Is bullying victimisation in childhood associated with mental health in old age?

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There is no conflict of interest to declare.

Funding: None.

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Abstract

Objective: This study investigates the relationship between bullying victimization in childhood and mental health in old age.

Methods: The study uses data from a nationally representative sample of 9,208 older people aged 60 and over collected through the China Health and Retirement Longitudinal Study (CHARLS) conducted in 2014 and 2015.

Results: Older people who were bullied in childhood have more severe depressive symptoms and are more likely to be dissatisfied with life than those without the experience of bullying victimization. The negative impacts remain significant after childhood confounders (15 types of familial adversities), four groups of contemporary confounders (demographic, health, social support and socioeconomic factors), and community-level unobserved heterogeneity are all controlled for. The negative impacts of bullying victimization on mental health are attenuated among people in very old age, which confirms the socioemotional selectivity theory.

Discussion: The consequences of bullying victimization for mental health are comparable to, or even greater than those of familial adversities and contemporary risk factors. The factors threatening mental health vary considerably for older people in different age groups. Effective anti-bullying schemes in childhood and personalized support in later life can make a substantial contribution to healthy aging.

Keywords: Life-course perspective, healthy aging, depressive symptoms, life satisfaction, socioemotional selectivity theory

Introduction

Mental health is crucial for people to lead a fulfilling life. Sustained poor mental well-being reduces older people's quality of life and is a strong predictor of morbidity and mortality (World Health Organisation, 2013). Therefore, it is vitally important to have a systematic understanding of the determinants of mental health in the older population. Numerous studies have examined the contemporary predictors of mental health and well-being in old age. Previous research has identified that stressful events and experiences, such as a decline in functional capability and the onset of illnesses, are a direct and major cause of mental health problems (Williamson, 1998; Zeiss, Lewinsohn, Rohde, & Seeley, 1996). Social support networks constitute invaluable resources that older people can utilize to compensate for their loss of functional capability and buffer against the negative impacts of stressors on mental health. A systematic review conducted by Nyqvist, Forsman, Giuntoli, and Cattan (2013) showed that social support is positively associated with older people's life satisfaction, quality of life and happiness. Moreover, there are considerable socioeconomic inequalities in mental health. Older people's depressive symptoms are inversely associated with their income, wealth and educational qualifications (Kourouklis, Verropoulou, & Tsimbos, 2019; Lei, Sun, Strauss, Zhang, & Zhao, 2014).

Recently, increasing attention has been devoted to the linkage between childhood experience and healthy aging. The life-course perspective stresses that aging is a developmental process that spans a person's entire life (Stowe & Cooney, 2015). Experience, events and risk exposure in early life can have a profound impact that lingers for decades. Studies show that childhood adversities are associated with a number of undesirable health outcomes in old age, including depressive symptoms (Yang & Lou, 2016), anxiety (Draper et al., 2008), loneliness (Kamiya, Doyle, Henretta, & Timopen, 2014), poor physical health (Draper et al., 2008; Landes, Ardelt,

Vaillant, & Waldinger, 2014; Schafer & Ferraro, 2012; Shrira & Litwin, 2014), lower cognitive function (Brown, 2010), and work disability (Laditka & Laditka, 2019).

Most of the existing research, however, has focused on childhood adversities in the family or household setting, and very little is known about the impacts of adversities in the community or school setting. Yet adversities in the latter category are vitally important. School-age children spend a large proportion of their time outside the family socializing and interacting with peers. Repeated traumatizing experiences may have a long-lasting effect on their health trajectories in later life.

This study investigates the relationship between bullying victimization in childhood and mental health in old age. Bullying refers to repeatedly and intentionally hurtful behaviors against one individual by the peers (Schoeler, Duncan, Cecil, Ploubidis, & Pingault, 2018). Bullying behaviors arise out of a power imbalance, often take the form of verbal or physical aggression, and sometimes may also involve social exclusion. The experience of being bullied, especially during childhood, is a major contributing factor to mental health problems, with grave consequences such as self-harm behaviors and suicidal ideation, and the impacts can last for sustained periods of time after the victimization stops (Arseneault, Bowes, & Shakoor, 2010). Hence, it is important for gerontological research to establish whether the inter-temporal effect of bullying victimization dissipates or persists when people reach old age. Moreover, bullying victimization is a modifiable risk (Ttofi & Farrington, 2011). An investigation into its association with mental health in later life will further our understanding of possible intervention and prevention strategies to promote healthy aging.

Bullying victimization and mental health: the life course perspective

There are three competing models in the life-course theories to explain the linkage between childhood experience and health outcomes in later life: the latency model, the social trajectory

model, and the cumulative risk model (Berkman, Ertel, & Glymour, 2011; Hendricks, 2012). In the latency model, adverse childhood experience has a direct impact on later-life health outcomes, whereas, in the social trajectory model, the former indirectly affects the latter through other life outcomes. The cumulative risk model posits that the direct and indirect effects co-exist in the inter-temporal pathways. Based on the existing evidence, we argue that the relationship between bullying victimization in childhood and mental health in old age can be better understood by following the logic of the cumulative risk model.

