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The impact of community services usage on geriatric depression: a ten-year follow-up study

Xiaowen Li¹, Yuanqing He^{2*}, Shuhu Chen³ and Jun Zhang¹

Abstract

Background This study explores whether the impact of environmental factors (community services usage, CSU) on geriatric depression is mediated by psychological resilience and moderated by the COMT (catechol-O-methyltransferase) gene val158met polymorphism.

Methods The data consists of 13,512 entries from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) collected in the years 2008, 2011, 2014, and 2018. The study employed a Random Intercept Cross-Lagged Panel Model (RI-CLPM) to examine the relationship between CSU and geriatric depression, including the mediating effect of psychological resilience and the moderating role of the comt gene val158met gene polymorphism in this relationship.

Results Lower CSU at earlier assessments were significantly associated with more severe geriatric depression in subsequent evaluations. Psychological resilience was found to partially mediate the relationship between CSU and depression. Differential impacts were observed among various gene genotypes; specifically, the val genotype demonstrated a significantly greater influence of CSU on subsequent psychological resilience and on subsequent depression compared to the met genotype.

Conclusion Enhancement in CSU can predict subsequent geriatric depression. The relationship between the CSU and depression can be mediated by psychological resilience, with genetics modulating the pathway from CSU through psychological resilience to depression. Multidisciplinary interventions focused on enhancing community service quality, boosting psychological resilience, and mitigating depression are likely to benefit the older adults's emotional and psychological well-being.

Keywords Community services usage, Psychological resilience, Geriatric depression, Random intercept cross-lagged panel model, Older adults

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Introduction

Geriatric depression encompasses depressive disorders that emerge or prevail in old age (i.e., 60 years and older), representing a widespread mental health concern among the older adults. It results in diminished physical functionality, lower quality of life, elevated suicide risk, and increased mortality rates [1–4]. Concurrently, it exerts a considerable disease burden and financial strain on families and society [5–7].

As a critical strategy for managing aging populations, community service has garnered increasing attention and seen rapid development globally [8]. Community service for the older adults encompasses a range of services offered by the community, such as life care and health care [9]. According to the main-effect model, support and services for the older adults directly bolster their subjective well-being and diminish depression levels [10]. Specifically, community-based services provide the older adults with opportunities to engage with their communities, thus mitigating the potential adverse effects of social isolation on psychological health [11]. Furthermore, Park et al.'s study showed that regular attendance at senior centers is significantly correlated with fewer depression symptoms among the older adults, highlighting these centers' role as vital community resources for social and emotional support [12]. Empirical research suggests that community services usage (CSU) act as a protective factor against depression among China's older adults, effectively mitigating cognitive decline and improving mental health [13].

In China, the aging population and changes in family structures have made it increasingly difficult for families to provide adequate support for the older adults. At the same time, the high cost of institutional services makes it difficult for many elderly people to access these services, leading to a decreased likelihood of opting for institutional care [14]. Therefore, community-based services are particularly important. Community services provide a variety of support for the older adults to meet their health, social, and daily living needs. These services include, but are not limited to, home care services, health consulting, cultural and recreational activities, legal aid, and psychological support [15]. The CSU among older adults in China is quite common. With the rapid development of China's aging society, both government and non-governmental organizations are actively promoting these services to address the challenges brought by the growth of the elderly population. Studies show that an increasing number of older adults rely on these community services to improve their social participation and overall well-being [16]. However, although the supply of services is increasing, there is still an imbalance in the accessibility and quality of these services. Older adults in some regions may have difficulty accessing these services

due to remote geographical locations or economic constraints [17]. Currently, there is relatively little research on the relationship between CSU and geriatric depression, and studies often use cross-sectional data, facing the issue of being unable to distinguish between correlations among variables and individual differences, which may lead to an unreasonable evaluation of the relationship [18]. Therefore, this study aims to investigate the longitudinal link between CSU and geriatric depression, with a focus on exploring the potential mechanisms that could expand our knowledge in this field.

