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Elder Abuse and Mortality: The Role of Psychological and Social Wellbeing

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Key Words
Elder abuse · Psychosocial wellbeing · Depression · Social network · Social engagement · Mortality · Population-based study

Abstract
Background: Elder abuse is a pervasive human right and public health issue. ***Objectives:*** We aimed to examine the mortality associated with elder abuse across levels of psychological and social factors. ***Methods:*** The Chicago Health and Aging Project (CHAP) is a prospective population-based cohort study that began in 1993. A subset of these participants enrolled between 1993 and 2005 had elder abuse reported to social services agencies (n = 113). Mortality was ascertained during follow-up and with the National Death Index. Psychosocial factors (depression, social network and social engagement) were assessed during the CHAP interview. Cox proportional hazard models were used to assess the mortality of elder abuse across levels of psychosocial factors using time-varying covariate analyses. ***Results:*** The median follow-up time for the cohort (n = 7,841) was 7.6 years (interquartile range 3.8–12.4 years). In multivariate analyses, those with highest (hazard ratio (HR) 2.60, 95% CI 1.58–4.28) and middle levels (HR 2.18, 95% CI 1.19–3.99) of depressive symptoms had an increased mortality risk associated with elder abuse. For social network, those with lowest (HR 2.50, 95% CI 1.62–3.87) and middle levels (HR 2.65, 95% CI 1.52–4.60) of social network had increased mortality risk associated with elder abuse. For social engagement, those with lowest (HR 2.32, 95% CI 1.47–3.68) and middle levels (HR 2.59, 95% CI 1.65–5.45) of social engagement had increased mortality risk associated with elder abuse. Among those with lowest levels of depressive symptoms, highest levels of social network and social engagement, there was no significant effect of reported or confirmed elder abuse on mortality risk. ***Conclusion:*** Mortality risk associated with elder abuse was most prominent among those with higher levels of depressive symptoms and lower levels of social network and social engagement.

Introduction

Elder abuse is a substantial global public health and human rights problem. The World Health Organization has declared that elder abuse is a violation of one of a human being's most basic fundamental rights, that of older persons to be safe and free of violence [1]. Elder abuse includes neglect, physical abuse, sexual abuse, emotional abuse, and financial abuse and available data suggest

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that 2 million US elderly persons experience abuse each year, and many of them experience it in multiple forms [2].

Estimates of the prevalence of elder abuse vary depending on survey methodology and the population studied. Recent reviews suggest that 2–10% of community elders have been victims of abuse [3, 4]. In addition, recent data from US adult protective services agencies suggest an increasing trend in the reporting of elder abuse [5]. This trend is particularly alarming as literature suggests that elder abuse is associated with increased risk of morbidity and mortality [6, 7]. Furthermore, the US National Research Council has urgently called for rigorous research on all aspects of elder abuse, especially through population-based epidemiological studies [2], as our current understanding of the consequences of elder abuse in the general population remains limited.

This study followed the conceptual model of Socio-Cultural Context suggested by the National Research Council [2]. This model focuses on the integration of individual-level factors such as their relationship, socioeconomic status inequality, and power and exchange dynamic while considering the context in which elder abuse takes place. The model highlights the importance of these interactions created by psychosocial context of the abused person, especially due to lower levels of psychological and social wellbeing. Moreover, the Socio-Cultural Context provided guidance on a number of vulnerability and dependency factors as potential contributors toward the acts of elder abuse.

In the USA, there are now 45 million people over the age of 60 and 3 million over the age of 85; the oldest age group is the fastest growing. Evidence suggests that elder abuse may occur more commonly among the most vulnerable elderly, and those with low levels of psychological and social wellbeing may be at higher risk for elder abuse [8–13]. However, the associations of elder abuse with mortality risk across levels of psychosocial factors remain unclear in the general population.

In this work, we build on the existing literature and examine the relationship between elder abuse and mortality across levels of psychosocial factors. Our underlying hypothesis is that mortality risks associated with elder abuse are exacerbated among those with higher levels of depressive symptoms and lower levels of social network and social engagement. In addition, we hypothesize that mortality risk associated with elder abuse are not significant among those with lowest levels of depressive symptoms and highest levels of social network and social engagement.

Methods

Design and Participants

The study population consisted of participants in the Chicago Health and Aging Project (CHAP). CHAP is a prospective, population-based study of a geographically-defined, urban, biracial community population, which is designed to identify risk factors for Alzheimer's disease and other common chronic health problems in older age. Details of the CHAP study design have been described previously [14, 15].

Briefly, the study population enrolled residents aged 65 years and older in three adjacent neighborhoods on the south side of Chicago. In 1993, the study began with a complete census of the community area. The census identified 7,813 age-eligible residents, 6,158 (78.9%) of whom were enrolled between 1993 and 1997 (original cohort). In 2000, CHAP began to enroll additional participants from the study community who had turned 65 since inception of the study (successive cohort). Data collection occurs in 3-year cycles, with each follow-up cycle beginning after the conclusion of the previous cycle. Each data-collection cycle includes an in-person interview conducted in participant's homes. The interviews include standardized questionnaires and tests for the assessment of health history, physical function, cognitive function, health behaviors and social factors. Follow-up participation rate averages 80–85% of survivors at each cycle.

