more likely to demonstrate objectively measured physical mobility

Table 4 Adjusted Associations Between History of Adverse Childhood Experiences (ACEs) and Objectively-Measured Physical Mobility and Cognitive Impairment After Age 50.

ACE exposures	Physical mobility impairment*				At least mild cognitive impairment†			
	Percent with impairment		Age-adjusted OR (95%CI)	Age and early-life demographic-adjusted OR (95%CI)‡	Percent with impairment		Age-adjusted OR (95%CI)	Age and early-life demographic-adjusted OR (95%CI)‡
	Participants with ACE history	Participants without ACE history			Participants with ACE history	Participants without ACE history		
Experience of physical violence or abuse in childhood	37.4	34.9	**1.47 (1.18–1.83)***	**1.38 (1.11–1.71)***	21.4	24.4	0.99 (0.73–1.32)	0.93 (0.69–1.25)
Witnessing of physical violence or abuse in childhood	33.4	35.6	1.14 (0.91–1.43)	1.03 (0.82–1.30)	25.1	23.7	1.25 (0.97–1.60)	1.09 (0.82–1.43)
Family financial stress in childhood	43.2	33.9	1.26 (1.00–1.60)	1.10 (0.87–1.41)	33.4	22.5	**1.57 (1.26–1.94)***	1.21 (0.94–1.56)
Separation from parent in childhood	40.2	33.9	**1.48 (1.22–1.79)***	**1.27 (1.05–1.54)***	31.9	22.1	**1.78 (1.34–2.35)***	1.32 (0.96–1.80)
Poor or fair childhood health	47.8	34.5	**1.84 (1.30–2.59)***	**1.73 (1.21–2.48)***	37.1	23.1	**2.00 (1.42–2.83)***	**1.74 (1.20–2.53)***
Unhappy family life	35.4	34.8	1.22 (0.97–1.52)	1.18 (0.93–1.49)	26.8	23.0	**1.36 (1.06–1.75)***	**1.42 (1.08–1.86)***
At least one type of ACE vs no ACEs	38.5	32.8	**1.44 (1.23–1.69)***	**1.30 (1.11–1.52)***	27.8	21.0	**1.56 (1.31–1.85)***	**1.26 (1.03–1.54)***
Two or more types of ACEs vs no ACEs	39.1	32.8	**1.56 (1.25–1.94)***	**1.37 (1.10–1.72)***	29.2	21.0	**1.72 (1.35–2.17)***	**1.38 (1.07–1.79)***

* Defined as impairment with any of the following physical mobility tests: static tandem balance test, 3-m walk, or repeated chair stand tests

† Defined as a Montreal Cognitive Assessment -Survey adaptation instrument score of 22 or lower

‡ Adjusted for age, gender, race, and Hispanic or Latino ethnicity

impairment and cognitive impairment as well as report difficulty with activities of daily living in older age. For example, participants with a history of experiencing violence in childhood had an approximately 40% greater odds of demonstrating physical mobility impairment and over 80% greater odds of reporting difficulty with ADLs compared to those with no history of ACEs. Other ACEs, such as unhappy family life, were associated with an over 40% increased odds of exhibiting at least mild cognitive impairment. These results suggest that early life stressful experiences may be a marker of increased risk of functional impairment and disability across the aging spectrum.

Despite calls for healthcare providers to systematically screen for ACEs, few studies have documented effects of ACEs across the lifespan.[11] Most studies reporting associations between history of ACEs and functional impairment or disability in older age have relied on subjective measures, such as self-reported cognitive health, physical health, or functional health.[8,16,17,19,20] Recent epidemiologic studies from Canada and China reported that history of ACEs was associated with increased frailty defined by an index that combined subjective and performance measures; although, reports did not indicate which components of the index were the main drivers of the ACEs associations.[15,50] Our study enhances the existing body of evidence by using objective measures to support associations between history of ACEs and functional impairment in older adults.

Our findings also indicate that specific types of ACEs such as experience of violence or abuse during childhood may have particularly strong associations with aging-associated functional impairment. Prior investigations of the long-term effects of childhood violence or abuse have posited multiple biologic, behavioral, and social pathways for the long-term

Table 5 Adjusted Associations Between History of Adverse Childhood Experiences (ACEs) and Self-Reported Functional Disability After Age 50.