Recently, academic interest has grown in the impact of psychological resilience on older adults lives [8]. Psychological resilience is the ability to adapt to life changes and environmental stressors, considered a key protective mechanism [19]. In essence, highly resilient elderly individuals adapt and cope better with life changes, leading to a higher quality of life and less depression. Specifically, older adults with high psychological resilience may use their psychological strengths to overcome adversity and attain well-being [20]. Older adults with strong psychological resilience often have higher self-esteem and confidence, enabling them to foster and use interpersonal relationships, thus reducing depression levels [8]. However, most prior research on psychological resilience's impact on mental health has focused on children and adolescents, with fewer studies involving the older adults. CSU can enhance the older adults's sense of community, promoting psychological resilience. These services also establish social connections, boost intrinsic motivation, and improve older adults psychological resilience [21]. At the same time, community-based services play a crucial role in enriching the lives of the older adults by alleviating feelings of helplessness, reducing social isolation, and enhancing their psychological resilience. These services not only meet their immediate needs but also contribute to the development of social capabilities [22].

Psychological resilience is theoretically divided into state resilience and trait resilience. Trait resilience is a stable personal characteristic that influences a person's consistent coping methods across various adversities encountered throughout life [23]. In contrast, state resilience is more situational and refers to the resilience an individual demonstrates in response to specific adversities [19]. For the older adults, since personality traits are relatively stable in the later stages of life, trait resilience may be well-developed and form a fixed pattern throughout their life [24]. Therefore, the trait resilience of the older adults may not change much, whereas state resilience is more crucial as it relates to whether the older adults can effectively cope with sudden health issues, changes in living environments, or the loss of interpersonal relationships. Thus, this study uses the level of state resilience to represent psychological resilience. Despite

studies on the positive effects of CSU on psychological resilience and its relation to depression, in-depth analysis of psychological resilience's mediating role in the CSU-depression relationship among China's older adults is lacking.

Behavioral genetics research indicates that depression significantly stems from genetic factors, with heritability rates ranging from 24 to 55% [25]. The integration of molecular genetics techniques with traditional psychological research methods to explore the gene-environment interaction in depression susceptibility is a prominent and burgeoning research area [26]. The COMT (catechol-O-methyltransferase) gene is a significant candidate gene implicated in depression [27, 28]. The COMT gene, situated on the long arm of chromosome 22 at 22q11.2, functions as a primary metabolic enzyme for catecholamines such as adrenaline, noradrenaline, and dopamine. At least eight single nucleotide polymorphisms exist in this gene's coding region, with the val158met polymorphism (rs4680) being the most prevalent functional variant, whereby the val allele's COMT enzyme activity is 3 to 4 times that of the met allele [29]. Current research has explored the interaction between the COMT gene's val158met polymorphism and social environment in affecting depression, yet findings are still inconclusive. The social salience hypothesis may shed light on these varying findings. It suggests that oxytocin enhances individual sensitivity and response to social environments [30]. Shamay-Tsoory and Abu-Akel further detailed the neurophysiological mechanisms of oxytocin's effect on social salience, specifically its interaction with the dopaminergic system in modulating environmental sensitivity [31]. While the COMT gene does not directly alter oxytocin levels, it can impact the oxytocinergic system by modulating oxytocin receptors' quantity, arrangement, and function, thus influencing environmental sensitivity [32]. fMRI studies indicate that the COMT gene regulates individual sensitivity to environmental stimuli by affecting the hypothalamus and amygdala's functional coupling, influencing social emotions and behaviors [33]. Drawing on the social salience hypothesis and fMRI evidence, this study hypothesizes that the COMT gene's expression may serve as a protective or risk factor, contingent upon the individual's social environment, suggesting a gene-environment interaction.

Given this, the present study uses longitudinal data to discuss the relationship between the environment factors (CSU) and geriatric depression. It also examines whether psychological resilience can mediate the relationship between CSU and geriatric depression to some extent, and whether this relationship varies with individual genotype differences.

Method

Data and sample

The data for this study are derived from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which represents the most comprehensive and extensive cohort dataset on the older adults in China [34]. The survey has been conducted by the Center for Healthy Aging and Development Studies and the National Development Research Institute of Peking University since 1998, covering all provinces, autonomous regions, and municipalities directly under the Central Government in China, except for Hong Kong and Macau. The Peking University Institutional Review Board approved the human subject protections in CLHLS (Clinical Trial Number: IRB00001052-13074), and written informed consent was obtained from all individuals participating in the study.

Data collection in the CLHLS is typically conducted through face-to-face interviews involving extensive, structured questionnaires, primarily based on self-reports. Participants usually respond to questions guided by trained interviewers. Interviewers receive training on the survey tools and techniques, interviewing skills, and handling sensitive issues before the survey commences. Their role is not only to collect data but also to ensure adherence to ethical standards, respecting the privacy and voluntariness of the participants.