As of 2005, a total of 7,841 older participants had participated in the CHAP study. In addition, there were 264 older persons with valid age who refused to participate from the available data. The CHAP study has extremely limited information about those who declined to participate in this research study. From the available information, those refused to participate were more likely to be younger, women and non-Hispanic black older adults. Written informed consent was obtained and the study was approved by the Institutional Review Board at Rush University Medical Center.

Reporting of Elder Abuse

Reports of elder abuse to social services agencies can come from a variety of sources, including healthcare and legal professionals, community organizations, city workers (e.g. postal worker, utility worker), family members, or concerned neighbors or friends who have contact with seniors. In Illinois, elder abuse is only partially mandated for report, i.e., reporting is mandatory only for those who are unable to report themselves and for whom abuse has occurred within the last 12 months. Elder abuse cases were reported to Illinois Adult Protective Services (APS) through the Elder Abuse Hotline.

Definition of Elder Abuse

In Illinois APS, the definition of abuse includes physical abuse, sexual abuse, emotional abuse, confinement, neglect, willful deprivation and financial exploitation. Physical abuse is defined as inflicting physical pain or injury upon an older adult. Sexual abuse is touching, fondling, intercourse, or any other sexual activity with an older adult, when the older adult is unable to understand, unwilling to consent, threatened or physically forced. Emotional abuse involves verbal assaults, threat of abuse, harassment or intimidation. Confinement is restraining or isolating an older adult, other than for medical reasons. Neglect is a caregiver's failure to provide an older adult with life's necessities, including, but not limited to, food, clothing, shelter or medical care. Willful

deprivation is defined as willfully denying an older adult medication, medical care, shelter, food, a therapeutic device or other physical assistance, and thereby exposing that person to the risk of physical, mental or emotional harm – except when the older adult has expressed capacity to understand the consequences and intent to forgo such care. Financial exploitation includes the misuse, or withholding of an older adult's resources by another, to the disadvantage of the elderly person or the profit or advantage of someone else.

Confirmation of Elder Abuse

Confirmation of abuse is based on the number and type of indicators seen by APS workers. The training of APS workers is standardized and uniform, and they use multiple indicators for each type of abuse. Physical abuse indicators include: physical injuries such as cuts, burns, dislocations, or evidence of other violent actions such as kicks or punches. Sexual abuse indicators consist of: the presence of semen; bruising of the inner thigh; a history of being forced to engage in or observe sexual activities; sexual assault, or unwanted sexual touching. Emotional abuse indicators involve: a history of name-calling; insults; stalking; talking about the elder's death; or threatening the elder with abandonment, institutionalization, or violence. Confinement indicators encompass a history of being: locked in a room; not permitted to leave home; not allowed to have visitors, and being restrained without medical orders. Neglect indicators include: improper hygiene and nutrition; inadequate clothing or supervision, and not being provided with essential needs such as medical care, medications, heat, water, or electricity. Willful deprivation indicators consist of evidence of depriving elders of needed services or essential items such as food or water. Financial exploitation indicators include evidence of: inappropriate banking activities; unusual financial transactions; inappropriate decision-making by the abuser; theft, or abuser control of banking decisions or cash.

Record Linkage

We matched data from CHAP participants to elder abuse cases reported to the social services agencies from 1993 through 2005. Matching was based on an algorithm that compared the following information: date of birth, sex, race, exact home address, zip codes, and the home phone number, and was performed twice to increase accuracy. This resulted in a total of 113 older CHAP participants who matched a social service agency record. If a CHAP participant was found to be reported more than once, we selected the first report. For the present study, we only used elder abuse cases that were reported to social services agencies after the baseline CHAP interview.

Study Variables

Elder abuse status was separated into three groups for the cohort (reported, confirmed, and no elder abuse). Reported elder abuse consists of all reported cases to social services agencies whether confirmed or unconfirmed. Confirmed elder abuse consists of subset of reported elder abuse cases and determined by social services agencies based on the above indicators. No elder abuse group consists of remaining CHAP cohort without any reported or confirmed elder abuse cases. Both reported elder abuse and confirmed abuse were separately compared to the reference group of no elder abuse reports with respect to mortality outcomes.

Data on vital status were obtained from informants at regular follow-up contact and through newspaper obituaries. Reported deaths were examined through matching with the National Death Index.. We used all-cause mortality as the primary endpoint for the present analysis. Demographic variables include age (in years), sex, race (self-reported: non-Hispanic black vs. non-Hispanic white), income, and education (years of education completed). A cohort indicator was defined according to baseline participation in either the original cohort or successive cohorts.

Health-related control variables include cigarette smoking, alcohol use, depressive symptoms, self-reported medical conditions, cognitive function, physical function, body mass index, social network and social engagement. Cigarette smoking (ever smoked) and alcohol use (more than 12 drinks in the last 12 months) were assessed based on a series of questions derived from the Established Populations for Epidemiological Studies of the Elderly project [16]. Weight loss was assessed by changes in measurement of weight over time. Data on self-reported, physician-diagnosed medical conditions were collected for hypertension, diabetes mellitus, stroke, heart disease, hip fracture and cancer.

