Elder Abuse and its Medical Outcomes in Older Chinese People with Cognitive and Physical Impairment

Abstract

Objectives: Elder abuse poses a major public health threat considering the ongoing rapid aging of the global population. This study investigates the association between elder abuse by family caregivers and medical outcomes among older Chinese patients with cognitive and physical impairments in the People's Republic of China.

Methods: Using cross-sectional design, 1002 older patients (aged 55 y and older) and their family caregivers were recruited from 3 grade A hospitals in Guangdong Province. The major independent variable is caregiver-reported elder abuse, while outcome variables include cardiovascular disease, cerebrovascular disease, chronic obstructive pulmonary disease, peptic ulcer, digestive disorder, chronic hepatic disease, chronic renal disease, metabolic disease, acute inflammation, joint disease, tumor, and general injury. The prevalence of these medical conditions among patients who were abused and those who were not were compared using descriptive analyses and chi-square tests, and logistic regression was used to establish the relevant independent associations.

Results: A total of 429 (42.8%) older persons have experienced physical or psychological abuse over the past 12 months. After adjusting for potential confounders, abused older persons were more susceptible to cardiovascular disease, chronic obstructive pulmonary disease, peptic ulcer, digestive disorder, metabolic disease, acute inflammation, tumor, and injuries.

Conclusion: Elder abuse is associated with various major medical morbidities. Interdisciplinary cooperation is necessary to identify and reduce the adverse physiological consequences in victims.

Key words: elder abuse; medical outcomes; older Chinese people; cognitive and physical impairments

Key points:

- Prevalence of various medical outcomes is higher in abused than non-abused older Chinese people. Elder abuse increases the risk of various medical outcomes in older Chinese people after adjusting for confounding variables.
- Elder abuse typically comes in the form of physical abuse, psychological abuse, financial exploitation, caregiver neglect, and/or self-neglect.1 Elder abuse poses a major public health threat considering the ongoing rapid aging of the global population.

INTRODUCTION

Elder abuse typically comes in the form of physical abuse, psychological abuse, financial exploitation, caregiver neglect, and/or self-neglect[1]. Elder abuse poses a major public health threat considering the ongoing rapid aging of the global population.

Elder Abuse in Chinese Societies

Studies on elder abuse among older Chinese people[2,3] have yielded comparable prevalence rates (20.0-26.8% for psychological and 2.4-2.5% for physical abuse) next to those returned by their counterparts focusing on Europeans using similar methodologies (10.4-29.7% for psychological and 1.0-4.0% for physical abuse).[4,5] Older Chinese people with cognitive and/or physical impairment are particularly prone to abuse, likely a result of victims being perpetually subjected to revictimization and chronic stress in abusive relationships due to inability to care for self-reliance and overreliance on caregiver support.[6] The shift of social values away from traditional concepts of familism and filial piety, which prescribes one's obligation to respect and care for older family members, might have further undermined the privilege and protection traditionally enjoyed by the elderly.

Medical outcomes and elder abuse

Results from research on the relationship between elder abuse and physiological outcomes have been conflicting.[7] While some studies found chronic illness8 and poor health[3,9] to be contributing factors, a different study found no association between elder abuse and medical conditions.[10] Meanwhile, a recent study found metabolic disorders[11] to be more prevalent among older persons subjected to abuse. It should however be noted that the cross-sectional nature of such studies also means that it is unclear whether abuse is a product or predictor of medical outcomes.

Longitudinal evidence provided by existing literature, however, is scarce and comes primarily from 2 studies. Lachs et al[12] followed 2812 older community dwellers for 13 years and concluded that mortality rate remained over 3 times higher for the abused older victims, with survival rates recorded as 9.0% and 40.0% in abused and nonabused cohort members, respectively. The longitudinal predictive effect of elder abuse on mortality was also documented in a more recent prospective study with 9813 older adults.[13] The same study also reported that abused older community dwellers were almost 4 times more likely to have metabolic disorders than their intact counterparts. In view of such ambiguity, the present study took into account literature on domestic violence in general, which has shown direct associations between spousal abuse and more observable physiological outcomes such as fractures and bodily injuries[14] and less observable ones such as renal disease, cardiovascular disease, gastrointestinal disorder, asthma, tumor, diabetes, inflammation, genitourinary disease, and digestive tract conditions.[15-17]

With all that said, evidence has emerged to support the dysregulation "allostatic load" mechanism theory and suggests that exposure to abuse can affect locus coeruleus/norepinephrine-sympathetic system and hypothalamic-pituitary-adrenal axis regulation,[18,19] which predisposes dysregulation in immune, cardiovascular, metabolic, neuroendocrine, inflammatory, and reproductive systems.[20]

Research gap

Existing research on abuse-related medical outcomes tend to be based only on samples from the general population. The present study aims to provide much needed empirical data on the associations between abuse and medical conditions in different physiological systems

specifically among older persons with cognitive and/or physical impairment, who are subject to unique risk factors and vulnerabilities.

THE PRESENT STUDY

The biopsychosocial model, which ascribes disease etiology to both internal and external biological and psychological factors affecting victims, was used to establish theoretical relationships between elder abuse and medical conditions[21].

Previous studies have identified other confounders, in addition to elder abuse, that lead to poor physiological status, including external factors such as inadequate formal[22] and informal social support[12], and internal factors such as old age, gender, substance use[23], physical disability, cognitive impairment, and neuropsychiatric symptoms[24-25].

