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Longitudinal bidirectional relations between self-care ability of daily living and depressive symptoms among Chinese older adults: The mediating role of parent-child relationship

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Abstract

While extensive studies have investigated the stability impact of Activities of Daily Living (ADL) on depressive symptoms in older adults (from a physical to mental perspective), the cross-lagged effects of ADL on depressive symptoms and the stability and cross-lagged effects of depressive symptoms on ADL remains unexplored (from a mental to physical perspective). And the bidirectional relations between depressive symptoms and Instrumental Activities of Daily Living (IADL) are also rarely mentioned. To bridge these gaps, data from China Health and Retirement Longitudinal Study (CHARLS) in 2015 (T1), 2018 (T2), and 2020 (T3) was utilized, and a Cross-Lagged Panel Model (CLPM) was employed in this study to analyze the longitudinal and bidirectional effects between self-care abilities of daily living (ADL and IADL) and depressive symptoms in older adults. Besides, the analysis also considered the longitudinal mediating role of parent-child relationships in the interplay. The results showed that there was a significant positive bidirectional relation between the self-care ability of daily living (ADL, IADL) and the depressive symptoms. And the stable effect and lag effect were both significant. Notably, the longitudinal bidirectional mediating effect of parent-child relationship between ADL and depressive symptoms was not significant, but there was a significant longitudinal bidirectional mediating effect between IADL and depressive symptoms. Therefore, when the elderly only have impaired IADL and intact ADL function, interventions should aim at strengthening interaction with family members. When the ADL of the elderly is impaired, interventions should aim at providing psychological counseling and support services.

Introduction

With the rapid aging of China's society, the number and proportion of elderly people have significantly increased. According to data from the National Bureau of Statistics, as of December 2023, China's elderly population aged 60 and above has exceeded 290 million, accounting for 21.1% of the total population (The People's Republic of China, 2024). In addition, by 2030, projections indicate that the elderly demographic will touch 400 million, mirroring the combined population of 15 nations within the European Union (Guo, 2018). The rapid process of aging has not only brought economic and social challenges but also posed new demands on public health and medical care in China. The elderly, as a vulnerable group in society, face a variety of both physical and mental health issues, among which depressive symptoms are particularly prominent. Reports indicate that nearly half of individuals in China who die by suicide are struggling with mental health issues (Liang et al., 2018). Additionally, depressive symptoms tend to increase with age, with a noticeable surge among those aged 60 to 64 (Leigh et al., 2020). Therefore, exploring the issue of depressive symptoms in the elderly is a very urgent topic to improve their quality of life in their later years.

Previous research has significantly contributed to the theoretical foundation and policy recommendations regarding depressive symptoms among the elderly. Some studies have shown that factors such as social support, economic status, physical health, and life events (such as retirement, widowed, and children leaving home, et al) are closely associated with the occurrence of depressive symptoms among the elderly (Bui, 2020; Lin et al., 2023; Pengpid & Peltzer, 2023; Zhang & Li, 2011). Conversely, researchers have also examined the negative impact of depressive symptoms on the quality of life, cognitive function, and daily living abilities of the elderly (Rong et al., 2019). Especially, the self-care ability in daily life is noticeable related to the quality of life and dignity of the elderly in their later years. From the perspective of "from body to mind", the Pressure Process Theory holds that the loss of self-care ability of daily living can lead to a decrease in people's sense of self-control, a decrease in self-esteem, and ultimately an increase in depression (Turner & Noh, 1988). In a similar vein, Berman & Statland (2010) found that losing the self-care ability in daily life may affect their social support and participation, leading to symptoms of depression. From the perspective of "from mind to body", an increase in depressive symptoms indicates a deterioration in self-care ability of daily living within four years, and different degrees of depressive symptoms have a gradient effect on the risk of disability in the elderly (Penninx et al., 1998). Additionally, the level of self-care ability in daily life largely predicts changes in depressive symptoms in older adults (Ormel et al., 2002). It is evident that previous studies have made some progress in exploring the relationship between self-care ability of daily life and depressive symptoms among the elderly. However, most of these studies have focused on the correlation between the two, with relatively few examining their bidirectional causal relationship, particularly from a longitudinal perspective.

The parent-child relationship is one of the most crucial dyadic relationships for older adults in China. And the connection between parent-child relationship and depressive symptoms in the elderly has long been a key focus in psychological research. Previous studies have shown that the parent-child relationship is closely linked to the emotional well-being of older adults. For instances: Zhang et al. (2024) found that the parent-child relationship had a crucial impact on the depressive symptoms of elderly people and their spouses. Wang et al. (2020) concluded that older adults enjoying positive relationships with their children likely had few depressive symptoms. Likewise, a study found that the "stay at home" regulation during COVID-19 destroyed personal parent-child relationship, increasing the possibility of elderly parents suffering from depression by about 17% (Brugiavini et al., 2022). Furthermore, studies have shown that depressive symptoms may lead to low mood, irritability, and other emotional changes in elderly people, which may make them more negative or sensitive when interacting with their children, leading to tension in parent-child relationships (Li & Zhang, 2023). The research mentioned above has made notable progress in exploring the bidirectional relationship between depressive symptoms in elderly individuals and their relationships with their children. However, most previous studies have relied on cross-sectional data and lack a comprehensive analysis of the longitudinal bidirectional dynamics between these factors.