A battery of four different cognitive function tests was administered: the Mini-Mental State Examination [17], immediate and delayed recall of brief stories in the East Boston Memory Test [18] and the Symbol Digit Modalities Test [19]. To assess global cognitive function with minimal floor and ceiling artifacts, we constructed a summary measure for global cognition based on all four tests. Individual test scores were summarized by first transforming a person's score on each individual test to a z-score and then averaging z-scores across tests to yield a composite score for global cognitive function.

Physical function was assessed by direct performance testing, which is thought to provide a more objective and detailed assessment of certain abilities (range 0–15) [20] than self-report. It assesses walking speed, tandem stands ability, and repeated chair-stand ability. Associations between measures of reported disability and physical performance tests are usually strong [21], and physical performance tests have been used to confirm self-report measures [20]. In addition, self-reported physical function was assessed. The Katz Activities of Daily Living (ADL) scale measures limitations in an individual's ability to perform basic self-care tasks [22]. It consists of six items and an ADL score is created by adding the individual items (range 0–6).

Psychosocial factors included assessment of depressive symptoms, social network and social engagement. Symptoms of depression were measured using a modified version [23] of the Center for Epidemiologic Studies of Depression Scale [24]. Social network was summarized as the total the number of children, relatives, and friends seen at least monthly [16]. Social engagement was assessed by asking how often subjects participate in social activities outside of house, such as religious activities, museums, library and senior centers.

Analytic Approach

Each of the psychological and social factors was divided based on the ordinal levels of these variables into tertiles according to the approximate distribution of each factor. Descriptive information was provided for elder abuse report status (reported, confirmed, no-elder abuse) across levels of each psychological and social factor. In this study, because elder abuse report occurred throughout the study period of 1993–2005, reports of elder abuse

were modeled as a time-varying covariate [25] in a series of Cox proportional hazards models [26] which were used to examine the relationship between elder abuse reporting and mortality across tertiles of depression, social network and social engagement, adjusting for covariates. In the primary model (model A), we tested the association of elder abuse report on mortality risk across tertiles of psychosocial factors after adjustment for cohort, age, sex, race, marital status, education and income. We tested two-way and three-way interactions of these core variables and retained those with statistical significance in the primary model. In the second model (model B), we added health-related variables of medical conditions, global cognitive function, Katz ADL, Nagi Index, physical performance testing, weight loss, alcohol use and smoking to the primary model. In addition, we considered the confirmed cases of elder abuse and re-analyzed all of the above models A and B across tertiles of each psychosocial factor using the same time-varying covariate analyses.

Mortality for elder abuse was reported for all analyses as number deaths per 100 person-years. Medical conditions, cognitive function and physical function were modeled as time-dependent variables in our analyses, accounting for changes of these factors over time in our analyses. All analyses used a two-sided alternative with acceptable significance of p value <0.05. All analyses were performed using the PROC PHREG procedure in SAS® [27].

Table 1. Characteristics of the study cohort (n = 7,841)

Sociodemographic	
Age, years, mean (SD)	73.1 (7.0)
Men, n	3,189 (40.7%)
Black, n	4,617 (58.9%)
Education, years, mean (SD)	12.3 (3.6)
Income categories, mean (SD)	5.3 (2.5)
Married, n	3,949 (50.4%)
Health-related variables	
Medical conditions	
Heart disease, n	1,147 (14.6%)
Hypertension, n	4,486 (57.2%)
Cancer, n	1,491 (19.0%)
Stroke, n	776 (9.9%)
Diabetes, n	1,536 (19.6%)
Hip fracture, n	296 (3.8%)
Mini-Mental State Examination, mean (SD)	26.2 (5.2)
Global cognition, mean (SD)	0.18 (0.84)
Katz disability, mean (SD)	0.3 (1.1)
Nagi disability, mean (SD)	0.9 (1.4)
Physical performance, mean (SD)	10.4 (3.7)
Weight loss, mean (SD)	1.7 (7.0)
Smoking, n	4,211 (53.7%)
Alcohol, n	2,828 (36.2%)

Results

Baseline Characteristics

Of 7,841 CHAP participants, the mean age was 73.1 (standard deviation 7.0), 3,189 (40.7%) were men, and 4,617 (58.9%) were black older adults. Detailed sociodemographic and health-related characteristics are presented in table 1. Proportions of reported elder abuse, confirmed elder abuse, no elder abuse and mortality across the tertiles of psychosocial factors are detailed in table 2. Total cohort was followed for up to 15.7 years (median 7.6, interquartile range 3.8–12.4). Follow-up times by elder abuse status are detailed in table 2.

Reported Elder Abuse and Mortality

Depressive Symptoms. For participants in the highest tertiles of depressive symptoms, there were 7.57 deaths/100 person-years for those without elder abuse and 15.64 deaths/100 person-years for those with reported elder abuse. In the primary analysis of those with highest levels of depressive symptoms (table 3, model A), reported elder abuse was significantly associated with mortality risk (hazard ratio (HR) 1.66; 95% CI 1.15–2.40). The association between reported elder abuse and mortality changed slightly after additional adjustment for cognitive function, physical function, weight loss, alcohol, smoking, and the presence of medical conditions, and was still statistically significant (HR 1.54, 95% CI 1.04–2.28) (table 3, model B). For those in the middle tertile of depressive symptoms, after adjusting for all prior confounders, reported elder abuse was also associated with increased risk of mortality (HR 1.76, 95% CI 1.05–2.96). However, those with the lowest levels of depressive symptoms did not have increased mortality risk associated with elder abuse.