Repeated exposure to adverse events or experiences in childhood prompts excessive activation and deactivation of the stress-management system in the body. This can lead to an unbalanced physiological state, result in 'wear and tear' on a child's brain, and over time impair its development, growth and even function (McEwen & Gianaros, 2011; McEwen & McEwen, 2017). There is a massive body of literature that examines the concurrent relationships between bullying victimization and mental health in childhood. A meta-analysis of 29 studies reported that children who experience bullying are more likely to suffer from depression (Ttofi, Farrington, Losel, & Loeber, 2011). This was later confirmed by another meta-analysis, which focused on quasi-experimental studies (Schoeler et al., 2018). In addition, a number of studies have found that bullying victimization is associated with anxiety, low self-esteem, self-harm behavior and suicide ideation (Fisher et al., 2012; Geel, Vedder, & Tanilon, 2014; Moore et al., 2017; Tsaousis, 2016).

There is mounting evidence that the direct impacts of bullying victimization on mental health persist into adulthood and midlife (Arseneault, 2017, 2018). Lund et al. (2008) found that people aged 31-51 who reported being bullied in childhood had an increased risk of diagnosed depression. Takizawa, Maughan, and Arsenault (2014) found that children who were bullied at the ages of 7 and 11 had an increased risk of depression at the age of 45 and lower levels of life satisfaction at the age of 50. These studies show that mental health issues caused by

bullying victimization are likely to turn into chronic problems and be difficult to reverse in later life. Hence, it seems reasonable to argue that the direct impact of bullying victimization may persist into old age.

Regarding the indirect effects, there is a growing consensus in the literature that the mental health problems caused by childhood adversities are accompanied by compromised self-regulation capacities and cognitive performance, which can result in a proliferation of other adversities later in life (McEwen & McEwen, 2017; Pearlin, 2010). So far, only a few studies have investigated the non-health consequences of bullying victimization. Wolke, Copeland, Angold, and Costello (2013) reported that being bullied in childhood is associated with an increased risk of dismissal from a job, quitting multiple jobs, living in poverty, poor financial management and poor social functioning in early adulthood. Brimblecombe et al. (2018) found that bullying victimization is associated with economic inactivity, lower weekly earnings and lower savings in midlife. Meanwhile, it has been well-documented that financial hardship in adulthood and midlife are associated with poor mental health in old age (Kahn & Pearlin, 2006). The implication is that bullying victimization in childhood may indirectly cause mental health problems in old age through its impacts on economic outcomes in adulthood and midlife.

In sum, bullying victimization may take effect through direct or indirect pathways. In both cases, the impacts can be highly damaging to people's mental health. Therefore, we propose the first hypothesis of this study as follows:

> H1: Older people who were bullied in childhood have poorer mental health than those who were not.

One feature that distinguishes old age from the other life stages in the life cycle is the perception of time. People are increasingly aware of the constraints of life as they age. The socioemotional selectivity theory posits that, with perceived limitations on time, older people reconsider their

life goals and priorities, and pay more attention to those with emotional meaning (Carstensen, Fung, & Charles, 2003). Appreciation for the fragility of life and the time left leads to better emotion regulation and stress-coping abilities. Studies have shown that older people enhance their mental well-being by focusing on positive and meaningful events in the present (Hicks, Trent, Davis, & King, 2012), distancing themselves from negative experiences in the past (Folkman, Lazarus, Pimley, & Novacek, 1987; Grossmann, Karasawa, Kan, & Kitayama, 2014), and forgiving those people who have previously offended them (Cheng & Yim, 2008).

The previous decades have seen a continuous demographic shift in the older population. People in very old age have been and are projected to be the most rapidly expanding sector of the population in developed and developing countries alike. Bullying victimization in childhood involves traumatizing experiences in the past caused by peer offenders. As people survive to very old age, their perception of time changes and ability to cope with childhood adversities improves. As a result, the impacts of bullying victimization on mental health are likely to alter with age as well. Compared to their younger counterparts, people in very old age should be more proficient in dispelling the negative effects of past unpleasant experiences, which leads us to the second hypothesis:

> H2: The negative associations between bullying victimization and mental health decrease among people in very old age.

Research methods

Data

This study uses data from the China Health and Retirement Longitudinal Survey (CHARLS). The survey adopts a multi-stage cluster sampling approach and by design is comparable to the Survey of Health, Ageing and Retirement in Europe (SHARE) and the Health and Retirement Study (HRS) in the US. The baseline survey took place in 2011 and collected health and aging-

related information from a nationally representative sample of 17,587 Chinese people aged 45 and over living in private households (Zhao et al., 2013). The two follow-up studies took place in 2013 and 2015, respectively. Those who died or were lost to follow-up in the 2013 or 2015 surveys were replaced with a refreshed sample. The life history survey that took place in 2014 collected information on experiences and events in childhood. All of those who participated in the 2011 or 2013 survey were contacted for interviews, among whom 77% participated in the life course survey (Ko & Yeung, 2018).