The Social Support Theory emphasizes the importance of social relationships for individual psychological and physical health (Cohen & Wills, 1985). The relationship between the elderly and their children can be seen as an important form of social support, which can work by enhancing the elderly's self-care ability. As elderly individuals experience declines in their self-care abilities, they often rely more heavily on their children for support. This increased reliance can strain parent-child relationships, leading to potential conflicts and stress (Bangerter et al., 2018). Vice versa, emotional and practical support from children, such as assistance with daily activities or emotional encouragement, can improve the elderly individual's motivation and capacity to manage self-care tasks effectively (Chen et al., 2021). Giving this backdrop, we that the relationship between parents and children may serve as a mediator in the bidirectional relationship between self-care abilities and depressive symptoms.

To further explore the impact path among self-care ability, parent-child relationship, and depressive symptoms, this study harnessed the Cross-Lagged Panel Model (CLPM), considering both longitudinal and bidirectional relationships among the three variables. The CLPM is a widely used statistical model in longitudinal studies that allows researchers to examine the reciprocal relationships between variables over time (Little & Card, 2013). This model is particularly valuable for exploring the directionality and strength of relationships among variables by considering their temporal precedence. The CLPM enables the analysis of both stability effects (i.e., the consistency of a variable over time) and cross-lagged effects (i.e., the influence of one variable on another at a subsequent time point), making it a powerful tool for understanding complex, bidirectional dynamics in psychological and behavioral research (Selig & Little, 2012).

Several additional factors should also be considered in this study. For example, the onset of depressive symptoms in older adults can be influenced by variables such as age, gender, place of residence, marital status, and educational background (Marzo et al., 2022; Xu et al., 2023). Moreover, the individual income is another significant factor to take into account (Li et al., 2022).

Although many studies have explored the correlation between self-care abilities of daily living and depressive symptoms in older adults, the mediating role of parent-child relationships have not been fully examined. Furthermore, the longitudinal bidirectional effects among these variables have not been thoroughly investigated. To bridge these gaps, this study aims to utilize the CLPM to explore the longitudinal bidirectional relationships between daily self-care abilities, depressive symptoms, and parent-child relationships among Chinese older adults. Based on the theoretical analysis above, the following research hypotheses are proposed:

Hypothesis 1

There is a positive reciprocal relationship between daily self-care abilities and depressive symptoms in older adults.

Hypothesis2

There is a positive reciprocal relationship between parent-child relationships and depressive symptoms in older adults.

Hypothesis 3

Parent-child relationships act as a longitudinal mediator between daily self-care abilities and depressive symptoms in older adults.

Methods

Study population and data source

Data are extracted from China Health and Retirement Longitudinal Study (CHARLS), an ongoing nationally representative survey in China (Hou et al., 2024). The CHARLS encompasses participants aged 45 and above from 28 distinct administrative divisions within China, gathering a vast array of information, ranging from sociodemographic nuances to health statuses. A multistage probability-proportional-to-size (PPS) approach was adopted in this survey. The CHARLS was first conducted in 2011 (wave 1), and four subsequent assessments were conducted in 2013 (waves 2), 2015 (waves 3), 2018 (waves 4) and 2020 (waves5). The initial ethical clearance for CHARLS was granted by the Ethical Review Committee of Peking University in 2008 (IRB00001052-11,015). The study was approved by the Ethics Review Committee of the First People's Hospital of Yunnan Province (approval number 2022ZYFB001). And all participants provided their written consent.

In order to fully utilize the timeliness of data, the present study utilizes data from three waves (2015, 2018, and 2020) of the CHARLS. We restrict individuals who met any of the following criteria at T1 (2015): (1) a minimum age of 60 (The People's Republic of China, 2019); (2) clear and complete scoring on the Center for Epidemiological Studies-Depression Scale (CESD-10); (3) clear and complete scoring on the Activities of Daily Living (ADL) and the Activities of Daily Living (IADL) Scale; and (4) having at least one offspring. Finally, there are 8362, 6385, and 6226 valid participants in the present study in T3 (2020), T2 (2018), and T1 (2015) respectively. And 2877 individuals completed the follow-up survey over three waves.

Measurement

Predictor (self-care ability)

This study was based on the ADL and IADL scale to assess self-care ability. The ADL scale includes six items with 4-point Likert-type scale (e.g., "Do you have any difficulty with eating?"; 0 = do not have any difficulty, 1 = have difficulty but can still do it, 2 = have difficulty and need help, 3 = cannot do it). The cumulative scores span from 0 to 18, with higher sum score indicating poorer self-care ability. The Cronbach's alpha coefficients were 0.761 (T1), 0.861 (T2), and 0.807 (T3). Similarly, the IADL scale includes five items, e.g., "Do you have difficulties with shopping for groceries", "Do you have any difficulties with taking medications". The responses are "Do not have any difficulty", "Have difficulty but can still do it", "Have difficulty and need help", and "Can not do it". The Cronbach's alpha coefficients were 0.767 (T1), 0.847 (T2), and 0.758 (T3).

In order to ensure the robustness of the results, this study further set up a sequential variable "degree of disability" to measure the self-care ability of older adults. If all 11 items of ADL and IADL were scored of 3, the variable "degree of disability" was defined as "severe". If all 11 items were less than 3 scores, the variable "degree of disability" was defined as "moderate". If all 11 items were less than 2 scores, the variable "degree of disability" was defined as "mild". And if all 11 items scored 0, the variable "degree of disability" was defined as "intact".