This study presents the hypothesis that, after adjustment for such confounders, elder abuse can be independently associated with an increased risk of various medical conditions. Furthermore, additional data on the rates of physical and psychological abuse as reported by family caregivers were also collected with the aim of informing existing and future practices, research, and policies.

METHODS

Sampling

A convenience sample of older Chinese patients and their primary family caregivers was acquired through the geriatric and neurological departments of 3 grade A hospitals in Guangdong Province of the PRC. The inclusion criteria adopted were as follows: (1) The care recipient should be a community-dwelling older Chinese adult aged 55 or above, whose medical records (a) indicated mild to moderate cognitive impairment ($9 < MMSE < 27$) or physical impairment but (b) no psychiatric disorder apart from such impairment; (2) the family caregiver was

providing at least 4 hours of care per week; and (3) both the care recipient and caregiver were able to communicate in Mandarin, Cantonese, or Chiu Chow dialect. A sample size of 1000 dyads was needed to achieve intervals of 3.1% at a confidence level of 95%. One thousand two hundred dyads meeting our inclusion criteria were selected, with 1002 successfully enrolled, yielding a response rate of 83.5%. All participants gave informed consent, which specified our study purpose, confidentiality issues, and the principle that information would not be kept in secret if anyone were found being harmed. For older persons lacking the capacity to give consent, their caregivers were asked to provide consent in their place if they thought the older person in question would have given consent should he or she have the capacity to do so. No differences were found between the characteristics of participants and nonparticipants in terms of gender ($\chi 2 = 1.793$, $P = .818$), age ($t = 1.290$, $P = .840$), and kinship to primary caregivers ($\chi 2 = 0.348$, $P = .840$).

Data collection

Between September 2015 and February 2016, data were collected by a clinical team (including a chief physician, 2 attending physicians, 3 resident physicians, and 2 senior nurses) and 6 research assistants each with a master's degree in medicine through evaluation of the older person's medical records and interviews with family caregivers. The protocol was approved by the ethical committee of the author's affiliated university.

Measures

Controlled variables. Demographic characteristics collected included age, gender, use of substance, and diagnosis of cognitive and physical impairments of the older care recipients. Patients' age and gender were retrieved from the hospital registration system, and information on alcohol and cigarette use in the past year was collected from the family caregivers. Positive

cigarette smoking was defined as ≥10 cigarettes/week and positive alcohol consumption as ≥105 g/week.

Information regarding diagnosis of cognitive and physical impairments was obtained from the patients' medical records. Diagnosis of cognitive impairment included confirmed mild cognitive impairment and dementia, based on doctors' best professional judgment and/or brain imaging (eg, computed tomography scan and magnetic resonance imaging). Physical impairment included physical disabilities that restrict one or more major life activities, poliomyelitis, sensory impairment, and cerebral palsy.

Psychosocial factors examined included the care recipient's social network (informal social support, assessed based on the number of relatives or friends who were paying regular visits) and use of community service (formal social support, operationalized as whether the care recipients used any community services, such as day care, rehabilitation care, and memory clinic services).

Neuropsychiatric symptoms were assessed with the 12-item Neuropsychiatric Inventory,[26] the Chinese version, of which has shown satisfactory internal consistency (Cronbach's $\alpha = 0.82$) and interrater reliability (intraclass coefficient = 0.98) when applied to community- dwelling older Chinese adults with dementia.[27] Family caregivers rated on a 4-point scale to indicate the frequency in which the care recipient demonstrated each of the listed neuropsychiatric symptoms in the surveyed month. The Chinese version of Neuropsychiatric Inventory achieved an internal consistency α of 0.836 in this study.

Major independent variable. Physical and psychological abuse were assessed respectively with the 12-item physical assault and 8-item psychological aggression subscales from the Revised Conflict Tactic Scale.[28] The Chinese version of Revised Conflict Tactic Scale

has been previously applied to older Chinese people with dementia, yielding an internal consistency α of 0.69 to 0.82 and 0.64 to 0.81, respectively, for the physical assault and psychological aggression subscales.[2,29] This study recorded an internal consistency α of 0.921 and 0.763 for these 2 subscales, respectively.

Family caregivers were asked to rate on a 5-point Likert scale (1 = never, 5 = all the time) how frequently they had committed each of the 20 items on the subscales over the preceding 12 months. The results were categorized into 2 groups: (1) a score of 3 or lower for all 20 items and (2) a score of 3 or higher for at least 1 item. This was based on observations in previous studies that found category 2 to be an effective threshold for separating cases that carry clinical significance from those that do not.[30]

Dependent variable. Dependent variables included a range of medical conditions diagnosed. The multimorbidity index[31] and the International Classification of Disease, Tenth Revision,[32] were used, whereby medical outcomes were categorized into (1) chronic conditions including cardiovascular disease (eg, peripheral arterial disease, rheumatic heart disease, and hyperten- sion), chronic obstructive pulmonary disease (COPD), peptic ulcer (eg, gastric ulcer and duodenal ulcer), digestive disorder (eg, irritable bowel syndrome, functional dyspepsia, and constipation), chronic hepatic disease (eg, chronic hepatitis B, hepatic adipose infiltration, and alcoholic liver disease), chronic prostate disease (eg, chronic prostatitis and benign prostatic hyperplasia), metabolic disease (eg, diabetes, metabolic arthritis, and osteoporosis), joint disease, and tumor; and (2) acute conditions including cerebrovascular disease, general injury, and acute inflammation (eg, acute pneumonia, acute appendicitis, acute cholecystitis, and acute urethritis). Medical records of the care recipients were reviewed to ascertain whether they had a clinically validated diagnosis of these medical conditions at the time of the study.