Social Network. For participants in the lowest tertile of social network, there were 7.58 deaths/100 person-years for those without elder abuse and 19.19 deaths/100 person-years for those with reported elder abuse. In the primary analyses of those with lowest levels of social network, reported elder abuse was associated with increased risk of mortality (HR 2.02, 95% CI 1.40–2.89) (table 3, model A). After considering health-related variables (table 3, model B), reported elder abuse was still associated with increased risk of mortality (HR 1.74, 95% CI 1.18–2.56). For reported elder abuse, mortality risk was not statistically significant among those with middle or high levels of social network.

Social Engagement. For participants in the lowest tertile of social engagement, there were 8.16 deaths/100 person-years for those without elder abuse and 17.16 deaths/100 person-years for those with reported elder abuse. In the primary analyses of those with lowest levels of social engagement, reported elder abuse was associated

Table 2. Elder abuse and mortality by levels of psychosocial factors

	No elder abuse			Reported elder abuse			Confirmed elder abuse		
	n = 7,728	follow-up times, years median (IQR)	deaths/100 person-years	n = 113	follow-up times, years median (IQR)	deaths/100 person-years	n = 63	follow-up times, years median (IQR)	deaths/100 person-years
Depression									
Low	3,265 (43.1)	7.1 (8.8)	4.61	35 (31.3)	11.2 (7.6)	9.44	20 (31.8)	11.3 (7.1)	12.88
Middle	2,668 (35.2)	6.8 (8.5)	6.06	28 (25.0)	7.7 (8.3)	14.56	17 (26.9)	6.9 (7.8)	19.78
High	1,641 (21.7)	6.3 (7.8)	7.57	49 (43.8)	8.1 (7.2)	15.64	26 (41.3)	7.9 (8.4)	22.03
Social network									
Low	2,153 (28.0)	5.9 (7.1)	7.58	45 (39.8)	7.9 (7.7)	19.19	29 (46.0)	6.9 (6.7)	28.00
Middle	3,119 (40.6)	6.7 (8.4)	5.68	43 (38.1)	8.4 (6.2)	10.76	22 (34.9)	7.8 (6.3)	19.40
High	2,417 (31.4)	7.5 (8.9)	4.84	25 (22.1)	13.1 (7.5)	9.23	12 (19.1)	13.2 (4.6)	5.74
Social engagement									
Low	3,002 (39.0)	5.8 (6.9)	8.16	58 (51.3)	6.9 (6.5)	17.16	32 (50.8)	6.7 (5.9)	27.41
Middle	2,416 (31.4)	7.1 (8.5)	5.38	30 (26.6)	11.6 (8.1)	12.01	18 (28.6)	12.0 (7.6)	14.53
High	2,275 (29.6)	7.4 (8.6)	3.91	25 (22.1)	11.7 (5.1)	8.99	13 (20.6)	11.8 (3.7)	10.63

Confirmed elder abuse cases are a subset of reported elder abuse cases.

with increased risk of mortality (HR 1.97, 95% CI 1.39–2.77) (table 3, model A). After considering health-related variables (table 3, model B), reported elder abuse was still associated with increased risk of mortality (HR 1.89, 95% CI 1.29–2.77). For reported elder abuse, mortality risk was not statistically significant among those with middle or high levels of social engagement.

In addition, we examine the association of elder abuse and mortality among those with highest depressive symptoms, lowest social network and lowest social engagement. From considering the same above sociodemographic, socioeconomic, and health-related variables, this subgroup with elder abuse had even higher mortality risk (HR 3.15, 95% CI 1.65–6.00)

Confirmed Elder Abuse and Mortality

For those in the highest tertile of depressive symptoms, there were 22.03 deaths/100 person-years for those with confirmed elder abuse. In the fully-adjusted analyses, confirmed elder abuse was associated with increased mortality risk among those with highest levels (HR 2.60, 95% CI 1.58–4.28) and middle levels (HR 2.18, 95% CI 1.19–3.99) of depressive symptoms (table 4, model B).

For those in the lowest tertile of social network, there were 28.00 deaths/100 person-years for those with confirmed elder abuse. In the fully-adjusted analyses, confirmed elder abuse was associated with increased mortality risk among those with lowest levels (HR 2.42, 95% CI 1.52–3.85) and middle levels (HR 2.65, 95% CI 1.52–4.60) of social network (table 4, model B).

For those in the lowest tertiles of social engagement, there were 27.41 deaths/100 person-years for those with confirmed elder abuse. In the fully-adjusted analyses, confirmed elder abuse was associated with increased mortality risk among those with lowest levels (HR 2.32, 95% CI 1.47–3.68) and middle levels (HR 2.59, 95% CI 1.41–4.77) of social engagement (table 4, model B).