Mediator (parent-child relationship)

Individuals with living children were asked to evaluate their bond with their offspring. The query posed was, “To what extent are you pleased with your rapport with your children?” The values on the scale from one to five respectively corresponded to being “Fully satisfied”, “Highly satisfied”, “Moderately satisfied”, “Slightly unsatisfied”, and “Wholly unsatisfied” with the parent-child relationship.

Outcome variables (depressive symptoms)

The depressive symptoms of participants were evaluated utilizing the Center for Epidemiological Studies-Depression Scale (CESD-10). This scale incorporates eight inquiries with a negative tone, e.g., “I felt despondent,” and a pair of positive-toned inquiries, one of which is “I felt joyous” (Zhao et al., 2022). Each inquiry offers four graded response choices: seldom or never (< 1 day), occasionally or briefly (1–2 days), sometimes or to a fair degree (3–4 days), and frequently or persistently (5–7 days). While negative inquiries were assigned values from 0 to 3, the positive ones received scores in the reverse order, from 3 down to 0. The cumulative scores span from 0 to 30, where an elevated score denotes heightened depressive symptom intensity. The internal consistency of this scale, represented by Cronbach’s alpha, stood at 0.791 (T1), 0.840 (T2), and 0.781 (T3).

Covariates

This study was adjusted for variables such as age, gender, residence, marital status, educational, physical health, and logarithm of personal income. Age was presented as a continuous figure in years. Gender was divided into male (coded as 1) and female (coded as 0). Residence was bifurcated into urban settings, including cities and towns (coded as 1) and rural settings like villages (coded as 0). Marital status was divided into two groups, with a regular partner (scored as 1), without a regular partner (scored as 0). A participant’s educational background was classified into categories ranging from not finish primary (scored as 0) to middle and above (scored as 2), with a higher score indicating advancing education. Health problems was graded on a scale where 0 indicates excellent health and 4 signifies very poor health, thus, a lower score is indicative of better health status. Moreover, the logarithm of personal income was a continuous variable, and the higher the personal income, the larger the score.

Statistical analysis

Three statistical steps were conducted on the current study. First, descriptive statistic methods were used to analyze the characteristic of the sample. Correlational analyses were conducted to analyze the correlation of key variables in three waves.

Second, we examined the influence of self-care ability on depressive symptoms with a fixed effect model, which aims to address the impact of unobserved variables on the causal relationship between self-care ability and depressive symptoms. The model is described as follows.

$$Y_{it} = \alpha_{it} + \beta_1 X_{it} + \sum \beta_k COV_{it} + \epsilon_{it}$$

1

Where Y_{it} represents the depressive symptoms of the *i*-th participant in the *t*-th wave. X_{it} represents the self-care ability of the *i*-th participant in the *t*-th wave. COV_{it} is controlled variable. β_1 and β_k are coefficient. α_{it} is intercept. And ϵ_{it} is error term.

Third, we analyzed bidirectional causal relationship between self-care ability, parent-child relationship and depressive symptoms by Cross-Lagged Panel Models (CLPM) (Malik et al., 2022; Fang et al., 2021). The model is described as follows.

$$X_{t+1} = \beta_x X_t + \epsilon_{x(t+1)}$$

2

$$M_{t+1} = \beta_M M_t + aX_t + \epsilon_{M(t+1)}$$

3

$$Y_{t+1} = \beta_Y Y_t + bM_t + c' X_t + \epsilon_{Y(t+1)}$$

4

Where *M* is mediating variable. *a*, *b*, and *c* are lag effect coefficient. β_x, β_x, and β_Y are autoregressive effect coefficient.

The analytical procedures were executed using the STATA 15.0 software. The researchers adjusted all path models considering the covariates. To determine 95% confidence intervals (*CIs*) for every parameter, The researchers engaged in as many as 16,000 iterations, as suggested by Mi et al. (2023). The researchers regarded a *p*-value below 0.05 as indicative of statistical relevance.

Model fit

To evaluate the appropriateness of models, several fit indicators were utilized. The root mean square error of approximation (RMSEA, with values under 0.06 suggesting a satisfactory fit), the standardized root mean squared residual (SRMR, where values below 0.10 signal an acceptable fit), along with the

comparative fit index (CFI), tucker-lewis index (TLI, both requiring values above 0.90 for an adequate fit) and the chi-squared goodness-of-fit test ($\chi^2/df \leq 3.00$ indicated a good model fit) as per recommendations from Irani et al. (2021). These fit metrics were further examined considering the intricacies inherent to the model.

Results

Descriptive results and correlations between study variables

Our study engaged a total 2877 participants who completed three waves survey. As detailed in Table 1, the mean age of the 2877 participants in 2015 (T1) was 66.83 (with a standard deviation of 5.37). It was observed that 56.38% were female and 80.08% participants lived in rural areas. A significant majority, 83.63%, lived with a regular partner, contrasted by 16.37% without a regular partner. In terms of education level, 53.49% participants had not completed primary school and 20.26% respondents had completed middle school. From 2015 (T1) to 2020 (T3), as the age increased, their physical health decreased. The proportion of older adults who rated their health status as “very poor” increased from 4.48% in T1 to 10.71% in T3. Meanwhile, their personal income levels had continued to decline (-1.06 in 2015 and − 1.45 in 2020). In addition, the self-care ability of participants also showed a downward trend, with the mean ADL and IADL increasing from 0.75 (T1) and 1.06 (T1) to 0.93 (T3) and 1.29 (T3), respectively. Likewise, the proportion of older adults with intact self-care ability decreased from 55.34% (T1) to 50.64% (T3). Furthermore, the CESD increased from 9.46 (T1) to 10.69 (T3), which means worse depressive symptoms of older adults. Finally, as age increased, the proportion of participants who were completely satisfied with their parent-child relationship decreased (8.97% in T1, 5.56% in T3).