DATA ANALYSIS

SPSS 21.0 was applied in all data analyses. The prevalence (%) of categorical variables and means (SDs) of continuous variables were assessed. The prevalence of medical conditions was analyzed based on abuse status, while bivariate analyses were performed to compare the prevalence of abuse and medical outcomes using chi-square test. Two series of logistic regression analyses were then conducted with medical conditions as dependent variables and abuse as the targeted independent variable. In the first series, abuse was entered to generate crude odd ratios, and in the second series, controlled variables were entered in step 1 and abuse in step 2 to generate adjusted odd ratios. For the analyses above, a P value of .05 or less was set as the threshold in determining medical significance, and all variables were examined for multicollinearity prior to the analyses.

RESULTS

Sample characteristics

All the 1002 participating older persons were aged between 55 and 90 (mean = 68.72, SD = 8.72), and over half of them are male (55.6%, N = 557). All were suffering from some degree of cognitive (79.8%, N = 800) and/or physical (69.7%, N = 698) impairment, with cognitive impairment slightly more common among females than males (81.8% and 78.3%, respectively, $\chi 2 = 22.084$, $P < .001$). A greater number of males than females were positive for consuming cigarettes and/or alcohol (60.9% and 4.9%, respectively, $\chi 2 = 33.599$, $P < .001$), and over half of all participating older persons had used community services (53.8%, N = 539). On average, each participating older person was paid regular visits by over 7 (mean = 7.30, SD = 3.72) friends or relatives, and most of the family caregivers were adult children (59.4%, N = 595), spouses (19.5%, N = 195), or other family members (21.2%, N = 212).

Prevalence of elder abuse

Elder abuse was common in this sample: Of the 1002 family caregivers interviewed, 429 (42.8%) reported having exhibited some form of abusive behavior towards their care recipient over the preceding 12 months. No significant gender differences were noted in terms of rates of either psychological or physical abuse. Results are presented in Table 1.

Prevalence of medical outcomes

Prevalence of medical outcomes was examined using descriptive analysis and chi-square. Certain medical outcomes were found to be more prevalent among the older persons who were subjected to abuse compared with those who were not, such as cardiovascular disease (72.3% vs 56.0%), cerebrovascular disease (21.9% vs 16.2%), COPD (23.5% vs 12.2%), peptic ulcer (11.4% vs 5.4%), digestive disorders (24.2% vs 10.6%), metabolic disease (80.2% vs 47.5%), acute inflammation (22.1% vs 14.0%), tumor (42.7% vs 24.4%), and injuries (4.0% vs 0.90%). Medical outcomes across genders were also compared. Cerebrovascular disease (21.0% vs 15.7%), COPD (19.9% vs 13.5%), and tumor (37.3% vs 25.8%) were more common in males than in females. In general, prevalence differences in medical outcomes were higher for abuse than nonabuse group. Results are presented in Table 2. Logistic regression between elder abuse and medical outcomes Following adjustment for all potential confounders, an independent association can be drawn between elder abuse and an increased risk of cardiovascular disease (OR, 2.049, 1.551-2.706), COPD (1.782, 1.259-2.522), peptic ulcer (2.208, 1.362-3.579), digestive disorder (2.192, 1.535-3.130), metabolic disease (4.576, 3.395-6.167), acute inflammation (1.923, 1.366-2.707), tumor (1.848, 1.390-2.459), and general injuries (4.216, 1.506-11.805). Results were presented in Table 3.

DISCUSSION

Elder abuse

The prevalence rates of abuse generated by the present sample are comparable with those yielded from other older Chinese populations with declined cognitive and physical functioning (62.3%[29] and 42.3%[33]), but higher than those recorded in their counterparts in western societies (27.9%,[34] 33.6%,[35] and 22.2%[30]). The higher rates possibly result from a shift in culture away from traditional values, the prevalence of multigenerational coresiding,[36] and a higher tolerance towards domestic violence for the sake of protecting family honor.[7]

Consistent with previous findings,[29,37] all physically abused older persons in this sample were found to be also suffering from psychological abuse, suggesting the potential existence of common mechanisms shared by different abuse subtypes and the possibility of multiple victimizations in a single caregiving relationship.

Medical outcomes

Results from bivariate analyses showed a higher prevalence of various medical outcomes among abused older persons. Multivariate analyses further validated that elder abuse was associated with increased odds of cardiovascular disease, COPD, peptic ulcer, digestive disorder, metabolic disease, acute inflammation, tumor, and general injuries. This finding is consistent with previous observations that elder abuse significantly increased the risk of cardiovascular[13] and metabolic diseases[11] and further suggests that elder abuse can bring about medical consequences not limited to any one particular aspect of the victim's health but across multiple physiological systems.

In addition, in line with previous studies that found a positive correlation between spousal abuse and the risk of chronic lung conditions,[38] our results show a positive relationship between elder abuse and COPD, which, when considered with previous evidence that depression

significantly contributed to COPD[39] and that elder abuse led to depression,[3] raises the possibility that depression is a mediator between elder abuse and COPD—a subject that warrants further investigation.