A total of 9,923 people aged 60 and over participated in the life history survey in 2014, among whom 2.4% (n=234) had died and 4.8% (n=481) were lost to follow-up in the third wave in 2015. The remaining 9,208 people are the focus of the analyses in this study. 99% of the people in our sample were born between the 1920s and 1950s. This was a period of time when China went through rapid educational modernization. Formal education provided by the government replaced private or informal education and was open to the public. The enrollment rate for primary education increased from 20% in the 1930s to more than 95% in the 1960s, and the average years of schooling of the population increased from 2 to 10. The long history of female exclusion from the education system came to an end. Gender equality in education was firmly established in the legislation (Gao, 2018).

Our initial analyses of the CHARLS sample show that: (1) the mortality rate of 2.4% calculated using the survey data is consistent with the official data; (2) bullying victimization in childhood is not associated with mortality or loss to follow-up in 2015; and (3) the demographic, social and economic profiles of older people in our sample are similar to those in the 2011 and 2013 surveys, which indicates that our sample is representative of the Chinese older population.

Key measurements

Mental health is a multifaceted construct. According to Headey, Kelley, and Wearing (1993), it consists of four dimensions: depression, life satisfaction, positive affect and anxiety. These dimensions may respond to bullying victimization differently and thus should be investigated separately in a study. The CHARLS collected information on the first two dimensions, namely depressive symptoms and life satisfaction, which are the focus of the analysis and the dependent variables in our study. Depressive symptoms are measured by the 10-item Centre for Epidemiologic Studies Depression Scale (CES-D). The CHARLS questionnaire asked participants to rate 10 statements on a four-point scale: 1=less than one day, 2=one to two days, 3=three to four days, and 4=five to seven days. There were eight negative statements (e.g. I felt fearful) and two positive statements (e.g. I felt hopeful). The positive statements were reverse scored. We added up the scores to create the depressive symptoms variable ranging from 10 (no symptoms) to 40 (severe symptoms). Psychometric analyses show that the 10-item CES-D Scale has good reliability and validity and is suitable to study the Chinese older population (Chen & Mui, 2014).

Life satisfaction is a single-item measure. 'Please think about your life as a whole. To what extent are you satisfied with it? Are you completely satisfied, very satisfied, somewhat satisfied, not very satisfied or not at all satisfied?' We created a dichotomized life satisfaction variable: 1=not very satisfied or not at all satisfied, and 0=completely, very and somewhat satisfied.

The key independent variable of interest is self-reported bullying victimization in childhood. The survey asked the participants to recall whether they were bullied by other kids in the neighborhood or in their school, respectively. For both questions, participants answered on a four-point scale: 1=often, 2=sometimes, 3=occasionally, and 4=never. We reverse scored the two items and combined them into one variable with four categories: 1=never bullied in the neighborhood or school, 2=occasionally bullied in either setting (excluding sometimes or often bullied), 3=sometimes bullied (excluding often bullied), and 4=often bullied in either setting.

This approach allowed us to examine the dose-response relationships between bullying victimization and mental health.

Control variables

We controlled for confounders of bullying victimization. The selection of the confounders followed the studies reviewed in the previous sections. We investigated both childhood and contemporary confounders. For the childhood confounders, we controlled for familial adversities. 15 familial adversities were identified in the life history questionnaire: (a) death of a parent; (b) parental divorce; (c) serious physical disability of a parent; (d) a bedridden parent; (e) a parent often feeling anxious; (f) a parent often feeling depressed; (g) a parent suffering from mental illness; (h) being physically abused by a parent; (i) parental alcohol abuse; (j) parental drug abuse; (k) a parent involved in criminal activities; (l) lack of affection from a parent; (m) neglect by a parent; (n) often witnessing domestic violence; and (o) being much poorer than other families. Based on the number of adversities reported by respondents, we created a variable with four categories: no adversities, one adversity, two adversities, and three or more adversities. The count variable is useful to capture the interaction effects between, and the cumulative effects of multiple familial adversities.

We controlled for four groups of contemporary confounders: demographic characteristics, physical health, perceived social support and socioeconomic status. We considered three demographic factors including age, gender and rural-urban residence. For physical health, we investigated functional limitations, self-reported health, and feeling pain. The CHARLS asked respondents whether they could perform six activities of daily living (ADLs; eating, dressing, bathing, using the toilet, continence, and getting in and out of bed) and six instrumental activities of daily (IADLs; cooking, shopping, making phone calls, taking medication, managing money and doing housework). Each item was measured on a four-point scale: 1=I

do not have difficulty, 2=I have difficulty but can do it, 3=I need help, and 4=I cannot do it. Adding up the scores, we created an ADL limitation variable and an IADL limitation variable, respectively. The ADL limitation variable ranges from 6 (no ADL limitations) to 24 (severe ADL limitations), and its Cronbach's alpha is 0.84. The IADL limitation variable ranges from 6 (no IADL limitations) to 24 (severe IADL limitations), and its Cronbach's alpha is 0.80. Self-reported health is a dichotomized variable: 0=very good, good and fair health, and 1=poor or very poor health. The CHARLS asked respondents whether they were often troubled with bodily pains. We created a dichotomized variable (0=no, 1=yes).