Table 2 underscores that the correlations between pivotal variables of the study. It was observed that the relations between depressive symptoms, self-care ability, and parent-child relationship in T1, T2, and T3 all showcased significant interrelations ($p < 0.05$).

Table 1
Descriptive statistics of the sample

Characteristic		T1	T2	T3
Age, mean (sd)		66.83 (5.37)	69.71 (5.39)	71.73 (5.42)
Gender, No (%)	Female	1622 (56.38)	1622 (56.38)	1622 (56.38)
	Male	1255 (43.62)	1255 (43.62)	1255 (43.62)
Residence, No (%)	Rural	2304 (80.08)	2159 (75.04)	1964 (68.27)
	Urban	573 (19.92)	718 (24.96)	913 (31.73)
Marital status, No (%)	Without a regular partner	471 (16.37)	586 (20.37)	679 (23.60)
	With a regular partner	2406 (83.63)	2291 (79.63)	2198 (76.40)
Education, No (%)	Not finish primary	1539 (53.49)	1539 (53.49)	1539 (53.49)
	Primary	755 (26.24)	755 (26.24)	755 (26.24)
	Middle and above	583 (20.26)	583 (20.26)	583 (20.26)
Physical health, No (%)	Very good	176 (6.12)	185 (6.43)	186 (6.47)
	Good	309 (10.74)	224 (7.79)	218 (7.58)
	Fair	1634 (56.80)	1392 (48.38)	1428 (49.64)
	Poor	629 (21.86)	830 (28.85)	737 (25.62)
	Very poor	129 (4.48)	246 (8.55)	308 (10.71)
Ln (individual income), mean (sd)		-1.06 (3.48)	-1.38 (3.07)	-1.45 (2.94)
Self-care ability of daily living				
ADL, mean (sd)		0.75 (1.63)	0.79 (1.64)	0.93 (5.42)
IADL, mean (sd)		1.06 (2.24)	1.30 (2.49)	1.29 (2.48)
Degree of disability, No (%)	Intact	1592 (55.34)	1530 (53.18)	1457 (50.64)
	Mild	662 (23.01)	602 (20.92)	735 (25.55)
	Moderate	213 (7.40)	255 (8.86)	356 (12.37)
	Severe	410 (14.25)	490 (17.03)	329 (11.44)
CESD, mean (sd)		9.46 (6.63)	10.03 (6.88)	10.69 (6.72)
Parent-child relationship, No (%)	Fully satisfied	258 (8.97)	208 (7.23)	160 (5.56)
	Highly satisfied	1400 (48.66)	1346 (46.78)	1297 (45.08)
	Moderately satisfied	1073 (37.30)	1151 (40.01)	1243 (43.20)
	Slightly unsatisfied	114 (3.96)	114 (3.96)	129 (4.48)
	Wholly unsatisfied	32 (1.11)	58 (2.02)	48 (1.67)

Notes: T1 baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020).

Table 2
Intercorrelation matrix for core variables

1.DS_T1	1	2	3	4	5	6	7	8	9	10	11	12	13
	1												
2.DS_T2	0.545***	1											
3.DS_T3	0.526***	0.554***	1										
4.ADL_T1	0.298***	0.217***	0.227***	1									
5.ADL_T2	0.244***	0.303***	0.267***	0.507***	1								
6.ADL_T3	0.227***	0.257***	0.302***	0.493***	0.552***	1							
7.IADL_T1	0.310***	0.223***	0.246***	0.572***	0.398***	0.424***	1						
8.IADL_T2	0.242***	0.285***	0.254***	0.416***	0.568***	0.492***	0.518***	1					
9.IADL_T3	0.219***	0.247***	0.300***	0.382***	0.445***	0.665***	0.459***	0.539***	1				
10.DoD_T1	0.314***	0.242***	0.248***	0.581***	0.348***	0.358***	0.738***	0.405***	0.360***	1			
11.DoD_T2	0.251***	0.291***	0.250***	0.355***	0.563***	0.392***	0.382***	0.755***	0.409***	0.386***	1		
12.DoD_T3	0.258***	0.284***	0.323***	0.325***	0.383***	0.598***	0.383***	0.441***	0.795***	0.367***	0.418***	1	
13.PCR_T1	0.213***	0.140***	0.133***	0.040*	0.012	0.025	0.047*	-0.020	0.035	0.051**	-0.002	0.039*	1
14.PCR_T2	0.190***	0.235***	0.204***	0.070***	0.076***	0.088***	0.007	0.021	0.093***	0.044*	0.036	0.091***	0.331
15.PCR_T3	0.180***	0.159***	0.231***	0.091***	0.070***	0.084***	0.063**	0.015	0.055**	0.064**	0.050**	0.067**	0.310

Notes: DS=Depressive Symptom. ADL=Activilities of Daily Living. IADL=Instrumental Activities of Daily Living. DoD=Degree of Disability. PCR=Parent-child Re
0.05, **p < 0.01, ***p < 0.001. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020).