Our finding that elder abuse significantly increases the risk of peptic ulcer by 2 times is also consistent with previous research on violence by intimate partners.[40] However, contrary to previous observation that gender, age, substance use,[41] and neuropsychiatric symptoms[42] influenced both life adverse experiences and peptic ulcer, our result indicated that adjusting for these variables did not alter the relationship between abuse and peptic ulcer. Further research is needed to ascertain the exact relationships between abuse and peptic ulcer.

Our study also supplements current literature on interpersonal relationship[43] by establishing a significant association between abuse and acute inflammation, which is possibly a result of increased stress that in turn leads to abnormalities in inflammatory biomarkers (C-reactive protein, interleukin 6, tumor necrosis factor α, etc) that trigger inflammation.[44] This is worth noting as inflammation can trigger cellular and physiological aging,[45] which in turn increases vulnerability to abuse and may leave the victim in perpetual cycles of abuse.

Our finding that elder abuse is positively associated with a higher risk of digestive disorder is also consistent with previous research that drew positive connections between intimate partner violence and various digestive problems, such as dyspepsia, constipation, irritable bowel syndrome, gastric reflux,[14] and functional gastrointestinal disorder.[46] That being said, the exact mechanisms governing such associations remain unclear, although recent studies have shown that stress resulting from physical or emotional abuse can cause deregulation of the gut-neurological system, corticotropin-release hormone secretion, and digestive enzyme activities,[17] which are significant predictors for digestive problems.[47] Furthermore, clinical data have found

psychological treatment and psychotropic agents targeting abuse-related depression to be effective in alleviating digestive disorders.[48] Such evidence suggests a connection between stress and abuse-related depression and digestive disorders, which is a subject warranting further investigation.

Our study further extends existing literature on family violence by identifying a prominent association between elder abuse and occurrence of tumor. Possibly, emotional distress and fear brought about by abuse[7] can in turn stimulate complex neuroendocrine and immune system reactions that reduce cytotoxin T cell and natural killer cell activities,[49] rendering victims more susceptible to developing tumors.[50] Furthermore, the fact that abusers are more likely to be controlling may lead to limited access to preventive health care services and tumor screenings,[51] which may in turn lead to delayed treatment. In particular, older victims with cognitive and/or physical impairment are often confined to their domicile without access to medical resources.[52] Lastly, this study identified a significant relationship between elder abuse and injuries, which may be a direct result of repeated physical assault or falls due to improper care.

LIMITATIONS

This study has several limitations. First, dependence on convenience sampling means that the present results cannot be generalized to other older populations with cognitive and physical impairments. Second, using self-reporting approaches is subject to bias caused by recall decays and social desirability effect, which can undermine the validity of the study. Future studies with proxy subjects and daily diary experience sampling[53] may address this limitation. The cross-sectional nature of our study prevents the establishment of temporal or causal associations, thus cannot exclude the possibility that certain medical conditions are in fact risk factors leading to abuse. Furthermore, as mentioned above, information on potential mediators such as depression and emotional stress is not available. Further investigation into their potential mediating roles will

be most helpful in understanding how they impair physical health.

IMPLICATIONS

Given the significant impact of elder abuse on physiological health, greater efforts should be made by clinical professionals to facilitate prevention and intervention. Elder abuse screening should be included as a routine procedure for patients examined with COPD, cardiovascular disease, peptic ulcer, digestive disorder, metabolic disease, acute inflammation, tumor, and general injuries, so that further inquiries on abuse and home safety issues can be made with patients suffering such medical conditions. Meanwhile, abused victims should be examined for such medical conditions once any possible symptom presents to facilitate diagnosis and treatments.

Existing literature has shown that only a small proportion of clinicians (6.0-21.0%) discuss domestic violence issues with patients and an overwhelming majority (92.0%) have found it challenging to do so[54] and many (88.3%) consider the lack of training, knowledge, and resources as major barriers to making proper inquiry and addressing the issue of abuse.[55] Therefore, continual education on the subject and proper support and resources are necessary to help clinicians tackle the issue adequately.

Clinicians should also receive training to refine techniques for evaluating and handling elder abuse cases to minimize the likelihood of false positive findings (spontaneous bruises misattributed to physical abuse) or false negative findings (eg, abuse-induced fractures misattributed to osteoporosis) in the assessment.[56] Clinicians should also get familiar with intervention resources in the community and make referrals for patients suspected or confirmed as victims. Geriatric nurses should regularly monitor physical and psychological health of older patients by home visits and coordinate care with clinicians and social workers to facilitate the implementation of necessary geriatric services, such as homecare services, mental health services,

and physical disease treatment, to improve home safety and overall well-being of the elderly. Multidisciplinary coordination involving clinicians, nurses, social workers, law enforcement, and other community participants has demonstrated efficiency and effectiveness in handling multidimensional problems of elder abuse.[56]

On policy level, elder abuse should be recognized as a priority public health issue and proportionate resources should be allocated to it. A workforce involving clinicians, geriatric nurses, geriatric psychiatrists, and social workers with sufficient training on elder abuse detection, prevention, and intervention should be developed. Furthermore, national mandatory reporting should be established to refer suspected or confirmed elder abuse cases to regulatory authority or law enforcement agencies.

Cultural sensitivity is essential in intervention and prevention efforts. Steps should be taken to address notions specific to Chinese culture, such as tolerance of abuse for preserving family honor, gender inequality, and justification of abuse against older persons with cognitive and/or physical impairment.