Regarding perceived social support, we investigated two variables including marital status and living arrangements. The marital status variable was dichotomized: 0=never married, separated, divorced or widowed, and 1=married. The living arrangements variable consisted of three categories: 0=living alone, 1=living with a spouse, and 2=living with other family members. For the socioeconomic variables, we investigated education, housing tenure, and household income per capita. The education variable consisted of three categories: 0=no education, 1=primary education, and 2=secondary education or above. Housing tenure was dichotomized: 0=owned housing, and 1=rented housing. Household income per capita was a continuous variable. We logarithmically transformed this variable so that it had an approximately normal distribution.

Statistical analysis

The CHARLS sample covers 480 rural villages/urban communities in 28 provinces. Different regions of China vary markedly in terms of economic development and social institutions. We built multilevel regression models to further control for community-level unobserved heterogeneity (Rabe-Hesketh & Skrondal, 2012). For the analyses of depressive symptoms and

life satisfaction, we built two-level linear regression models and two-level logistic regression models, respectively.

The variables with a noticeable proportion of missing values in our sample were depressive symptoms (16.7% of the sample), income (9.8%), housing tenure (9.5%), life satisfaction (7.5%), feeling pain (6.2%), self-reported health (6.2%), and bullying victimization (5.0%). We used the multiple imputation by chained equations (MICE) approach to simultaneously impute these variables (Van Buuren, Brand, Groothuis-Oudshoorn, & Rubin, 2006). Our analyses were based on five imputed datasets. The post-imputation diagnostics of the imputed datasets (Eddings & Marchenko, 2012) suggested that the imputed values were appropriate (see supplementary material).

To test the first hypothesis, we included childhood and contemporary confounders in the models one at a time, which could show us how the relationships between bullying victimization and mental health would change under alternative modeling specifications. Two approaches were used to test the second hypothesis. First, we stratified the sample by age group and conducted regression analyses for the sub-samples separately. Second, we included an interaction term between age and bullying victimization in the models to examine the moderating effect of age. The two approaches are based on different modeling assumptions and look at the same issue from slightly different angles. The extent to which the results corroborate each other shows the strength of the evidence supporting the hypothesis.

Results

Among the 9,208 older people in our sample, 25% (n=2,309) reported being bullied in childhood. Among the victims of bullying, 48% (n=1,099) were occasionally bullied, 35% (n=815) were sometimes bullied, and 17% (n=395) were often bullied. Univariate analyses show that the characteristics and life outcomes of the victims are drastically different from

those of the non-victims (table 1). The victims' average CED-S score is 20.0, which is significantly higher than older people with no victimization experience in childhood. 10.7% of the victims reported dissatisfaction with life. This is in contrast to 7.4% among the non-victims. 28.4% of the victims reported more than three familial adversities in childhood. In comparison, only 16.5% of the non-victims reported that this was the case. Bullying victimization is highly correlated with nearly all of the 15 types of familial adversities in childhood. The only exceptions are parental drug abuse and parental involvement in criminal activities (see supplementary material). The victims of bullying had a higher prevalence of poor health and more frequent bodily pain than the non-victims.

Bullying victimization is significantly associated with depressive symptoms and life satisfaction after we control for childhood confounders (table 2). For older people who were often bullied in childhood, their CES-D scores are 2.0 points ($p<0.001$) higher than the scores of older people who had never been bullied. Their odds of dissatisfaction with life are 2.2 times ($p<0.001$) higher than the odds of non-victims. When we add contemporary confounders to the regression models, the coefficients and odds ratios of the bullying victimization variable decrease slightly but remain highly statistically significant. For victims of frequent bullying, their CES-D scores are 1.3 points ($p<0.001$) higher than those of non-victims, and their odds of dissatisfaction with life are 2.0 times larger.

Moreover, the negative impacts of bullying victimization increase as the exposure intensifies. For people who were often bullied as a child, their odds of dissatisfaction with life are 1.6 times larger than those who experienced occasional victimization (i.e. 1.6=1.95/1.25, p-value=0.024). The effect size of frequent bullying victimization is comparable to, or even larger than that of two familial adversities.

Older people reporting more familial adversities had more severe depressive symptoms and were more likely to be dissatisfied with life. All of the variables relating to health conditions are significantly associated with older people's mental health. Both depressive symptoms and life satisfaction improve significantly with older people's age. Higher income is significantly associated with better mental health. The F-tests show that the level-2 random effects are statistically significant, confirming the importance of multilevel models to capture unobserved heterogeneity in this study.