Discussion

Our study in a community population suggests that reported elder abuse to a social services agency was associated with a significant increase in risk of mortality, among those with the lowest levels of psychological and social wellbeing (i.e., highest levels of depressive symptoms and lowest levels of social network and social engagement). The mortality risk associated with confirmed elder abuse was even greater among those with the lowest levels of psychological and social wellbeing. In addition, the increased mortality risk associated with confirmed elder abuse was present even among those in the middle tertiles of depressive symptoms, social network and social engagement.

Elder abuse reports are often initiated based on concerns for an older person's welfare, health and safety. However, the sensitivity and specificity of elder abuse re-

Table 3. Hazard ratio (95% CI) associated with reported elder abuse stratified by levels of psychosocial variables

	Low		Middle		High	
	A	B	A	B	A	B
Depression						
Elder abuse report	1.46 (0.86–2.48)	1.17 (0.66–2.08)	2.68 (1.66–4.34)	1.76 (1.05–2.96)	1.66 (1.15–2.40)	1.54 (1.04–2.28)
Sociodemographic						
Cohort	0.85 (0.6–1.05)	0.84 (0.68–1.03)	0.78 (1.66–4.34)	0.79 (0.64–0.97)	0.73 (0.58–0.91)	0.71 (0.56–0.91)
Age, centered at 75 years	1.09 (1.08–1.10)	1.05 (1.04–1.06)	1.08 (1.07–1.09)	1.05 (1.03–1.06)	1.08 (1.06–1.09)	1.04 (1.03–1.05)
Men	1.72 (1.52–1.94)	1.79 (1.56–2.01)	1.72 (1.52–1.94)	1.60 (1.39–1.83)	1.69 (1.46–1.98)	1.87 (1.56–2.23)
Black	0.91 (0.79–1.03)	0.65 (0.56–0.75)	0.93 (0.81–1.06)	0.70 (0.61–0.81)	0.98 (0.83–1.15)	0.71 (0.59–0.85)
Income	0.92 (0.89–0.95)	0.95 (0.92–0.98)	0.94 (0.92–0.97)	0.99 (0.96–1.02)	0.95 (0.91–0.99)	0.99 (0.94–1.03)
Education, centered at 12 years	0.98 (0.95–1.00)	1.01 (0.98–1.04)	0.98 (0.95–1.00)	1.01 (0.99–1.04)	0.97 (0.95–0.99)	1.03 (1.00–1.06)
Marital status	0.96 (0.84–1.10)	0.99 (0.86–1.15)	0.96 (0.85–1.09)	1.02 (0.89–1.17)	0.88 (0.77–1.02)	0.91 (0.78–1.08)
Age × education	1.00 (1.00–1.01)	1.00 (1.00–1.01)	0.99 (0.99–1.00)	0.99 (0.99–1.00)	1.00 (1.00–1.00)	1.00 (0.99–1.00)
Sex × education	1.02 (0.99–1.06)	1.00 (0.97–1.04)	1.04 (1.01–1.07)	1.00 (0.96–1.03)	1.00 (0.97–1.04)	0.99 (0.95–1.03)
Health-related variables						
Medical conditions		1.18 (1.12–1.25)		1.14 (1.08–1.20)		1.13 (1.06–1.21)
Global cognition		0.69 (0.65–0.74)		0.75 (0.70–0.81)		0.68 (0.63–0.74)
Katz		1.03 (0.92–1.14)		1.06 (0.98–1.14)		1.07 (1.00–1.14)
Nagi		1.05 (0.99–1.12)		1.02 (0.97–1.07)		1.03 (0.98–1.09)
Physical performance		0.92 (0.90–0.93)		0.91 (0.90–0.92)		0.91 (0.89–0.93)
Weight loss		0.98 (0.97–0.99)		0.98 (0.97–0.99)		0.99 (0.98–1.00)
Smoking		1.40 (1.24–1.59)		1.39 (1.23–1.57)		1.29 (1.12–1.50)
Alcohol		0.84 (0.74–0.96)		0.92 (0.81–1.05)		1.05 (0.88–1.24)
Social network						
Elder abuse report	2.02 (1.40–2.89)	1.74 (1.18–2.56)	1.39 (0.89–2.14)	1.06 (0.66–1.71)	1.73 (0.92–3.25)	1.45 (0.74–2.81)
Sociodemographic						
Cohort	0.83 (0.67–1.02)	0.84 (0.67–1.05)	0.67 (0.55–0.81)	0.64 (0.53–0.79)	0.93 (0.74–1.17)	0.99 (0.77–1.25)
Age, centered at 75 years	1.08 (1.07–1.09)	1.05 (1.04–1.06)	1.08 (1.07–1.09)	1.03 (1.02–1.04)	1.09 (1.08–1.10)	1.05 (1.04–1.07)
Men	1.53 (1.34–1.74)	0.64 (0.54–0.75)	1.84 (1.64–2.07)	0.71 (0.61–0.81)	1.66 (1.45–1.90)	0.69 (0.59–0.81)
Black	0.90 (0.78–1.04)	1.48 (1.27–1.73)	0.92 (0.81–1.04)	1.99 (1.74–2.28)	0.99 (0.86–1.15)	1.72 (1.47–2.01)
Income	0.95 (0.92–0.98)	1.00 (0.97–1.04)	0.91 (0.89–0.94)	0.96 (0.93–0.99)	0.93 (0.90–0.96)	0.96 (0.93–0.99)
Education, centered at 12 years	0.97 (0.95–0.99)	1.02 (0.99–1.05)	0.96 (0.94–0.99)	1.00 (0.98–1.03)	0.99 (0.97–1.02)	1.04 (1.01–1.07)
Marital status	0.89 (0.78–1.02)	0.97 (0.83–1.13)	0.89 (0.79–1.01)	0.92 (0.80–1.05)	1.03 (0.89–1.19)	1.08 (0.92–1.26)
Age × education	1.00 (0.99–1.00)	1.00 (0.99–1.00)	1.00 (1.00–1.00)	1.00 (0.99–1.00)	1.00 (1.00–1.01)	1.00 (1.00–1.00)
Sex × education	1.00 (0.97–1.03)	0.97 (0.94–1.01)	1.04 (1.01–1.07)	1.02 (0.99–1.05)	1.02 (0.98–1.05)	0.98 (0.94–1.01)
Health-related variables						
Medical conditions		1.14 (1.07–1.21)		1.16 (1.10–1.22)		1.17 (1.10–1.24)
Global cognition		0.71 (0.66–0.77)		0.72 (0.68–0.77)		0.68 (0.63–0.73)
Katz		1.05 (0.98–1.13)		1.03 (0.97–1.10)		1.10 (1.00–1.20)
Nagi		0.98 (0.93–1.04)		1.03 (0.98–1.08)		1.09 (1.02–1.15)
Physical performance		0.92 (0.90–0.93)		0.90 (0.89–0.92)		0.92 (0.90–0.94)
Weight loss		0.98 (0.98–0.99)		0.98 (0.97–0.99)		0.98 (0.97–0.99)
Smoking		1.57 (1.37–1.80)		1.24 (1.10–1.39)		1.37 (1.19–1.57)
Alcohol		0.91 (0.78–1.06)		0.94 (0.82–1.07)		0.91 (0.78–1.06)
Social engagement						
Elder abuse report	1.97 (1.39–2.77)	1.89 (1.29–2.77)	1.81 (1.12–2.94)	1.17 (0.72–1.91)	1.39 (0.77–2.49)	1.05 (0.55–1.99)
Sociodemographic						
Cohort	0.83 (0.71–0.98)	0.83 (0.69–0.98)	0.65 (0.52–0.83)	0.67 (0.52–0.85)	0.77 (0.59–1.01)	0.80 (0.60–1.06)
Age, centered at 75 years	1.08 (1.07–1.09)	1.04 (1.03–1.05)	1.08 (1.07–1.09)	1.04 (1.02–1.05)	1.09 (1.09–1.11)	1.06 (1.05–1.08)
Men	1.41 (1.26–1.58)	1.62 (1.42–1.85)	1.82 (1.59–2.08)	1.85 (1.59–2.16)	1.80 (1.53–2.12)	1.79 (1.49–2.14)
Black	0.97 (0.86–1.09)	0.68 (0.60–0.78)	0.95 (0.83–1.09)	0.68 (0.59–0.80)	0.93 (0.79–1.09)	0.72 (0.60–0.86)
Income	0.94 (0.92–0.97)	0.98 (0.95–1.01)	0.94 (0.91–0.97)	0.97 (0.93–0.99)	0.93 (0.89–0.96)	0.97 (0.94–1.01)
Education, centered at 12 years	0.97 (0.95–0.99)	1.01 (0.99–1.03)	0.99 (0.97–1.02)	1.04 (1.01–1.07)	1.01 (0.98–1.04)	1.03 (1.00–1.06)
Marital status	0.98 (0.88–1.10)	1.03 (0.90–1.16)	0.85 (0.74–0.98)	0.90 (0.77–1.04)	0.99 (0.85–1.17)	1.06 (0.89–1.26)
Age × education	1.00 (0.99–1.00)	1.00 (0.99–1.00)	1.00 (0.99–1.00)	1.00 (0.99–1.00)	1.00 (0.99–1.00)	1.00 (0.99–1.00)
Sex × education	1.03 (0.99–1.05)	1.01 (0.98–1.04)	1.01 (0.98–1.04)	0.98 (0.95–1.02)	1.00 (0.97–1.04)	0.97 (0.94–1.01)