CONCLUSION

Elder abuse is common and associated with an array of medical conditions in the victims. Our findings suggested that health burden of elder abuse should be recognized and adequate resources should be allocated to this public health priority. Equally important is to develop evidence-based prevention and intervention of elder abuse to reduce associated morbidity and mortality. Clinicians having opportunities to interact with older patients should be equipped with sufficient knowledge to detect elder abuse and refer victims to appropriate service providers. For older patients suffering abuse, proper diagnosis and medical treatment should be provided in conjunction with counseling, to prevent greater deterioration of their physical and psychological

health. Such multidisciplinary strategies require collective efforts from clinicians, geriatric nurses, social workers, law enforcement, and policy makers.

REFERENCES

1. National Research Council. *Elder Mistreatment: Abuse, Neglect, and Exploitation in an Aging America*. Washington, DC: National Academies Press; 2003.
2. Yan E, Tang C. Proclivity to elder abuse: a community study on Hong Kong Chinese. *J Interpers Violence*. 2003;18(9):999-1017.
3. Yan E, Tang C. Elder abuse by caregivers: a study of prevalence and risk factors in Hong Kong Chinese families. *J Fam Violence*. 2004; 19(5):269-277.
4. Melchiorre MG, Rosa MD, Lamura G, et al. Abuse of older men in seven European countries: a multilevel approach in the framework of an ecological model. *PLoS One*. 2016;11(1): e0146425):1-28.
5. Lindert J, de Luna J, Torres-Gonzales F, et al. Abuse and neglect of older persons in seven cities in seven countries in Europe: a cross-sectional community study. *Int J Public Health*. 2013;58(1):121-132.
6. Dichter ME, Gelles RJ. Women's perceptions of safety and risk following police intervention for intimate partner violence. *Violence against Women*. 2012;18(1):44-63.
7. Yan E, Chan KL, Tiwari A. A systematic review of prevalence and risk factors for elder abuse in Asia. *Trauma Violence Abuse*. 2014; 16:199-219.
8. Wu L, Chen H, Hu Y, et al. Prevalence and associated factors of elder mistreatment in a rural community in People's Republic of China: a cross sectional study. *PLoS One*. 2012;7:1-8.
9. Dong X. Do the definitions of elder mistreatment subtypes matter? Findings from the PINE Study. *J Gerontol A Biol Sci Med Sci*. 2014; 69A(S2):S68-S75.

10. Dong X, Simon M. Urban and rural variations in the characteristics associated with elder mistreatment in a community-dwelling Chinese population. *J Elder Abuse Negl*. 2013;25(2):97-125.
11. Dong X, Simon M. Association between elder abuse and metabolic syndromes: findings from the Chicago health and aging project. *Gerontology*. 2015;61(5):389-398.
12. Lachs MS, Williams CS, O'Brien S, Pillemer KA, Charlson ME. The mortality of elder mistreatment. *Jama*. 1998;280(5):428-432.
13. Dong X, Simon M, Mendes de Leon C, et al. Elder self-neglect and abuse and mortality risk in a community-dwelling population. *JAMA*. 2009;302(5):517-526.
14. Coker AL, Davis KE, Arias I, et al. Physical and mental health effects of intimate partner violence for men and women. *Am J Prev Med*. 2002; 23(4):260-268.
15. Bertone-Johnson ER, Whitcomb BW, Missmer SA, Karlson EW, Rich-Edwards JW. Inflammation and early-life abuse in women. *Am J Prev Med*. 2012;43(6):611-620.
16. Campbell J. Health consequences of intimate partner violence. *Lancet*. 2002;359(9314):1331-1336.
17. Leserman J, Drossman DA. Relationship of abuse history to functional gastrointestinal disorders and symptoms: some possible mediating mechanism. *Trauma,*
18. Hueston CM, Deak T. The inflamed axis: the interaction between stress, hormones, and the expression of inflammatory-related genes within key structures comprising the hypothalamic–pituitary–adrenal axis. *Physiol Behav*. 2014;124:77-91.
19. Arnett MG, Muglia LM, Laryea G, Muglia LJ. Genetic approaches to hypothalamic-pituitary-adrenal axis regulation. *Neuropsychopharmacology Reviews*. 2016;41(1):245-260.

20. Dutton MA, Green BL, Kaltman SI, Roesch DM, Zeffiro TA, Krause ED. Intimate partner violence, PTSD, and adverse health outcomes. *J Interpers Violence*. 2006;21(7):955-968.
21. Engel GL. The clinical application of the biopsychosocial model. *Am J Psychiatry*. 1980;137(5):535-544.
22. Lee M, Kolomer S. Caregiver burden, dementia, and elder abuse in South Korea. *J Elder Abuse Negl*. 2005;17(1):61-74.
23. Krug DG, Mercy JA, Dahlberg LL, et al. The world report on violence and health. *The Lancet*. 2002;360(9339):1083-1088.
24. Johannesen M, LoGiudice D. Elder abuse: a systematic review of risk factors in community-dwelling elders. *Age Ageing*. 2013;42(3):292-298.
25. Lee Y, Back JH, Kim J, et al. Systematic review of health behavioral risks and cognitive health in older adults. *Int Psychogeriatr*. 2010; 22(2):174-187.
26. Cummings JL. The Neuropsychiatric Inventory: assessing psychopa- thology in dementia patients. *Neurol*. 1997;48(5):10-16.
27. Wang T, Xiao S, Li X, et al. Reliability and validity of the Chinese version of the neuropsychiatric inventory in mainland China. *Int J Geriatr Psychiatry*. 2012;27(5):539-544.
28. Straus MA, Hamby SL, Boney-McCoy S, et al. The Revised Conflict Tactics Scales (CTS 2). *J Fam Issues*. 1996;17(3):283-316.
29. Yan E, Kwok T. Abuse of older Chinese with dementia by their family caregivers: an inquiry into the role of caregiver burden. *Int J Geriatr Psychiatry*. 2011;226:527-535.
30. Beach SR, Schulz R, Williamson GM, Miller LS, Weiner MF, Lance CE. Risk factors for potentially harmful informal caregiver behavior. *J Am Geriatr Soc*. 2005;53(2):255-261.