For older people aged 60-79, bullying victimization in childhood is significantly associated with more severe depressive symptoms (column 2, table 3). In contrast, the relationship between the two variables is not statistically significant among older people aged 80 and over (column 3). The relationships between bullying victimization and life satisfaction show a similar pattern, although the negative association starts to dissipate for people at a younger age. For older people aged 60-69, bullying victimization is significantly associated with dissatisfaction with life. However, the relationship is not statistically significant among older people aged 70 and over (column 5). For older people in the higher age groups, although bullying victimization no longer has a significant impact, most of the physical health variables remain significant predictors of mental health.

Table 4 shows the results of the regression models that include an interaction term between bullying victimization and age. The main effect of bullying victimization on mental health is statistically significant, which is consistent with the results in table 2. For people aged 70 and over, the negative impact of bullying victimization on depressive symptoms remains significant (coefficient=1.09, p-value<0.001), which is consistent with the results in table 3. The interaction effect is not statistically significant. In the life satisfaction model, in comparison, the interaction term is statistically significant (coefficient=0.66, p-value<0.05), which means that age moderates the relationship between bullying victimization and life satisfaction. The

negative impact of bullying victimization on life satisfaction is significantly weakened for people aged 70 and over.

Discussion and Conclusion

Using a nationally representative sample of Chinese older people, this study investigated the relationships between bullying victimization in childhood and mental health in old age. The research findings confirmed the two hypotheses of the study. First, older people who were bullied in childhood have poorer mental health, which is reflected in more severe depressive symptoms and dissatisfaction with life. Studies have reported that bullying victimization has a long-lasting effect on mental health that can persist until early adulthood or mid-life (Arseneault, 2017, 2018; Lund et al., 2008; Takizawa et al., 2014). Our analyses show that the negative impacts remain highly salient when people reach old age. The 'long-arm' of bullying victimization can follow the victims throughout their lifespan.

Most of the gerontological studies that have taken a life-course perspective have reported that familial adversities in childhood undermine healthy aging (Draper et al., 2008; Kamiya et al., 2014; Landes et al., 2014; Schafer & Ferraro, 2012; Shrira & Litwin, 2014), which is consistent with our research findings from the perspective of mental health. Our study extends the existing knowledge by showing that bullying victimization by peers, an adversity experienced in the community or school setting, is equally damaging to mental health.

Although bullying victimization is highly correlated with other predictors of mental health such as familial adversities in childhood and a wide range of life outcomes in old age, its association with mental health remains strong after these confounders and community-level unobserved heterogeneity are all controlled for, which indicates an independent negative effect of bullying victimization on mental health. Moreover, the significant role of bullying victimization is manifested in both the presence and the magnitude of the impact. Frequent bullying

victimization has an impact on depressive symptoms comparable to that of two or more familial adversities. Even more remarkable is that frequent bullying victimization, a traumatizing experience traced back to several decades ago, has an impact on life satisfaction that is larger than that of many contemporary risk factors such as functional disability, living alone and lower educational qualifications.

Regarding the second hypothesis, we have found strong evidence that the negative impacts of bullying victimization on life satisfaction are weakened for people aged 70 and over. The two approaches (i.e. sub-group analysis and moderation analysis) based on different assumptions point to the same conclusions. For depressive symptoms, bullying victimization is a significant predictor among older people aged 60-79, but does not make a significant difference among those aged 80 and over. Different timings in the dissipation of negative impacts lend support to Headey et al.'s (1993) conceptualization that depressive symptoms and life satisfaction are two distinct dimensions of mental health. Depressive symptoms reflect people's emotional responses, whereas life satisfaction is a cognitive appraisal of one's current circumstances, relative to certain standards such as expectations. Victims at a certain age may no longer feel dissatisfied with life, but they continue to have more severe depressive symptoms than non-victims. Nonetheless, our findings are fairly consistent with the prediction of the socioemotional selectivity theory (Carstensen et al., 2003; Cheng & Yim, 2008; Folkman et al., 1987; Grossmann et al., 2014). With an acute awareness of time limitations, people in very old age may have forgiven people who offended them in the past or prefer to reappraise unpleasant experiences in childhood more positively. It seems that better emotion regulation and stress-coping abilities allow them to reach reconciliation with childhood adversities.

People in very old age are not entirely free of mental health problems. They are less affected by childhood adversities, but poor physical health continues to be a major threat. Indeed, our study shows that, for people aged 80 and over, functional capabilities and health conditions are

the only statistically significant factors associated with mental health. Such a result highlights the great variations in the risk factors of mental health among people in different age groups. The implications are twofold. First, a country's welfare system should be sufficiently flexible to suit the great diversity of needs in the older population. Although financial, emotional, and social support are indispensable for older people in all age groups, high-quality healthcare and long-term care services seem especially important to the mental health and well-being of people in very old age. Second, people in very old age have been the fastest growing group in many countries. At the population level, programs and services that help to delay the onset or progression of disability or morbidity in old age are bound to play an increasingly significant role in tackling mental health and improving people's overall quality of life in the future.