This study utilized data from four waves: 2008 ($n=4413$), 2011 ($n=3837$), 2014 ($n=3154$), and 2018 ($n=2108$), with a participant attrition rate of 52.23%. High attrition rates are common in longitudinal studies, but they are particularly pronounced in this study due to multiple reasons. Firstly, the demographic focus on the older adults means that natural factors such as morbidity and mortality significantly impact participant retention. As older adults are more susceptible to health issues and death, longitudinal studies involving this group inherently face higher dropout rates [35]. Moreover, logistical challenges amplify attrition rates in the CLHLS. Issues such as participants moving without notifying researchers, changes in contact information, and the logistical difficulties of tracking individuals across vast and often rural areas contribute to the loss of participants over time. Such challenges are particularly acute in large-scale studies spanning extensive geographical areas [36]. Participant burden also plays a critical role in the high attrition rates observed in the CLHLS. The frequency and invasiveness of the assessments can deter ongoing participation, particularly if the perceived burden outweighs the perceived benefits of participating in the study [37, 38].

The genetic data were derived from the genotype data of the 2008 cohort, produced by genotyping DNA samples of CLHLS participants in the laboratory of the Institute of Molecular Medicine at Peking University.

Analysis of the genotype data, including quality control procedures, single SNP association analysis, genotype association analysis, linkage disequilibrium, and haplotype association analysis, is introduced in section M2 of the methods in reference 41 and is not repeated here [39].

Measurement

CLHLS measures CSU by asking respondents whether their communities provide the following social services: personal daily care, daily shopping, home visits, psychological counseling, health education, neighborhood relations, social and recreational activities, and human rights consulting services. According to previous research [11], if the community provides one social service, community service is coded as 1; if not, it is coded as 0. To assess the availability of CSU, scores from all eight items are summed, resulting in a score ranging from 0 to 8.

The assessment of psychological resilience utilized a 5-item Chinese scale adapted by Shen and Zeng, which has demonstrated strong reliability and validity in measuring psychological resilience among the older adults in China [40]. The scale includes five items: 1. Do you always see the bright side of things? 2. Do you feel that as you get older, you become more useless and have difficulty doing things? 3. Do you often feel lonely and isolated? 4. Do you often feel fearful or anxious? 5. Are you able to make your own decisions regarding your personal affairs? Answers are assessed using a five-point Likert scale (1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always). Items 2, 3, and 4 are scored in reverse. The total score reflects the level of psychological resilience, with a range of 5–25; higher scores indicate better psychological resilience. In this study, the Cronbach's alpha coefficient was 0.89.

The assessment of geriatric depression utilized a shortened Chinese version of the 9-item Center for Epidemiologic Studies Depression Scale (CES-D). Responses were recorded using a 4-point Likert scale. This scale has been widely used in multiple studies and has been well validated for measuring depression among the older adults in China [41, 42]. To enhance interpretability, reverse scoring techniques were applied, meaning higher cumulative scores indicate increased severity of depression symptoms. In this study, the Cronbach's alpha coefficient was 0.94.

Control variables

To minimize the potential influence of other variables on the relationship between CSU, psychological resilience, and geriatric depression, covariates related to depression were controlled based on baseline data from previous studies [43]. First, demographic covariates included age, gender, and education level. Then, lifestyle covariates comprised physical exercise, current smoking status, and current drinking status. Respondents were asked whether they regularly engage in physical exercise (1=yes; 2=no), currently smoke (1=yes; 2=no), and drink alcohol (1=yes; 2=no). Interpersonal relationship covariates included marital status (1=never married, separated, divorced, or widowed; 0=married), living arrangements (1=living alone; 0=with family members or in an institution), and social activities. Social activities were assessed by asking, "Do you currently participate in any social activities?" with responses ranging from 1 (almost every day) to 5 (never). In addition, the difficulty of performing six activities of daily living (dressing, walking, bathing, eating, getting in and out of bed, and using the toilet) was assessed by asking participants to indicate any difficulties they experience while performing these activities.

Date analyses

The Cross-Lagged Panel Model (CLPM) has traditionally been used as a standard method to investigate the causal influences between variables in longitudinal panel data. However, CLPM only accounts for the time stability of variables and does not adequately consider time-invariant individual differences, which can lead to biased estimates [44]. To address this issue, the Random Intercept Cross-Lagged Panel Model (RI-CLPM) has been proposed. Specific descriptions are available in [supplementary materials](#).