Fixed effect model estimation results between self-care ability and depressive symptoms

In order to address the impact of omitted variables, such as genetic and personality factors et al., on research results, a fixed effects model was first adopted to estimate the influence of the self-care ability of daily living on the depressive symptoms among older adults. From the estimation results in Table 3, it can be seen that after controlling for variables such as gender, age, and residence et al., there was a significant positive correlation between self-care ability and depression symptoms in the older adults. When using continuous variables, ADL, to measure the self-care ability of older adults, it can be seen from Model 1 that as the ADL decreased, their depressive symptoms become higher (Coef. =0.469, P < 0.001). When using continuous variables, IADL, to measure the self-care ability of older adults, it can be inferred from Model 2 that the worse the IADL, the higher the depressive symptoms (Coef. =0.299, P < 0.001). Furthermore, when using categorical variables, degree of disability, to measure the self-care ability of older adults, it can be concluded from Model 3 that as the degree of disability increased, the degree of depression of older adults also increased (Coef. =0.642, P < 0.001; Coef. =1.32, P < 0.001; Coef. =1.351, P < 0.001).

Cross-lagged panel model results

CLPM results between self-care ability and depressive symptoms

Figure 1 reports the mutual relationship between ADL and depressive symptoms among Chinese older adults. It can be concluded that there was a positive mutual influence between ADL and depressive symptoms. And the ADL in T1 and T2 had a significant positive effect on the ADL in T2 and T3 (Coef. =0.478, 0.444, 0.320). Similarly, the depressive symptoms in T1 and T2 also had a significant positive impact on the depressive symptoms in T2 and T3 (Coef. =0.547, 0.353, 0.312). In addition, the depressive symptoms in T2 and T3 exhibited a positive relationship with the ADL in T1 and T2 (Coef. =0.253, − .339). Furthermore, the ADL in T2 and T3 exhibited a positive relationship with the depressive symptoms in T1 and T2 (Coef. =0.025, 0.022).

Table 3
Influence of self-care ability on depressive symptoms among Chinese older adults (a fixed effect model estimation)

Self-care ability	Model 1	Model 2	Model 3
ADL	0.469***		
	[0.370, 0.569]		
IADI		0.299***	
		[0.229, 0.370]	
DoD			
(regerence=intact)			
Mild			0.642***
			[0.310, 0.975]
Moderate			1.320***
			[0.856, 1.785]
Severe			1.351***
			[0.907, 1.795]
Control variables			
Gender (reference=female)	-2.447	-2.367	-2.075
	[-6.068, 1.174]	[-5.993, 1.259]	[-5.707, 1.557]
Age	0.182***	0.175***	0.184***
	[0.116, 0.248]	[0.109, 0.241]	[0.117, 0.250]
Residence	-0.012	-0.009	0.018
(reference=rural)	[-0.491, 0.467]	[-0.488, 0.470]	[-0.462, 0.498]
Marital status	-0.977**	-1.009**	-1.053**
(reference=without a regular partner)	[-1.700, -0.255]	[-1.733, -0.286]	[-1.778, -0.329]
Education			
(reference = not finish primary)			
Primary	0.143	0.064	0.073
	[-0.414, 0.699]	[-0.494, 0.621]	[-0.485, 0.632]
Middle and above	-0.108	-0.177	-0.152
	[-0.889, 0.673]	[-0.960, 0.605]	[-0.936, 0.631]
Physical health			
(reference=very good)			
Good	0.370	0.403	0.367
	[-0.285, 1.025]	[-0.254, 1.059]	[-0.291, 1.024]
Fair	0.753**	0.791**	0.785**
	[0.192, 1.314]	[0.228, 1.353]	[0.221, 1.348]
Poor	1.353***	1.356***	1.387***
	[0.742,1.965]	[0.744, 1.968]	[0.774, 2.000]
Very poor	2.477***	2.498***	2.592***
	[1.744, 3.211]	[1.764, 3.233]	[1.857, 3.326]

Notes: DS=Depressive Symptom. ADL=Activilities of Daily Living. IADL=Instrumental Activities of Daily Living. DoD=Degree of Disability. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Self-care ability	Model 1	Model 2	Model 3
Ln (individual income)	-0.008	-0.007	-0.005
	[-0.052, 0.036]	[-0.051, 0.037]	[-0.049, 0.039]
Sigma_u	5.348	5.359	5.394
Sigma_e	4.516	4.523	4.529
Rho	0.584	0.584	0.587
Adj. R-sq	0.083	0.080	0.071
N	8631	8631	8631
F	19.26	17.80	15.95

Notes: DS=Depressive Symptom. ADL=Activilities of Daily Living. IADL=Instrumental Activities of Daily Living. DoD=Degree of Disability. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Figure 2 reveals that the IADL in T1 and T2 positively affected IADL in T2 and T3 (Coef. =0.546, 0.394, 0.257). And there was a positive mutual influence between IADL and depressive symptoms among Chinese older adults. To elaborate, the IADL in T1 and T2 positively impacted the depressive symptoms in T2 and T3 (Coef. =0.185, 0.204). Likewise, the depressive symptoms in T1 and T2 positively affected the IADL in T2 and T3 (Coef. =0.034, 0.030).