31. Radner H, Yoshida K, Mjaavatten MD, et al. Development of a multimorbidity index: impact on quality of life using a rheumatoid arthritis cohort. *Semin Arthritis Rheum*. 2015;45(2):167-173. https:// doi.org/10.1016/j.semarthrit.2015.06.010
32. Eisfeld J. International classification of diseases and related health problems, tenth revision (ICD-10). 2014;1(1–2):107-110.
33. Yan E. Abuse of older persons with dementia by family caregivers: results of a 6-month prospective study in Hong Kong. *Int J Geriatr Psychiatry*. 2014;29(10):1018-1027.
34. Cooper C, Manela M, Katona C, Livingston G. Screening for elder abuse in dementia in the LASER-AD study: prevalence, correlates and validation of instruments. *Int J Geriatr Psychiatry*. 2008;23(3):283-288.
35. Cooper C, Selwood A, Blanchard M, Walker Z, Blizard R, Livingston G. The determinants of family carers' abusive behaviour to people with dementia: results of the CARD study. *J Affect Disord*. 2010; 121(1-2):136-142.
36. Sooryanarayana R, Choo W, Hairi NN. A review on the prevalence and measurement of elder abuse in the community. *Trauma Violence Abuse*. 2013;14(4):316-325.
37. Kishimoto Y, Terada S, Takeda N, et al. Abuse of people with cognitive impairment by family caregivers in Japan (a cross-sectional study). *Psychiatry Res*. 2013;209(3):699-704. https://doi.org/10.1016/j.psychres.2013.01.025
38. Loxton D, Schofield M, Hussain R, et al. History of domestic violence and physical health in midlife. *Violence against Women*. 2007; 12(8):715-731.
39. Montserrat-Capdevila J, Godoy P, Marsal JR, et al. Overview of the impact of depression and anxiety in chronic obstructive pulmonary disease. *Lung*. 2016;194(1):1-9.

40. Levenstein S, Rosenstock S, Jacobsen RK, Jorgensen T. Psychological stress increases risk for peptic ulcer, regardless of helicobacter pylori infection or use of nonsteroidal anti-inflammatory drugs. *Clin Gastroenterol Hepatol*. 2015;13(3):498-506.
41. Realo A, Teras A, Kööts-Ausmees L, Esko T, Metspalu A, Allik J. The relationship between the Five-Factor Model personality traits and peptic ulcer disease in a large population-based adult sample. *Scand J Psychol*. 2015;56(6):693-699.
42. Faramarzi M, Kheirkhah F, Shokri-Shirvani J, Mosavi S, Zarini S. Psychological factors in patients with peptic ulcer and functional dyspepsia. *Caspian Journal of Internal Medicine*. 2014;5(2):71-76.
43. Friedman EM, Hayney MS, Love GD, et al. Social relationships, sleep quality, and interleukin-6 in aging women. *Proc Natl Acad Sci U S A*. 2005;102(51):18757-18762.
44. Newton TL, Fernandez-Botran R, Miller JJ, Lorenz DJ, Burns VE, Fleming KN. Markers of inflammation in midlife women with intimate partner violence histories. *J Womens Health*. 2011;20(12):1871-1880.
45. Damjanovic AK, Yang Y, Glaser R, et al. Accelerated telomere erosion is associated with a declining immune function of caregivers of Alzheimer's disease patients. *J Immunol*. 2007;179(6):4249-4254.
46. Black MC. Intimate partner violence and adverse health consequences: implications for clinicians. *Am J Lifestyle Med*. 2011;5(5):428-439.
47. Carabotti M, Scirocco A, Maselli MA, Severi C. The gut-brain axis: interactions between enteric microbiota, central and enteric nervous systems. *Ann Gastroenterol*. 2015;28(2):203-209.

48. Wu CY. Psychological co-morbidity in functional gastrointestinal disorders: epidemiology, mechanisms and management. *J Neuro gastroenterol Motil*. 2012;18(1):13-18.
49. Woods SJ. Intimate partner violence and post-traumatic stress disorder symptoms in women: what we know and need to know. *J Interpers Violence*. 2005;20(4):394-402.
50. Cesario SK, McFarlane J, Nava A, et al. Linking cancer and intimate partner violence: the importance of screening women in the oncology setting. *Clin J Oncol*. 2014;18(1):65-73.
51. Gandbi S, Rovi S, Vega M, et al. Intimate partner violence and cancer screening among urban minority women. *J Am Board Fam Med*. 2010; 23(3):343-353.
52. Grenade L, Boldy D. Measuring loneliness in later life: a comparison of differing measures. *Rev Clin Gerontol*. 2005;15(1):63-70.
53. Johns G, Miraglia M. The reliability, validity, and accuracy of self- reported absenteeism from work: a meta-analysis. *J Occup Health Psychol*. 2015;20(1):1-14.
54. Drossman DA, Leserman J. Relationship of abuse history to functional gastrointestinal disorders and symptoms—some possible medicating mechanisms. *Trauma, Violence, & Abuse*. 2007;8(3):331-343.
55. Alotaby IY, Alkandari BA, Alshamali KA, Kamel MI, el-Shazly MK. Barriers for domestic violence screening in primary health care centers. *Alexandria Journal of Medicine*. 2013;49(2):175-118.
56. Lachs MS, Pillemer KA. Elder abuse. *N Engl J Med*. 2015;373(20):1947- 1956.