Longitudinal measurement invariance is a prerequisite for modeling changes over time. Using measurement invariance testing, confirmatory factor analysis (CFA) found that our proposed community service construct maintained invariance over time in terms of factor loadings and intercepts across these waves, thus meeting the requirements for strong measurement invariance. The scalar longitudinal invariance model for community service allows for correlations between the same parcels' residual variances and imposes invariance constraints on factor loadings and intercepts across four time points. Additionally, the CFA for the depression scale also demonstrated scalar longitudinal invariance, indicating that longitudinal cross-lagged analysis can be conducted between depression and community service. Our RI-CLPM primarily involves the comparison of 3 nested models (Table 1). Model 1 assessed the correlations between CSU and depression within time points and autoregressive paths between time points. Model 2 added

Table 1 Fit indices of structured equation models

Model	S-B χ^2	RMSEA	CFI	TLI
Model 1. correlations within time points and autoregressive paths between time points	349.15	0.046	0.945	0.945
Model 2. plus cross-lagged paths	125.71	0.041	0.959	0.945
Model 3. plus psychological resilience as a mediating variable and genes as a moderating variable based on Model 2	233.36	0.041	0.966	0.960

cross-lagged paths between CSU and depression, testing their interrelationships, and included control variables. Model 3 built upon Model 2 by incorporating mediating and moderating variables. Genes were divided into val and met groups according to dominant coding. The gene’s moderating effect was tested through the comparison of two regression models.

This study utilized 13,512 entries from the CLHLS collected in the years 2008, 2011, 2014, and 2018, with missing data handled through Full Information Maximum Likelihood (FIML) estimation. We observed that the highest absolute values of skewness and kurtosis for variables were 2.197 and 4.973, respectively, for CMMSE scores, hence parameters were derived using robust maximum likelihood estimation. All these analyses were conducted using the R.

Results

Descriptive statistics

The sample characteristics are presented in Table 2. From 2008 to 2018, the average scores for CSU in the existing samples were 1.15, 1.24, 1.61, and 2.48, respectively. The average scores for psychological resilience were 27.34, 26.86, 26.35, and 23.35, respectively. The average scores for depression were 20.28, 21.39, 21.85, and 24.31, respectively.

Testing the randomness of attrition in subjects

To test the impact of the high attrition rate on the study results, we conducted a test of the randomness of the attrition of subjects. The 4,413 subjects from 2008 were divided into two groups (retained group and attrition group). The retained group consisted of 3,837 subjects who were still present in the 2011 data, while the attrition group included 576 subjects who were lost by

Table 2 Sample characteristics of depression, CSU, psychological resilience and covariates

Variables	2008(n = 4413)		2011(n = 3837)		2014(n = 3154)		2018(n = 2108)	
	Arithmetic Means/%	SD	Arithmetic Means/%	SD	Arithmetic Means/%	SD	Arithmetic Means/%	SD
Age	84.53	10.88	85.73	11.09	85.13	9.76	85.38	8.03
Sex								
Male	45.25		42.81		46.35		46.09	
Female	54.75		57.19		53.65		53.91	
Education	2.13	3.44	2.01	3.39	2.53	3.56	2.95	3.89
Living arrangement								
Living with others	89.55		84.45		81.88		78.85	
Living alone	10.45		15.55		18.12		21.15	
Marriage statue								
Married	70.22		69.73		63.70		60.74	
Unmarried	29.78		30.27		36.30		39.26	
Smoking								
Current smoker	18.14		17.19		17.41		15.63	
Current no smoking	81.86		82.81		82.59		84.37	
Drinking								
Current drinker	17.21		16.95		15.74		14.46	
Current no drinking	82.79		83.05		84.26		85.54	
Physical exercise								
Regular physical exercise	27.01		27.74		32.19		32.35	
No physical exercise	72.99		72.26		67.81		67.65	
Frequency of social activity	4.65	0.89	4.75	0.80	4.69	0.88	4.67	0.90
Activities of daily living	6.77	2.20	6.97	2.38	7.21	2.64	7.14	2.60
Community Service	1.15	1.58	1.24	1.67	1.61	1.85	2.48	1.90
Psychological Resilience	27.34	4.24	26.86	4.32	26.35	4.49	23.35	4.51
Geriatric Depression	20.28	4.77	21.39	4.86	21.85	5.61	24.3	5.57
Genotype								
VAL	35.72		36.17		36.35		36.92	
MET	64.28		63.83		63.65		63.08	

2011. An independent sample T-test was conducted to determine the differences between the two groups. The results showed that there were no significant differences between the two groups in terms of CSU, psychological resilience, and depression, among other study variables. This process was repeated by dividing the subjects from 2011 to 2014 into attrition and retained groups for difference testing. Ultimately, it was concluded that there was no difference between the retained and attrition groups, indicating that the attrition of subjects was random (specific results can be found in Supplementary Material 2).