Being bullied in childhood is a highly stressful experience. At present, the worldwide prevalence of bullying victimization among children aged 11 to 15 years old is estimated to be 13% (Schoeler et al., 2018). In a national survey conducted in 2013, 20% of high school youths in the US reported being bullied in the last 12 months (Hatzenbuehler, Schwab-Reese, Ranapurwala, Hertz, & Ramirez, 2015). Cyberbullying, which involves aggressive and hostile messages repeatedly and intentionally sent through electronic media and extends beyond the school or community setting, has further escalated these problems. In extreme cases, bullying and cyberbullying may lead to devastating consequences such as suicide or attempted suicide (Hinduja & Patchin, 2010).

The damage caused by bullying victimization to individuals, families and society calls for an urgent and rigorous response from the public and governments. Anti-bullying programs such as parent meetings, firm disciplinary methods and improved playground supervision are effective in preventing and reducing victimization, and some of these can be implemented at a low cost (Ttofi & Farrington, 2011). Childhood is a sensitive period. The research findings of this study provide further evidence that interventions targeting this life stage are critical to the

health and well-being of older people. Well-designed anti-bullying and education policies not only protect children's well-being and opportunities for development, but also have great potential to alter people's life-long trajectories in terms of mental health for the better and help them lay a good foundation for healthy and successful aging. Moreover, a decrease in bullying victimization in childhood would lead to a parallel reduction in the demand for mental health services in later life. The resources released would then be available for other support and services for the older population.

Three limitations of this study should be recognized. Like other studies that have examined childhood adversities and healthy aging, our analysis is based on retrospective information and may be affected by recall bias. The measurement of bullying victimization relies on self-reported information, and there is no further data available to verify these reports. Fortunately, Rivers (2001) found that people's memory of bullying victimization is stable and reliable over time and concluded that such information is useful in retrospective research. Moreover, an investigation into the SHARE dataset, the European counterpart of the CHARLS dataset, concluded that older people can remember their experiences and living conditions in childhood well (Havari & Mazzonna, 2015). It seems that recall bias does not constitute a major threat to the validity of our research findings, although we do acknowledge that older people's recollection of certain familial adversities such as parental anxiety or depression may be subjective.

Another limitation of the study is that we were not able to control for people's behavioral problems in childhood and genetic factors that might confound the relationship between bullying victimization and mental health in the regression analysis. This limits our ability to interpret the relationships reported in this study as causality. Finally, the existing data do not allow us to investigate the cohort effects. Future research that focuses on the extent to which social and historical contexts affect the mental health of older people in different cohorts would

be highly valuable.

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Table 1 Sample characteristics and univariate analysis

	Entire sample	Never bullied	Occasionally, sometimes or often bullied	Univariate analysis
Depressive symptoms	18.9	18.5	20.0	t=9.4***
Life satisfaction				
Satisfied	91.8%	92.6%	89.3%	
Not satisfied	8.2%	7.4%	10.7%	F=20.2***
Familial adversities				
No adversity	30.4%	32.9%	21.0%	
1 adversity	29.2%	30.3%	26.6%	
2 adversities	21.1%	20.4%	24.0%	
3+ adversities	19.3%	16.5%	28.4%	F=72.3***
Age	68.7	68.9	67.8	t=-6.1***
Gender				
Male	49.0%	45.8%	58.8%	
Female	51.0%	54.2%	41.2%	F=113.8***
Rural-urban residence				
Urban areas	27.0%	27.4%	25.8%	
Rural areas	73.0%	72.6%	74.2%	F=2.1
ADL score	6.91	6.87	6.93	t=0.93
IADL score	8.16	8.17	7.94	t=-2.26*
Health				
(Very) good or fair	68.8%	70.0%	65.5%	
(Very) poor	31.2%	30.0%	34.5%	F=14.8***
Often feel pain				
No	66.1%	67.9%	60.9%	
Yes	33.9%	32.1%	39.1%	F=34.9***
Marital status				
Single, separated, widowed or divorced	21.5%	21.8%	19.6%	
Married	78.5%	78.2%	80.4%	F=5.2*
Living arrangements				
Living alone	10.7%	10.8%	9.8%	
With a spouse	75.7%	75.7%	76.5%	
With other relatives	13.6%	13.5%	13.7%	F=1.0
Education				
No education	30.3%	32.5%	23.0%	
Primary education	45.7%	44.2%	50.9%	
Secondary education or above	24.0%	23.4%	26.1%	F=35.6***
Housing tenure				
Owned housing	83.3%	83.1%	83.7%	
Rented housing	16.7%	16.9%	16.3%	F=0.37
Logarithm of income (¥)	8.29	8.30	8.26	t=-0.56
Sample size	9,208	6,899	2,309	

Note:*p<0.05, **p<0.01, ***p<0.001; results based on five multiply imputed datasets

Table 2 The impacts of bullying victimisation in childhood on mental health in old age