ACE exposures	Difficulty with at least one activity of daily living*				Difficulty with at least one instrumental activity of daily living†			
	Percent with impairment		Age-adjusted OR (95%CI)	Age and early-life demographic-adjusted OR (95%CI)‡	Percent with impairment		Age-adjusted OR (95%CI)	Age and early-life demographic-adjusted OR (95%CI)‡
	Participants with ACE history	Participants without ACE history			Participants with ACE history	Participants without ACE history		
Experience of physical violence or abuse in childhood	32.5	23.0	**1.90 (1.52–2.37)***	**1.86 (1.49–2.33)***	49.4	40.1	**1.77 (1.36–2.30)***	**1.71 (1.31–2.23)***
Witnessing of physical violence or abuse in childhood	29.3	23.4	**1.55 (1.19–2.02)***	**1.54 (1.18–2.02)***	44.4	40.9	1.29 (0.98–1.71)	1.31 (0.99–1.72)
Family financial stress in childhood	33.1	23.0	**1.51 (1.18–1.93)***	**1.48 (1.14–1.94)***	50.9	39.8	**1.44 (1.14–1.83)***	1.37 (1.07–1.75)
Separation from parent in childhood	27.9	23.5	**1.33 (1.06–1.68)***	**1.32 (1.06–1.66)***	46.5	40.1	1.37 (1.00–1.86)	1.31 (0.96–1.80)
Poor or fair childhood health	34.0	23.8	**1.67 (1.13–2.49)***	**1.65 (1.10–2.48)***	51.0	41.0	**1.51 (1.07–2.13)***	1.37 (0.98–1.91)
Unhappy family life	28.6	23.2	**1.46 (1.13–1.89)***	**1.42 (1.09–1.85)***	45.7	40.1	**1.36 (1.10–1.69)***	**1.31 (1.06–1.62)***
At least one type of ACE vs no ACEs	29.3	20.6	**1.70 (1.39–2.08)***	**1.69 (1.38–2.07)***	46.7	37.5	**1.55 (1.29–1.86)***	**1.49 (1.24–1.79)***
Two or more types of ACEs vs no ACEs	31.9	20.6	**1.98 (1.62–2.42)***	**1.97 (1.59–2.43)***	48.9	37.5	**1.73 (1.35–2.20)***	**1.67 (1.31–2.13)***

*Participants were considered to have difficulty with any activity of daily living if they reported some difficulty, much difficulty, or unable to do one or more of the following: walking across a room, walking one block, dressing, bathing or showering, eating, getting in and out of bed, using the toilet

†Participants were considered to have difficulty with any instrumental activity of daily living if they reported some difficulty, much difficulty, or unable to do one or more of the following: preparing meals, taking medications, managing money, shopping for food, performing light housework, using a telephone, driving a car during the day, driving a car during the night

‡Adjusted for age, gender, race, and Hispanic or Latino ethnicity

health consequences of these experiences. Exposure to violence or abuse in childhood may increase allostatic load and stress,[51–53] which enact long-term harmful effects on multiple organ systems.[51,54–57] Over time, this prolonged stress response may lead to epigenetic changes,[58] predispose victims to higher-risk health-behaviors in adulthood, [7,59,60] or increase socioeconomic pressures,[52,61–65] all of which can contribute to physical and functional impairment in older age.[66] Our findings suggest that the associations between ACE exposure and later-life functional impairment were not entirely explained by tobacco or alcohol use. However, these associations were more strongly attenuated after adjustment for later-life sociodemographic variables, suggesting that these may be stronger indirect mediators of any relationships between early life stress and later life functional disability (Appendix Tables 5, 6).

Although this study benefits from a national sample and multiple objective measures of physical mobility impairment and cognitive impairment, it also has limitations. Questions used to assess ACEs focused on exposures between ages 6 to 16 and did not account for earlier childhood experiences. For ACEs involving experiencing or witnessing violent events, participants were not asked to further characterize the severity or frequency of their exposure. Further, NSHAP measures did not assess all potential types of ACEs. For example, participants were not asked explicitly about childhood neglect, experiencing houselessness, or substance use in the household, which could have resulted in a lower estimated prevalence of ACEs compared to other samples.[1,67] Finally, NSHAP focused on community-dwelling older adults only, so that individuals with the most severe levels of functional

impairment or disability requiring them to enter long-term care facilities were not represented.

Given how common ACEs were among our participants, our findings provide potential support for incorporating principles of trauma-informed care into clinical care for aging populations.[68] Institutions like the Substance Abuse and Mental Health Services Administration have advocated for creating integrated ACEs screening programs as one aspect of the trauma-informed approach to patient care.[68] Healthcare institutions are already embedding trauma-related treatment resources into geriatric care by offering ACEs screenings for older adult patients and educating staff on the impact of ACEs, all of which could improve the wellbeing of this medically vulnerable population.[69] Our work provides support for engaging older adults in conversations about the potential impact of early life trauma on late life health and considering whether identification of patients with ACEs could guide early interventions to prevent or mitigate age-related decline such as physical therapy for strength building and falls-prevention.[70]

CONCLUSION

These findings from a national population-based sample provide new evidence to suggest that stressful early life experiences may be markers of risk of functional impairment and disability later in life. Our results raise the possibility that early recognition of ACEs may be useful in identifying adults who may benefit from screening or prevention strategies for aging-associated functional decline. Future work is needed to develop and evaluate the impact of ACEs screening and trauma-informed geriatric interventions on the functioning and wellbeing of aging populations.

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Author Contribution *VML and AJH developed the research question and hypothesis. VML conducted the literature review. VML, AJH, NEL and ASH designed the study and analyzed and interpreted the data. NEL conducted the statistical analyses. VML wrote the initial draft and ASH, NEL, and AJH contributed to the revision of the manuscript. All authors have read and approved the final version of the manuscript before submission. There were no additional contributors to this research.*

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Data Availability *Data from the National Social Life Health and Aging Project cohort that underlie this manuscript are already available for public request and download through the National Archive of Computerized Data on Aging - https://www.icpsr.umich.edu/web/NACDA/studies/36873.*

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