Correlation between variables

The correlations between CSU, psychological resilience, and depression are presented in Table 3. Within the same period, both CSU and psychological resilience were negatively correlated with depression ($p < 0.01$). CSU was positively correlated with psychological resilience in later periods ($p < 0.001$) and negatively correlated with depression in later periods ($p < 0.001$).

The relationship between CSU and depression

Figure 1 depicts Model 2. After controlling for covariates, Model 2 fit the data well (RMSEA=0.041, CFI=0.959 as presented in Table 1). The cross-lagged effects of CSU on subsequent depression were significant ($\beta = -0.407, p < 0.001$; $\beta = -0.070, p < 0.01$; $\beta = -0.381, p < 0.001$), indicating that lower levels of CSU predicted higher subsequent depression.

The Mediating Role of Psychological Resilience and the moderating role of genes

As shown in Fig. 2, Model 3 which added three indirect paths of psychological resilience as potential mediators and adjusted for covariates, continued to exhibit good data fit (RMSEA=0.041, CFI=0.966 as presented in Table 1). Two cross-lagged regression models were created based on genetic grouping, for both the val and met groups.

The results show that higher previous CSU predict higher subsequent psychological resilience (higher scores) (Val group: $\beta = 0.256, 0.334, p < 0.001$; Met group: $\beta = 0.191, 0.202, p < 0.001$). Additionally, higher previous psychological resilience predicts lower subsequent depression (Val group: $\beta = -0.221, -0.295, p < 0.001$; Met group: $\beta = -0.142, -0.148, p < 0.001$).

Using the Bootstrap method, mediation effects were tested separately for two genetic groupings, yielding the following results, For the Val group: The indirect mediation pathway from T1 CSU through T2 psychological resilience to T3 depression has a 95% confidence interval of [-0.0672, -0.0247], which does not include 0. Therefore, T2 psychological resilience partially mediates the prediction of T3 depression from T1 CSU, with a mediation

Table 3 Correlations between latent variables of depression and community service and a Manifest Variable of psychological resilience

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1.CSU2008	1											
2.CSU2011	0.240**	1										
3.CSU2014	0.38**	0.34***	1									
4.CSU2018	0.29**	0.35***	0.34***	1								
5.Psychological resilience2008	0.169**	0.15**	0.17**	0.29**	1							
6.Psychological resilience2011	0.147**	0.17**	0.19**	0.29**	0.30**	1						
7.Psychological resilience2014	0.15**	0.10**	0.02	0.29**	0.29**	0.32**	1					
8.Psychological resilience2018	0.14**	0.11**	0.00	0.31**	0.29**	0.28**	0.29**	1				
9.Depression2008	-0.17**	-0.09**	-0.11**	-0.160**	-0.17**	-0.11**	-0.29**	-0.29**	1			
10.Depression2011	-0.23**	-0.16**	-0.09**	-0.159**	-0.19**	-0.16**	-0.50**	-0.51***	0.34**	1		
11.Depression2014	-0.20**	-0.32***	-0.18**	-0.24**	-0.20**	-0.12**	-0.42***	-0.43***	0.27**	0.29**	1	
12.Depression2018	-0.21**	-0.33***	-0.15**	-0.23**	-0.25**	-0.15**	-0.43***	-0.44***	0.32**	0.26**	0.33**	1