Table 3 (continued)

	Low		Middle		High	
	A	B	A	B	A	B
Health-related variables						
Medical conditions		1.16 (1.10–1.21)		1.11 (1.05–1.18)		1.20 (1.12–1.29)
Global cognition		0.71 (0.67–0.76)		0.69 (0.64–0.74)		0.75 (0.69–0.82)
Katz		1.06 (1.01–1.11)		1.05 (0.95–1.16)		0.96 (0.80–1.16)
Nagi		1.03 (0.98–1.07)		1.05 (1.00–1.11)		1.01 (0.94–1.08)
Physical performance		0.92 (0.91–0.94)		0.91 (0.90–0.93)		0.90 (0.88–0.92)
Weight loss		0.98 (0.98–0.99)		0.98 (0.97–0.98)		0.98 (0.97–0.99)
Smoking		1.42 (1.27–1.59)		1.30 (1.14–1.49)		1.26 (1.08–1.47)
Alcohol		0.91 (0.81–1.03)		0.87 (0.75–1.01)		0.95 (0.80–1.12)

Model adjusted for: cohort, age, sex, race, education, income, age × education, sex × education, medical conditions (hypertension, stroke, diabetes, hip fracture, cardiovascular disease, cancer), global cognition, Katz impairment, Nagi impairment, physical performance testing, weight loss, smoking, alcohol.