	Depressive symptoms		Life satisfaction	
	Two-level linear regression models		Two-level logistic regression models	
	Childhood confounders	Childhood & contemporary confounders	Childhood confounders	Childhood & contemporary confounders
	Coefficient (standard error)		Odds ratio (standard error)	
Bullying victimisation in childhood				
Never (ref.)	0.00	0.00	1.00	1.00
Occasionally	0.40 (0.23)	0.79*** (0.19)	1.14 (0.14)	1.25 (0.16)
Sometimes	1.43*** (0.27)	1.24*** (0.23)	1.28 (0.20)	1.24 (0.21)
Often	2.04*** (0.38)	1.31*** (0.29)	2.24*** (0.35)	1.95*** (0.33)
Familial adversities in childhood				
No adversity (ref.)	0.00	0.00	1.00	1.00
1 adversity	0.60** (0.19)	0.55** (0.17)	1.02 (0.12)	1.00 (0.12)
2 adversities	1.50*** (0.20)	1.16*** (0.17)	1.19 (0.15)	1.12 (0.15)
3+ adversities	2.58*** (0.21)	1.74*** (0.17)	1.74*** (0.21)	1.51*** (0.19)
Age		-0.04*** (0.01)		0.97*** (0.01)
Gender				
Male (ref.)		0.00		1.00
Female		1.15*** (0.14)		1.04 (0.10)
Rural-urban residence				
Urban areas (ref.)		0.00		1.00
Rural areas		0.78*** (0.16)		0.88 (0.10)
ADL score		2.30*** (0.22)		1.22 (0.18)
IADL score		1.66*** (0.16)		1.59*** (0.14)
Health				
Good or fair (ref.)		0.00		1.00
Poor		2.51*** (0.15)		2.32*** (0.22)
Often feel pain				
No (ref.)		0.00		1.00
Yes		3.86*** (0.16)		1.91*** (0.18)
Marital status				
Single (ref.)		0.00		1.00
Married		0.39 (0.39)		0.45** (0.14)
Living arrangements				
Living alone (ref.)				1.00
With a spouse		-1.27*** (0.38)		1.08 (0.33)
With others		0.05 (0.26)		0.70* (0.11)
Education				
No education (ref.)		0.00		1.00
Primary education		-0.07 (0.17)		0.95 (0.1)
Secondary education or above		-0.63** (0.20)		0.71* (0.11)
Housing tenure				
Owned housing (ref.)		0.00		1.00
Rented housing		0.09 (0.16)		0.89 (0.12)
Income		-0.09*** (0.02)		0.95** (0.01)
Joint significance test	F=41.3***	F=200.1***	F=11.8***	F=21.5***
Test of level-2 random effects	F=243.1***	F=80.6***	F=11.3**	F=8.9**
Sample size	9,208		9,208	

Note:*p<0.05, **p<0.01, ***p<0.001; results based on five multiply imputed datasets

Table 3 The impacts of bullying victimisation: stratification by age groups

	Depressive symptoms		Life satisfaction	
	Two-level linear regression models		Two-level logistic regression models	
	60-79 years old	80+ years old	60-69 years old	70+ years old
	Coefficient (standard error)		Odds ratio (standard error)	
Bullying victimisation in childhood				
Never (ref.)	0.00	0.00	1.00	1.00
Occasionally	0.79*** (0.19)	1.08 (0.88)	1.56** (0.26)	0.80 (0.20)
Sometimes	1.27*** (0.22)	1.21 (1.31)	1.30 (0.25)	1.22 (0.36)
Often	1.27*** (0.31)	1.69 (1.25)	2.35*** (0.46)	1.38 (0.48)
Familial adversities in childhood				
No adversity (ref.)	0.00	0.00	1.00	1.00
1 adversity	0.52** (0.18)	0.58 (0.52)	1.02 (0.16)	0.98 (0.19)
2 adversities	1.16*** (0.18)	0.98 (0.7)	1.06 (0.17)	1.23 (0.25)
3+ adversities	1.77*** (0.19)	1.23 (0.69)	1.53** (0.24)	1.55* (0.34)
Gender				
Male (ref.)	0.00	0.00	1.00	1.00
Female	1.18*** (0.14)	1.48 (0.78)	1.07 (0.13)	1.08 (0.17)
Rural-urban residence				
Urban areas (ref.)	0.00	0.00	1.00	1.00
Rural areas	0.83*** (0.16)	0.31 (0.77)	0.97 (0.15)	0.78 (0.15)
ADL score	2.23*** (0.26)	2.51*** (0.51)	1.15 (0.24)	1.26 (0.23)
IADL score	1.76*** (0.17)	1.20** (0.39)	1.52*** (0.19)	1.57*** (0.19)
Health				
Good or fair (ref.)	0.00	0.00	1.00	1.00
Poor	2.50*** (0.16)	2.40*** (0.60)	2.46*** (0.3)	2.30*** (0.39)
Often feel pain				
No (ref.)	0.00	0.00	1.00	1.00
Yes	3.92*** (0.16)	3.13*** (0.63)	1.90*** (0.23)	1.94*** (0.30)
Marital status				
Single (ref.)	0.00	0.00	1.00	1.00
Married	0.41 (0.38)	3.23 (3.51)	0.46* (0.15)	0.23 (0.24)
Living arrangements				
Living alone (ref.)	0.00	0.00	1.00	1.00
With a spouse	-1.35*** (0.39)	-3.54 (3.44)	0.99 (0.33)	0.23 (0.24)
With others	-0.10 (0.29)	0.68 (0.59)	0.85 (0.19)	0.23 (0.24)
Education				
No education (ref.)	0.00	0.00	1.00	1.00
Primary education	-0.08 (0.17)	0.09 (0.84)	0.97 (0.13)	0.92 (0.17)
Secondary education or above	-0.55** (0.20)	-1.33 (0.95)	0.73 (0.14)	0.70 (0.18)
Housing tenure				
Owned housing (ref.)	0.00	0.00	1.00	1.00
Rented housing	0.002 (0.17)	0.41 (0.52)	0.86 (0.15)	0.85 (0.16)
Income	-0.09*** (0.03)	-0.18 (0.10)	0.95** (0.02)	0.95 (0.03)
Joint significance test	F=198.3***	F=15.7***	F=15.2***	F=8.9***
Test of level-2 random effects	F=92.5***	n.a.	F=10.5**	F=1.48
Sample size	8,387	821	5,697	3,511