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

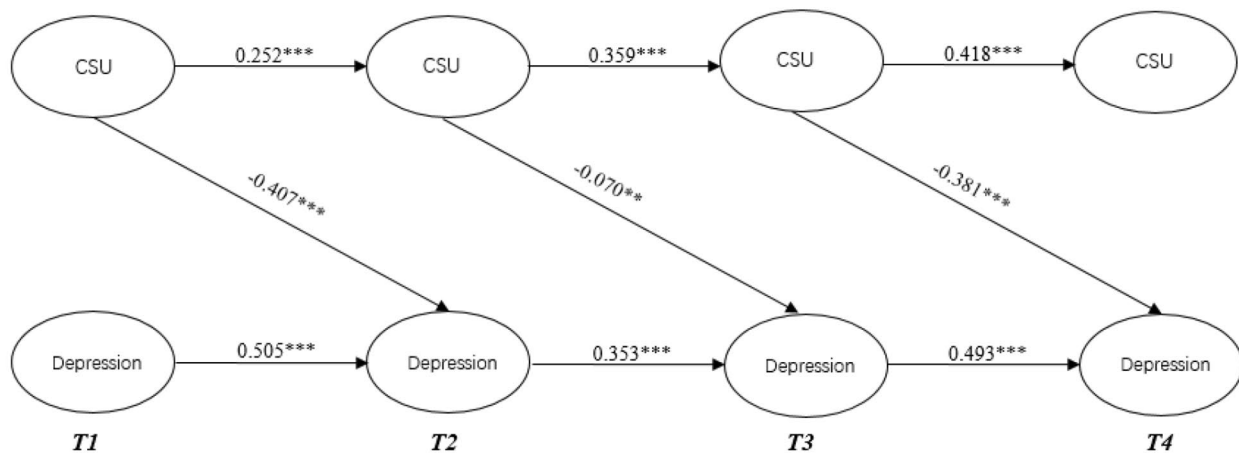


Fig. 1 Latent variable cross-lagged panel model of the reciprocal relationship between depression and CSU. Parcels of CSU, overtime correlations between parcel-specific residuals, fixed residual variances of depression and control variables are not shown to enhance clarity. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

effect ($a*b$) of -0.0579. The indirect mediation pathway from T2 community services through T3 psychological resilience to T4 depression has a 95% confidence interval of [-0.0598, -0.0124], which does not include 0. Thus, T3 psychological resilience partially mediates the prediction of T4 depression from T2 CSU, with a mediation effect ($a*b$) of -0.0985.

For the Met group: The indirect mediation pathway from T1 CSU through T2 psychological resilience to T3 depression has a 95% confidence interval of [-0.0566, -0.0381], which does not include 0. Therefore, T2 psychological resilience partially mediates the prediction of T3 depression from T1 CSU, with a mediation effect ($a*b$) of -0.0271. The indirect mediation pathway from T2 CSU through T3 psychological resilience to T4 depression has a 95% confidence interval of [-0.0716, -0.0425], which does not include 0. Thus, T3 psychological resilience partially mediates the prediction of T4 depression from T2 CSU, with a mediation effect ($a*b$) of -0.0298.

Using a two-sided difference in proportion z-test, the impact of CSU on subsequent psychological resilience and the effect of psychological resilience on subsequent depression were significantly greater in the val group than in the met group ($Z = -0.956$, $p < 0.001$). This indicates a significant moderating role of genetics.

Model robustness test

Considering the long-term longitudinal nature of this study, combined with the complex challenges brought by high attrition among participants, it could affect the interpretability and robustness of our findings. To address this, we supplemented with random intercept cross-lagged panel studies from two shorter longitudinal studies in 2008–2011 and 2008–2011–2014. This method can alleviate the problems caused by tracking subsamples

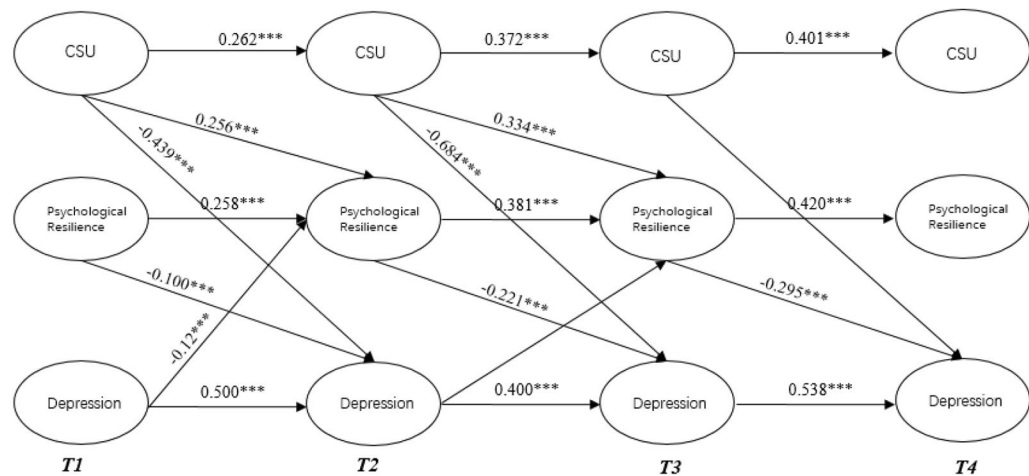
and managing data from participants who exit, thereby testing the robustness of our longitudinal studies from 2008 to 2018. For details, see the supplementary materials.