Figure 3 shows that the degree of disability in T1 and T2 had a positive effect on the degree of disability in T2 and T3 (Coef. =0.360, 0.266, 0.202). In addition, there was a positive bidirectional influence between degree of disability and depressive symptoms among Chinese older adults. To elaborate, the depressive symptoms in T2 and T3 exhibited a positive correlation with the degree of disability in T1 and T2 (Coef. =0.501, 0.395). Likewise, the degree of disability in T2 and T3 exhibited a positive correlation with the depressive symptoms (Coef. =0.025, 0.022).

CLPM results between parent-child relationship and depressive symptoms

Figure 4 shows that the depressive symptoms exhibited a positive bidirectional correlation with their parent-child relationship among Chinese older adults. And the parent-child relationship and depressive symptoms both had a significant positive impact on their one period delayed parent-child relationship and depressive symptoms respectively. The parent-child relationship of T2 had a positive effect on depressive symptoms of T3 (Coef. =0.508). The depressive symptoms of T1 and T2 had a positive impact on parent-child relationship of T2 and T3 (Coef. =0.015, 0.008). In addition, the parent-child relationship of T1 and T2 had a significant positive impact on delayed parent-child relationship of T2 and T3, the coefficients were 0.321, 0.217, and 0.223 respectively.

CLPM results between self-care ability, parent-child relationship, and depressive symptoms

Figure 5 reveals that the activities of daily living and the parent-child relationship positively predicted depressive symptoms of Chinese older adults. And the mediating role of parent-child relationship between activities of daily living and depressive symptoms was not significant. In addition, depressive symptoms positively predicted activities of daily living and parent-child relationship, while the mediating role of parent-child relationship was not significant. Specifically, the positive impact coefficients of activities of daily living in T1 on depressive symptoms in T2 and T3 were 0.256 and 0.344 respectively. The effect value of the parent-child relationship in T2 on depressive symptoms in T3 was 0.512. And the effect value of depressive symptoms in T1 and T2 on activities of daily living and parent-child relationship in T2 and T3 were 0.027, 0.020, and 0.014, 0.009.

Figure 6 reports that the instrumental activities of daily living in T1 had a significant positively effects on parent-child relationship and depressive symptoms in T2 among Chinese older adults (Coef. =0.018, 0.187). In a similar vein, the instrumental activities of daily living in T2 also had a significant positively effects on depressive symptoms in T3 among Chinese older adults (Coef. =0.217). In addition, the depressive symptoms in T1 and T2 also positively impacted the instrumental activities of daily living and parent-child relationship in T2 (Coef. =0.039, 0.016) and T3 (Coef. =0.020, 0.010). The mediating value of parent-child relationship (T2) between the instrumental activities of daily living (T1) and depressive symptoms (T3) was 0.010 (IADL on DS) and 0.003 (DS on IADL).

It can be concluded from Fig. 7 that the degree of disability in T1 and T2 positively affected the depressive symptoms in T2 and T3 (Coef. =0.504, 0.418). And the depressive symptoms in T1 and T2 positively impacted the parent-child relationship (Coef. =0.015, 0.009) and the degree of disability (Coef. =0.027, 0.021) in T2 and T3. In addition, the mediating effect of the parent-child relationship (T2) between the depressive symptoms (T1) and the degree of disability (T3) was 0.001.

Discussion

Trends in self-care ability of daily living, parent-child relationship, and depressive symptoms from 2015 to 2020

Through the three waves survey, we found that the self-care ability of daily living, depressive symptoms, and parent-child relationship among Chinese older adults showed a significant downward trend. Firstly, the changing trend of self-care ability of daily living were consistent with the research findings of Chang et al (2024). A potential explanation is that with the growth of age, the elderly were more likely to suffer from chronic diseases, such as arthritis, diabetes, cardiovascular disease, et al, which would further limit their self-care ability of daily living (Sharma et al., 2021). Another explanation is that dementia was more prevalent in the elderly population (Mograbi et al., 2018), which could affect the memory and mobility leading to a decline of the self-care ability of daily living with aging. Secondly, as people age, environmental changes such as retirement (Segel-Karpas et al., 2018) and widowhood, could also increase

depressive symptoms and anxiety of older adults. Thirdly, as children grew up and separated from family, the intimate relationship between the elderly and their children might decreased (Umberson & Montez, 2010). In addition, the declined physical function and mental health would also reduce the willingness of the elderly to maintain intimate relationship with their children.

Longitudinal bidirectional relations between self-care ability of daily living and depressive symptoms

In keeping with some previous studies, we found that the he self-care ability of daily living positively affected the depressive symptoms among Chinese older adults. From the perspective of the Activity Theory, maintaining active daily activities and self-management capabilities could enhance the mental health and life satisfaction of the elderly, thereby alleviating the development of depression symptoms (Havighurst, 1961). The daily living self-care ability of the elderly is a marker of their independence, which can enhance self-esteem and confidence, reducing dependency and helplessness (Tomstad et al., 2012). Studies found that elderly people with strong self-care abilities were more likely to feel a sense of control over their lives, thereby reducing depressive symptoms (Gao et al., 2022). In addition, the results showed that the self-care ability in T1 and T2 stages has a continuing impact on the depressive symptoms in later stages (T2 and T3), which suggesting that the improvement of daily living self-care ability might have long-term positive effects. This finding is consistent with the Life Course Theory, which suggests that early health behaviors and abilities have profound impacts on later life (Elder & Johnson, 2002). Additionally, a longitudinal study by Smith et al. (2010) supports this view. The study found that positive health behaviors in early life, such as regular exercise and a healthy diet, had a significant positive impact on mental health in older adults. This further validates the importance of early cultivation of health behaviors and abilities in preventing depressive symptoms in later life.