PE = Parameter estimate; SE = standard error.

Model goodness-of-fit was performed using the –2 log likelihood criterions for models with and without the specified covariates and then using χ^2 to test the differences between them.

For all analyses of depression, social network and social engagement, the χ^2 statistics were all >1,000 ($p < 0.0001$), further confirming the model fit.

ports are largely unknown. The National Elder Abuse Incidence Study indicates that only 1 out of 14 cases of elder abuse are reported to social services agencies [28]. Reported elder abuse may represent only the 'tip of the iceberg', as less egregious cases are less likely to be reported [28]. Some unconfirmed elder abuse cases represent partial or complete inability to gather evidence for substantiation due to lack of cooperation from elders or family members and limited by APS resources. Other unconfirmed cases represent situations in which, despite the suspicions occasioning a report, there is no evidence of abuse.

In some clinical case series, elder abuse was found to be associated with high mortality, but these studies were based on small sample sizes and did not utilize comparison groups [29, 30]. In a recent population-based study, Dong et al. [7] linked the social services agency data to the CHAP study. After a total of 14 years of follow-up, reported elder abuse was associated with 40% increased mortality risk and confirmed elder abuse was associated with more than twofold increased all-cause mortality risk.

Prior studies indicate that lower levels of psychosocial wellbeing are risk factors associated with elder abuse [8–13, 31]. Fulmer et al. [13] found that higher levels of depressive symptoms are associated with increased risk of elder abuse. Dong and Simon [9] suggest that higher levels of social support were associated with lower risk of elder abuse. Comijs et al. [12] found that greater social support showed a favorable effect on the level of psychological distress in victims of elder abuse.

In our present study using existing dataset from a population-based study in a geographically-defined community, our analytical strategy followed the Socio-Cultural conceptual framework recommended by the National Research Council. First, we followed the sociocultural context to consider the sociodemographic, racial/ethnic, socioeconomic and relationship differences between those with and without reported elder abuse, we found that elder abuse victims with lower levels of psychosocial wellbeing were at particular increased risk for mortality. Moreover, we followed the aforementioned conceptual framework to consider a wide range of medical comorbidities, cognitive status, functional status, health habits and nutritional status. Although the strength of the association decreased slightly, our findings remained statistically significant in that elder abuse victims with lower levels of psychosocial wellbeing had significant increased risk of mortality.

Our study extends the prior study in three ways. First, this study is comprised of a large sample of older adults in a population-based cohort of a geographically-defined community. The CHAP study is urban, racially/ethnically and socioeconomically diverse, and hence offers much greater generalizability of the findings than smaller studies in selected samples. In addition, the CHAP cohort has been very well characterized, with up to 15 years of detailed information on many relevant background vari-

Table 4. Hazard ratio associated with confirmed elder abuse stratified by levels of psychosocial variables

	Model	PE (SE)	HR (95% CI)
Depression			
Low	A	0.85 (0.32)	2.34 (1.25–4.39)
	B	0.48 (0.36)	1.61 (0.79–3.27)
Middle	A	1.18 (0.29)	3.26 (1.84–5.78)
	B	0.78 (0.31)	2.18 (1.19–3.99)
High	A	0.96 (0.25)	2.60 (1.58–4.28)
	B	0.77 (0.24)	2.17 (1.36–3.46)
Social network			
Low	A	0.92 (0.22)	2.50 (1.62–3.87)
	B	0.88 (0.24)	2.42 (1.52–3.85)
Middle	A	1.06 (0.26)	2.88 (1.72–4.81)
	B	0.97 (0.28)	2.65 (1.52–4.60)
High	A	0.12 (0.50)	1.12 (0.42–3.02)
	B	–0.03 (0.51)	0.97 (0.36–2.61)
Social engagement			
Low	A	1.02 (0.21)	2.76 (1.82–4.19)
	B	0.84 (0.23)	2.32 (1.47–3.68)
Middle	A	1.09 (0.31)	2.99 (1.65–5.45)
	B	0.95 (0.31)	2.59 (1.41–4.77)
High	A	0.28 (0.39)	1.33 (0.61–2.88)
	B	0.17 (0.42)	1.19 (0.52–2.72)

Model adjusted for: cohort, age, sex, race, education, income, age × education, sex × education, medical conditions (hypertension, stroke, diabetes, hip fracture, cardiovascular disease, cancer), global cognition, Katz impairment, Nagi impairment, physical performance testing, weight loss, smoking, alcohol.

PE = Parameter estimate; SE = standard error.