Discussion

This study conducted a longitudinal analysis on a representative sample of older adults individuals in China to explore the relationship between CSU and geriatric depression, as well as the mediating role of psychological resilience and the moderating effect of geriatric depression. Utilizing the RI-CLPM, which controls for time and individual effects, our research revealed that: (1) there is a negative correlation between CSU and geriatric depression; (2) psychological resilience partially mediates between community service and geriatric depression; (3) the COMT gene val158met polymorphism plays a moderating role.

First, CSU combat geriatric depression by enhancing social relationships. These services include volunteer activities and regular community gatherings, which help to establish stable social relationships and a sense of community belonging, thereby providing emotional support and practical help to the elderly [45]. The enhancement of social relationships also alleviates loneliness, a significant risk factor for geriatric depression. Social interactions and gatherings in the community offer older adults opportunities to connect with others, effectively easing feelings of loneliness [46]. Second, CSU grant older adults greater autonomy and a sense of control. For example, opportunities to participate in community decision-making and roles in managing and planning activities enhance elderly people's self-esteem and self-efficacy, making them feel valued and needed by their community [47]. Furthermore, community services also include

Val group



Met group

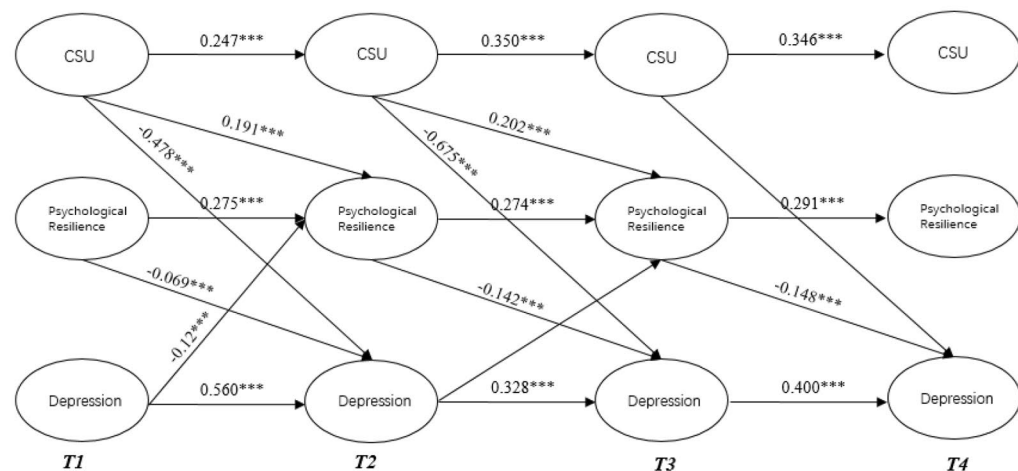


Fig. 2 Mediating effects of psychological resilience on the relationship between CSU and depression within different gene groups. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

programs that promote physical activity, which is crucial for maintaining the physical and mental health of the older adults [48]. Regular participation in these activities can improve mood and reduce symptoms of depression [49]. Community services provide the older adults with easier access to health and welfare resources, including mental health services [50]. This accessibility is essential for the early identification and treatment of depression symptoms, improving overall outcomes [51]. Finally, due to the uneven development between urban and rural areas in China, enhancing access to community services in rural areas is particularly important for improving residents' health and well-being. Healthcare providers play a central role in this process by establishing more grassroots health facilities, such as rural health clinics and community health service centers, directly improving the accessibility of medical services in rural areas. These grassroots medical institutions not only provide basic

medical services but also conduct public health education and disease prevention activities, thereby enhancing the overall health level of rural communities [52]. With the advancement of mobile health technologies, healthcare providers can also use mobile apps, online health consultations, and remote monitoring tools to provide telemedicine services to rural residents. The application of these technologies greatly compensates for the service access barriers caused by remote geographical locations, ensuring that even in resource-limited areas, residents can timely access necessary medical information and community services [53].