It is worthing note that this study also found that the depressive symptoms positively affected the self-care ability of daily living among Chinese older adults. This result can be explained by the Psychological Health and Functional Recovery Theory. This theory posits that improvements in psychological health can promote functional recovery, thereby enhancing daily living self-care abilities (Rowe & Kahn, 1997). Research indicated that elderly people with reduced depressive symptoms were more likely to actively participate in daily activities, thereby improving their self-care abilities (Mendes, et al., 2003). Improvements in mental health can lead to better self-management skills and quality of life, which further enhances self-care abilities. The results also showed that depressive symptoms in T1 and T2 stages had a continuing impact on the self-care abilities in later stages (T2 and T3), suggesting that improvements in psychological health might have long-term positive effects. This finding is consistent with the Life Course Theory, which suggests that early psychological health states have profound impacts on later life (Elder & Johnson, 2002). Furthermore, a longitudinal study by Smith et al. (2010) supports this view. The study found that positive psychological health states in early life, such as low levels of depression symptoms, have a significant positive impact on daily living self-care abilities in old age. This further validates the importance of early improvement in psychological health states in preventing functional decline in later life.

Longitudinal bidirectional relations between parent-child relationship and depressive symptoms

This study found that the parent-child relationship positively predicted depressive symptoms in the elderly, with T2 predicting T3, but T1 not predicting T2. Conversely, depressive symptoms also predicted the parent-child relationship, with T1 and T2 predicting T2 and T3, respectively. On the one hand, from the perspective of the Family Systems Theory, interactions and relationships among family members significantly impact individual psychological health (Tornello & Patterson, 2016). Positive family interactions and support can improve the mental health of the elderly, enhancing their emotional satisfaction and well-being (Zhang et al., 2024). On the other hand, from the perspective of the Family Life Cycle Theory, the quality of family relationships has different psychological health impacts at various stages (Martin, 2018). A longitudinal study by Johnson et al. (2018) supports this view. The study found that improvements in mid-stage family relationships (such as increased support from children to parents) have a significant positive impact on mental health in old age.

The longitudinal mediating role of parent-child relationship between self-care ability of daily living and depressive symptoms

This study also found that the parent-child relationship partially mediated the relationship between IADL and depressive symptoms in the elderly, but it did not significantly mediate the relationship between ADL and depressive symptoms. This result can be explained by the Social Support Buffering Model, which posits that social support (such as the parent-child relationship) can mitigate the negative impact of stress on individual mental health, especially when facing complex and demanding tasks (Cohen & Wills, 1985). Previous research also indicated that a good parent-child relationship could enhance the ability to perform instrumental daily living tasks of older adults, such as shopping and managing finances, thereby reducing depressive symptoms (Liu et al., 2016). While the parent-child relationship significantly mediated the impact on IADL, its mediation effect on ADL was not significant, possibly because the latter relied more on physical health and basic functions. IADL involves more complex and cognitively demanding tasks such as managing finances, using transportation, and handling household chores. Completing these tasks requires not only good physical health but also cognitive function and social interaction support. Thus, emotional support and interaction from the parent-child relationship can effectively help the elderly cope with these tasks, reducing their psychological stress and depression symptoms. In contrast, ADL like bathing, dressing, and eating primarily depend on basic physical functions and health. Regardless of the quality of the parent-child relationship, it is challenging to provide adequate help and support when the physical functions of elderly decline. Additionally, the insignificant impact of the parent-child relationship on ADL may also relate to cultural and social expectations, as in Chinese cultures, the elderly may prefer to complete these basic tasks independently to maintain their dignity and sense of autonomy.

Importantly, through longitudinal data analysis, this study revealed the bidirectional relationship between self-care ability of daily living and depressive symptoms among older adults, overcoming the limitation of cross-sectional studies in establishing causal relationships. Notably, this study systematically

explored the mediating role of parent-child relationships between self-care ability of daily living and depressive symptoms or the first time, which expanding the depth and breadth of existing research.

The findings provided empirical evidence for formulating policies to intervene in depressive symptoms and improve the self-care ability of daily living among older adults. Firstly, policymakers should formulate policies that promote communication and interaction among family members to enhance parent-child relationships, which can help improve the mental health and self-care ability of older adults. Secondly, communities and healthcare institutions should offer more psychological support services, such as counseling and group therapy, to help older adults cope with depressive symptoms. Finally, by promoting healthy lifestyles and providing necessary medical services, policymakers should strive to improve the physical health of older adults to enhance their self-care ability of daily living.

Several limitations in this study warrant attention. Although this study utilized nationally representative secondary data, potential selection biases may arise due to the exclusion of certain participants deemed unsuitable. This could impact the generalizability and reliability of the results. Additionally, the study heavily relied on participants' retrospective self-reported data, which might be subject to societal norms and memory inconsistencies, potentially compromising the accuracy and reliability of the data. Future research should incorporate objective assessment tools to enhance the credibility of the findings. Furthermore, while this study revealed the bidirectional relationship between self-care ability of daily living and depressive symptoms, the relatively short tracking period limited a comprehensive understanding of the long-term dynamics of this relationship. Future research should consider longer longitudinal tracking to fully grasp the ongoing relationship between self-care ability and depressive symptoms in older adults.