Note:*p<0.05, **p<0.01, ***p<0.001; results based on five multiply imputed datasets

Table 4 The impacts of bullying victimisation: regression analysis with an interaction term

	Depressive symptoms	Life satisfaction
	Two-level linear regression	Two-level logistic regression
	Coefficient (standard error)	Odds ratio (standard error)
Main effect		
Bullying victimisation		
No (ref.)	0.00	1.00
Yes	1.02*** (0.17)	1.60*** (0.19)
Age		
60-69 years old (ref.)	0.00	1.00
70+ years old	-0.52*** (0.15)	0.81 (0.09)
Interaction effect		
Bullying × Age	0.07 (0.32)	0.66* (0.14)
Control variables		
Familial adversities		
No adversity (ref.)	0.00	1.00
1 adversity	0.55** (0.17)	1.01 (0.12)
2 adversities	1.17*** (0.17)	1.14 (0.15)
3+ adversities	1.78*** (0.17)	1.57*** (0.2)
Gender		
Male (ref.)	0.00	1.00
Female	1.19*** (0.15)	1.06 (0.10)
Rural-urban residence		
Urban areas (ref.)	0.00	1.00
Rural areas	0.79*** (0.16)	0.89 (0.1)
ADL score	2.30*** (0.22)	1.23 (0.18)
IADL score	1.61*** (0.16)	1.52*** (0.13)
Health		
(Very) good or fair (ref.)	0.00	1.00
(Very) poor	2.53*** (0.15)	2.36*** (0.22)
Often feel pain		
No (ref.)	0.00	1.00
Yes	3.87*** (0.16)	1.92*** (0.18)
Marital status		
Single, separated, widowed or divorced (ref.)	0.00	1.00
Married	0.49 (0.39)	0.50* (0.15)
Living arrangements		
Living alone (ref.)	0.00	1.00
With a spouse	-1.29*** (0.38)	1.08 (0.32)
With other relatives	0.05 (0.26)	0.70* (0.11)
Education		
No education (ref.)	0.00	1.00
Primary education	-0.05 (0.18)	0.96 (0.11)
Secondary education or above	-0.58** (0.20)	0.73* (0.11)
Housing tenure		
Owned housing (ref.)	0.00	1.00
Rented housing	0.07 (0.16)	0.87 (0.12)
Income	-0.10*** (0.02)	0.95*** (0.01)
Joint significance test	F=208.4***	F=22.5***
Level-2 random effects	F=80.8***	F=8.7***
Sample size	9,208	9,208

Note:*p<0.05, **p<0.01, ***p<0.001; results based on five multiply imputed datasets.

Supplementary material

Table A1 Post-imputation diagnostics

		Observed data	Observed & imputed data	% missing
		Proportions or means (standard error)		
Depressive symptoms		18.5 (0.075)	18.9 (0.074)	16.7%
Logarithm of income		8.3 (0.027)	8.4 (0.027)	9.8%
Housing tenure	Owned housing	83.4%	83.3%	
	Rented housing	16.6%	16.7%	9.5%
Life satisfaction	Satisfied	92.3%	91.8%	
	Not satisfied	7.7%	8.2%	7.5%
Frequent bodily pain	No	67.0%	66.1%	
	Yes	33.0%	33.9%	6.2%
Self-reported health	(Very) good or fair	69.9%	68.8%	
	(Very) poor	30.1%	31.1%	6.2%
Bullying victimisation	Never	74.8%	74.9%	
	Occasionally	12.0%	11.9%	
	Sometimes	8.9%	8.9%	
	Often	4.3%	4.3%	5.0%
Sample size			9,208	