Table One. Descriptive statistics for major variables (n=1002)

Total (n=1,002)		Female (n=445)	Male (n=557)	X^2/ t-test (p)
Sample characteristics				
Age	68 (55-90); 68.72 (8.72)	68 (55-90); 68.40 (8.13)	67 (55-88); 68.98 (9.17)	1.051***
Diagnosis of physical disabilities	698 (69.7%)	304 (68.3%)	394 (70.7%)	0.686
Diagnosis of cognitive impairment	800 (79.8%)	364 (81.8%)	436 (78.3%)	22.084 ***
Use of substance (cigarette or alcohol)	361 (36.0%)	22 (4.9%)	339 (60.9%)	33.599***
Neuropsychiatric symptoms (range 12-48)	17 (12-26); 17.42 (2.52)	16 (12-36); 15.90 (3.62)	16 (12-34); 12.26 (4.04)	-0.674
Social networks	7 (0-18); 7.30 (3.718)	7 (0-16); 7.22 (3.74)	7 (0-18); 7.36 (3.70)	0.629
Use of community services	539 (53.8%)	236 (53.0%)	303 (54.4%)	0.185
Kinship to the family caregiver				4.344
Adult children	595 (59.4%)	267 (60.0%)	328 (58.9%)	-
Spouses	195 (19.5%)	75 (16.9%)	120 (21.5%)	-
Other family members	212 (21.2%)	103 (23.1%)	109 (19.6%)	-
Rates of abuse				
Psychological abuse	429 (42.8%)	176 (39.6%)	253 (45.4%)	3.483
Physical abuse	10 (1.0%)	2 (0.4%)	8 (1.4%)	2.658
Psychological or physical abuse	429 (42.8%)	176 (39.6%)	253 (45.4%)	3.483

Data presented as number (%), or median (range); mean (SD)

Table Two. Frequency of medical outcomes by elder abuse victimization and gender

	Total	Abuse (n=429)		Non-abuse (n=573)		X^2	Female (n = 445)		Male (n = 557)		X^2
		n	Prevalence (CI)	n	Prevalence (CI)		n	Prevalence (CI)	n	Prevalence (CI)	
Cardiovascular disease	631 (63.0%)	310	72.3% (0.680-0.765)	321	56.0% (0.519-0.601)	27.75***	268	60.2% (0.551-0.649)	363	65.2% (0.610-0.691)	2.595
Cerebrovascular disease	187 (18.7%)	94	21.9% (0.180-0.258)	93	16.2% (0.132-0.193)	5.22*	70	15.7% (0.124-0.191)	117	21.0% (0.176-0.244)	4.535*
Chronic obstructive pulmonary disease (COPD)	171 (17.1%)	101	23.5% (0.195-0.276)	70	12.2% (0.095-0.149)	22.24***	60	13.5% (0.103-0.169)	111	19.9% (0.166-0.232)	7.260**
Peptic ulcer	80 (8.0%)	49	11.4% (0.084-0.144)	31	5.4% (0.036-0.073)	12.07**	42	9.4% (0.069-0.121)	38	6.8% (0.048-0.089)	2.304
Digestive disorders	165 (16.5%)	104	24.2% (0.202-0.283)	61	10.6% (0.081-0.132)	32.97***	63	14.5% (0.109-0.174)	102	18.3% (0.151-0.215)	3.105
Chronic hepatic disease	33 (3.3%)	17	4.0% (0.021-0.058)	16	2.8% (0.014-0.042)	1.06	14	3.1% (0.016-0.049)	19	3.4% (0.020-0.050)	0.055
Chronic prostate disease	102 (10.2%)	44	10.3% (0.074-0.131)	58	10.1% (0.077-0.126)	0.01	46	10.3% (0.072-0.133)	56	10.1% (0.077-0.126)	0.022
Metabolic disease	616 (61.6%)	344	80.2% (0.764-0.840)	272	47.5% (0.432-0.516)	110.88***	265	59.6% (0.548-0.643)	351	63.0% (0.591-0.669)	1.255
Acute inflammation	175 (17.5%)	95	22.1% (0.182-0.261)	80	14.0% (0.111-0.168)	11.40**	76	17.1% (0.136-0.207)	99	17.9% (0.146-0.209)	0.838
Joint disease	51 (5.1%)	20	4.7% (0.027-0.067)	31	5.4% (0.036-0.073)	1.97	27	6.1% (0.040-0.083)	24	4.3% (0.027-0.059)	1.584
Tumor	323 (32.2%)	183	42.7% (0.380-0.474)	140	24.4% (0.209-0.280)	37.30***	115	25.8% (0.216-0.299)	208	37.3% (0.333-0.411)	14.977***
Injuries	22 (2.2%)	17	4.0% (0.021-0.058)	5	0.9% (0.001-0.016)	10.91**	9	2.0% (0.008-0.035)	13	2.3% (0.011-0.036)	0.112