Model goodness-of-fit was performed using the –2 log likelihood criterions for models with and without the specified covariates and then using χ^2 to test the differences between them. For all analyses of depression, social network and social engagement, the χ^2 statistics were all >1,000 ($p < 0.0001$), further confirming the model fit.

ables, permitting in-depth examination of potential confounders. Second, although this study suggests that while being reported for elder abuse may be associated with increased mortality risk among those with higher levels of depression and lower levels of social network and social engagement, the confirmed cases of elder abuse carry even higher risk of mortality. Third, this study is the first to demonstrate that increased mortality risk for confirmed elder abuse was not restricted to elders with lowest levels of psychosocial wellbeing, but was significantly greater across middle levels of psychosocial factors.

The precise causal mechanism between elder abuse and mortality across levels of psychosocial factors remain unclear. We considered a comprehensive series of health-related characteristics that are commonly associated with increased mortality risk among older adults, including chronic medical conditions, cognitive impairment, physical disability, smoking, and weight loss, but adjustment for these factors did not attenuate the relationship between elder abuse and mortality. Dehydration, infections or injuries as the result of elder abuse may be other mechanisms, but we did not have information on these factors to be considered in the present study.

The mechanisms for mortality risk of elder abuse not present among those lowest depressive symptoms and highest social network and social engagement remain unclear. It is possible that participants with the highest psychosocial wellbeing are more likely to have increased contact from other families, friends and healthcare professionals. As the result of increased interaction with these safety-net systems, interventions may be implemented to minimize future dangers to safety and wellbeing. Victims of elder abuse with lower psychosocial risks may be more likely to recognize the challenges of such abusive behaviors to their own health and safety, and these victims may be more likely to accept interventions suggested by healthcare professionals or social services agencies.

It is also possible that depression, social network and social engagement could be either triggers or risk factors for elder abuse, such as increasing likelihood of vulnerable populations. In turn, higher levels of depression and lower levels of social wellbeing could reflect illness-related changes, which could make mortality risk more prominent. It is also conceivable that higher levels of depression and lower levels of social wellbeing could be a response to the actions of elder abuse. Improved understanding of these issues will be critical to devise more targeted prevention and intervention strategies.

In addition, prior studies suggest that greater social support may also modify depression as risk factor associated with elder abuse, which may in turn ameliorate the adverse health outcomes associated with elder abuse. Furthermore, the nature or extent of the elder abuse subtypes may be different among those with higher levels of psychosocial wellbeing, in which there is relatively lower mortality risk. This study had inadequate details and power to fully examine this issue. Our study has the following limitations:

First, elder abuse is underreported, and the rate of underreporting is unclear from the current literature. Our

cases of elder abuse likely represent the tip of the iceberg where there are many unidentified and perhaps more egregious cases of elder abuse not coming to the attention of the social services agency.

Second, we did not have sufficient power to examine the mortality risk associated with subtypes of elder abuse or cause-specific mortality associated with elder abuse for the entire CHAP cohort.

Third, the tertile of psychosocial factors represent an approximation and may be sensitive to nature of the ordinal variable it represents. However, we did not have adequate power to further divide the psychosocial factors into quartiles or quintiles in order to more closely examine the minor changes in these factors with respect to elder abuse and mortality.

Fourth, potential confounding could account for the relationship between elder abuse and mortality across the psychosocial variables. This may be especially important, as we did not have information on the severity of medical conditions, detailed measures of the specific subtypes of cognition (i.e. executive function), or injuries associated with abuse, which could be potential confounders not considered in the association between elder abuse and mortality.

Fifth, we did not have measures of social support, to test how the extent of greater social support would modify the risk of mortality associated with elder abuse.

Sixth, we did not have detailed information on the perpetrator(s) (mental health, substance abuse, caregiver stress, etc.), or any available in-depth qualitative information about the detailed context of these human rights violations.

Seventh, we did not have adequate information on the non-responders in the CHAP study, many of whom could have poor physical, psychological and cognitive health. Future studies are needed to examine this potential vulnerable subgroup with respect to elder abuse and mortality outcomes.

Eighth, we did not have sufficient power to examine the relationship between potential changes in psychosocial wellbeing and risk of elder abuse.

Ninth, we could not systematically examine the potential differential mortality outcome between confirmed and unconfirmed elder abuse cases with respect to psychosocial factors and mortality outcomes. Future studies are needed to examine these associations.

Lastly, we did not have information about the intervention provided by social services agencies or the results of the intervention that might have modified the mortality outcomes.

Conclusion

Our study in a community-dwelling population suggests that both reported and confirmed elder abuse were associated with significantly increased risk of mortality, among those with lowest levels of psychosocial wellbeing. In addition, the increased mortality risk associated with confirmed elder abuse was not restricted to elders with highest levels of depression and lowest levels of social network and social engagement. Rather even those victims of elder abuse with middle levels of depression, social network and social engagement had significant increased mortality risk.

Future population-based studies are needed to examine the relation of elder abuse to other adverse health outcomes. Our findings may be useful not only in informing future research efforts of elder abuse, but also in developing future intervention studies to increase psychosocial wellbeing of these vulnerable older adults in order to reduce the adverse health outcomes. In addition, our findings could contribute to developing targeted relevant clinical, social and policy guidelines in the treatment and prevention of elder abuse. Together, these efforts would improve health and aging and ultimately improve human rights.

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