Additionally, this study innovatively investigates the mediating role of psychological resilience between CSU and geriatric depression. Empirical results corroborate previous findings that community-based services facilitate increased psychological resilience, thus helping to reduce geriatric depression [54]. Specifically, CSU, as a

source of psychological resilience, offers social interaction, meaningful activities, and access to resources, all of which contribute to building resilience in the older adults [55]. These services offer a platform for skill development, social support, and empowerment, crucial elements in fostering psychological resilience. Individuals with high resilience are more adept at handling stress and adversity, thus reducing their susceptibility to depression [56]. Enhanced resilience from participating in community service can serve as a protective barrier against the onset of depressive symptoms. Higher resilience levels in older adults individuals engaging in community service are associated with reduced depression levels [57, 58].

The COMT gene marker correlates with an increased susceptibility to depression, aligning with several prior studies [59, 60]. For instance, a study on children demonstrated that individuals with the val allele in care institutions exhibited more depression than those with the met allele [61]. The COMT gene val158met polymorphism critically modulates dopamine levels in the prefrontal area (where fewer dopamine transporters are distributed). Compared to individuals with the met allele, those with the val allele have higher COMT enzyme activity, lower interstitial dopamine levels, and show weaker prefrontal neuron activation [62] and weaker functional connectivity between the prefrontal lobe and amygdala, which play a crucial role in the generation, recognition, and regulation of emotions [63]. A weakened prefrontal lobe function and overactivation of the amygdala are significantly associated with the occurrence of depression [64]. Johnson et al. noted that genetic predispositions can influence individual responses to stress, social interactions, and environmental changes, all pertinent to experiences offered by community service [65]. CSU provides social support, engagement, and resources beneficial to mental health. Yet, the effectiveness of these services may vary based on individual genetic makeup, potentially influencing response to social and environmental stimuli [66].

Limitations

Limitations and future directions of this study include: Firstly, self-report measures were used for CSU, psychological resilience, and geriatric depression, which may lead to measurement bias. In future research, the use of both self-reported data and objective measurement data (such as physiological data or EEG data) can be combined to reduce potential biases. Secondly, it must be acknowledged that due to the inherent limitations of the dataset used in this study, we are unable to delve deeply into the CSU. Moreover, our sample consists solely of older adults individuals in China, which might limit the general applicability of our study findings to other older adults populations in different countries. Lastly, although the

RI-CLPM provides an effective method for analyzing longitudinal data and exploring causal relationships between variables, we should still remain cautious regarding the interpretation of ultimate causal relationships. Even with advanced statistical models, it is difficult to completely eliminate all potential confounding variables or fully prove causal relationships. In our future research, we plan to adopt a rigorous experimental design to explore the causal relationships between variables.

Conclusions

In summary, this study's longitudinal sample of Older Chinese individuals significantly enhances our understanding of the correlation between CSU and geriatric depression. To minimize potential evaluation biases, we addressed numerous confounding factors using the RI-CLPM. Additionally, this study delves deeper into the mediating role of psychological resilience and the moderating effect of genetics in this relationship. These findings broaden our understanding and offer valuable insights for the practical enhancement and implementation of community service for the older adults.

Abbreviations

CSU	Community services usage
COMT	Catechol-O-methyltransferase
CLHLS	Chinese Longitudinal Healthy Longevity Survey
CES-D	Center for Epidemiologic Studies Depression Scale
CLPM	Cross-Lagged Panel Model
RI-CLPM	Random Intercept Cross-Lagged Panel Model
CFA	Confirmatory factor analysis
FIML	Full Information Maximum Likelihood

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12877-024-05290-w>.

Supplementary Material 1
Supplementary Material 2
Supplementary Material 3

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XL conceptualized the model, composed the research gap, and drafted the initial manuscript; XL and YH revised the manuscript; YH provided funding; SC and JZ conducted the literature review. All authors read and approved the final manuscript.

Author contributions

XL conceptualized the model, composed the research gap, and drafted the initial manuscript; XL and YH revised the manuscript; YH provided funding; SC and JZ conducted the literature review. All authors read and approved the final manuscript.

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Data availability

Deidentified data are available upon reasonable request. The author, Xiaowen Li, can be contacted for any data-related requests.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the Ethics Review Board of the Anhui Normal University (reference 2022/023). All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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