Note: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

Table Three. Logistic regression on medical outcomes

	Crude OR	**Controlled variables (Block I)**								**Adjusted OR (Block II)**
	Elder abuse	Age	Gender (male)	Substance use	Physical impairment	Cognitive impairment	Neuropsychiatric symptoms	Social network	Community service utilization	Elder abuse
Cardiovascular disease	2.045*** (1.564,2.674)	1.005 (0.986, 1.024)	0.829 (0.589, 1.168)	1.183 (0.809, 1.729)	1.139 (0.806, 1.609)	2.244*** (1.468, 3.429)	1.006 (0.972, 1.041)	1.005 (0.969, 1.043)	1.191 (0.906, 1.565)	2.049*** (1.551, 2.706)
Cerebrovascular disease	1.448* (1.053, 1.992)	0.985 (0.962, 1.008)	0.713 (0.467, 1.089)	1.202 (0.761, 1.898)	1.587* (1.044, 2.412)	2.137** (1.380, 3.311)	1.007 (0.966, 1.049)	1.026 (0.981, 1.072)	0.959 (0.685, 1.344)	1.309 (0.939, 1.826)
COPD	2.213*** (1.583, 3.093)	0.941*** (0.916, 0.966)	0.688 (0.430, 1.101)	0.928 (0.575, 1.499)	0.683 (0.454, 1.028)	1.160 (0.737, 1.825)	1.019 (0.977, 1.062)	1.014 (0.968, 1.064)	0.848 (0.592, 1.213)	1.782** (1.259, 2.522)
Peptic ulcer	2.254** (1.411, 3.602)	0.987 (0.954, 1.022)	1.283 (0.690, 2.385)	1.076 (0.548, 2.112)	1.636 (0.930, 2.879)	0.525 (0.252, 1.091)	0.981 (0.919, 1.048)	1.009 (0.947, 1.076)	0.991 (0.611, 1.606)	2.208** (1.362, 3.579)
Digestive disorders	2.686*** (1.902, 3.794)	0.943*** (0.918, 0.968)	0.723 (0.451, 1.158)	1.179 (0.723, 1.923)	0.747 (0.494, 1.130)	1.300 (0.824, 2.051)	1.025 (0.982, 1.069)	1.029 (0.981, 1.079)	1.181 (0.820, 1.700)	2.192*** (1.535, 3.130)
Chronic hepatic disease	1.436 (0.717, 2.877)	1.024 (0.974, 1.076)	1.253 (0.500, 3.141)	0.604 (0.221, 1.650)	1.916 (0.694, 5.290)	1.170 (0.401, 3.413)	0.932 (0.828, 1.049)	0.976 (0.884, 1.078)	0.511 (0.244, 1.069)	1.673 (0.806, 3.474)
Chronic prostate disease	1.436 (0.717, 2.877)	1.020 (0.990, 1.052)	0.836 (0.495, 1.414)	1.399 (0.775, 2.527)	2.111** (1.228, 3.626)	0.663 (0.348, 1.262)	1.024 (0.937, 1.077)	0.989 (0.933, 1.047)	0.843 (0.551, 1.291)	1.076 (0.702. 1.650)
Metabolic disease	4.479*** (3.356, 5.976)	1.003 (0.983, 1.023)	1.134 (0.798, 1.612)	0.748 (0.505, 1.109)	1.606*** (1.119, 2.304)	1.297 (0.854, 1.969)	1.002 (0.967, 1.038)	0.992 (0.955, 1.030)	0.925 (0.698, 1.227)	4.576*** (3.395, 6.167)
Acute inflammation	1.753** (1.262, 2.434)	1.029* (1.005, 1.054)	1.076 (0.703, 1.648)	0.884 (0.553, 1.413)	1.055 (0.683, 1.629)	0.885 (0.536, 1.462)	1.007 (0.964, 1.051)	1.025 (0.980, 1.073)	1.242 (0.880, 1.755)	1.923*** (1.366, 2.707)
Joint disease	0.654 (0.360, 1.187)	0.980 (0.940, 1.022)	1.074 (0.515, 2.239)	1.342 (0.577, 3.120)	1.008 (0.473, 2.151)	0.401 (0.133, 1.207)	0.915 (0.830, 1.010)	0..980 (0.903, 3.048)	0.604 (0.328, 1.112)	0.655 (0.353, 1.214)
Tumor	2.301*** (1.756, 3.014)	0.939*** (0.919, 0.960)	0.691 (0.471, 1.013)	0.780 (0.525, 1.160)	1.124 (0.797, 1.584)	1.368 (0.929, 2.015)	1.004 (0.968, 1.040)	1.007 (0.968, 1.047)	1.153 (0.859, 1.548)	1.848*** (1.390, 2.459)
Injuries	4.687** 716,12.808)	0.986 (0.924, 1.051)	1.206 (0.368, 3.947)	0.818 (0.236, 2.830)	1.350 (0.486, 3.751)	1.554 (0.530, 4.557)	1.041 (0.947, 1.145)	1.039 (0.926, 1.166)	0.918 (0.375, 2.249)	4.216*** (1.506,11.805)

Note: OR = odds ratio; Adjusted OR = odds ratio adjusting for all tested variables in the model (age, gender, substance abuse, physical disability, diagnosis of dementia, and neuropsychiatric symptoms); CI = confidence interval; COPD = Chronic obstructive pulmonary disease

Note: *p<0.05,**p<0.01,***p<0.001.