Conclusions

This study found a significant bidirectional relationship between self-care ability of daily living and depressive symptoms among Chinese older adults, with parent-child relationships serving as a partial mediator. Self-care ability predicted future depressive symptoms, and conversely, depressive symptoms also affected the self-care ability of older adults. Notably, the impact of IADL on depressive symptoms is particularly pronounced under the influence of parent-child relationships.

Declarations

Statement on Ethics Approval and Consent to Participate

This study is a secondary data analysis of the China Health and Retirement Longitudinal Study (CHARLS). The original CHARLS survey received ethical approval from the Ethical Review Committee of Peking University (IRB00001052-11015). The current analysis was further approved by the Ethics Review Committee of the First People's Hospital of Yunnan Province (approval number 2022ZYFB001). The study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Informed consent was obtained from all individual participants included in the original CHARLS survey.

Consent for publication

Not applicable. This study utilizes de-identified, publicly available secondary data. No individually identifiable images or personal details of participants are presented in this manuscript.

Availability of data and materials

The datasets analyzed during the current study are publicly available from the China Health and Retirement Longitudinal Study (CHARLS) repository:http://charls.pku.edu.cn/ upon reasonable request and completion of a data use agreement.

Competing interests

The authors declare that they have no competing interests.

Funding

The authors received no specific funding for this work.

Authors' contributions

Nannan Xu conceptualized the study, developed the methodology, performed the statistical analysis, and wrote the original draft. Xue Zhang conceived the study, supervised the methodology, contributed to data interpretation, and critically revised the manuscript. Wei Li supervised the project, administered resources, and contributed to manuscript review and editing. Jing Dai contributed to data curation, formal analysis, and manuscript review. All authors have read and approved the final manuscript.

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Additional declarations for articles in life science journals that report the results of studies involving humans and/or animals

Not applicable. (All relevant ethical declarations are provided in the “Ethics approval and consent to participate” section above.)

Trial registration

Not applicable. This study is a longitudinal observational analysis utilizing secondary data from the China Health and Retirement Longitudinal Study (CHARLS). It does not involve a prospective clinical trial that required registration. The original CHARLS survey was approved by the Ethical Review Committee of Peking University (IRB00001052-11015).

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Figures

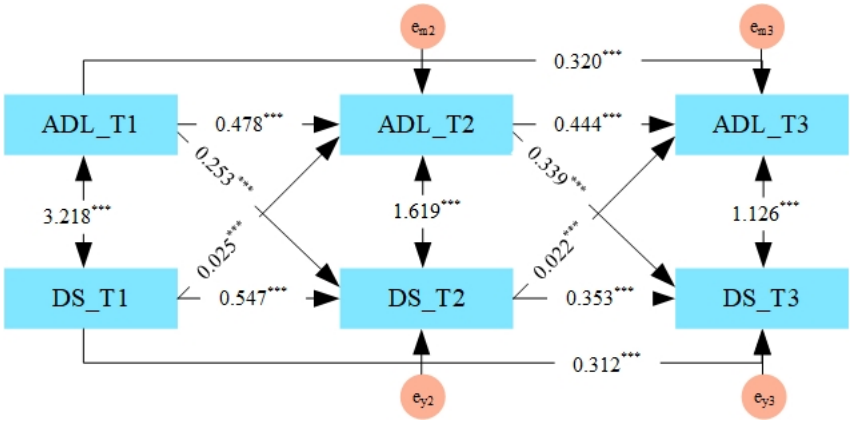


Figure 1

Bidirectional causal relationship between ADL and DS (a cross lagged panel model estimation). *Notes:* DS=Depressive Symptom. ADL=Activities of Daily Living. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.000, SRMR=0.004, CFI=1.000, TLI=1.000, χ^2/df=1.17.

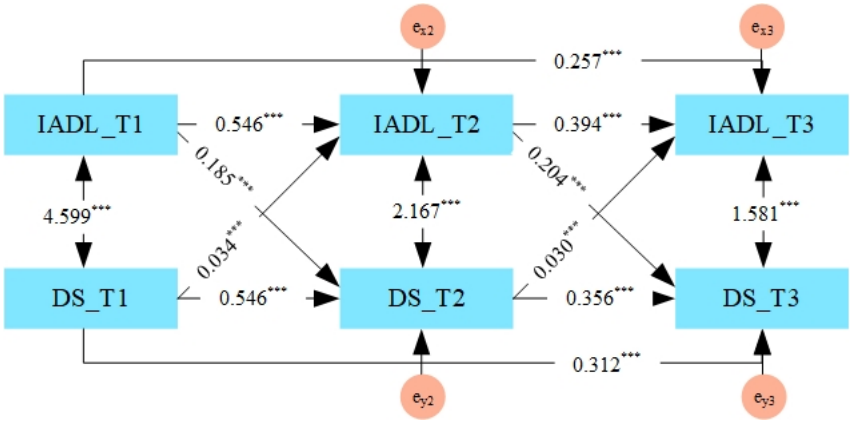


Figure 2

Bidirectional causal relationship between IADL and DS (a cross lagged panel model estimation). *Notes:* DS=Depressive Symptom. IADL= Instrumental Activilities of Daily Living. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.027, SRMR=0.007, CFI=0.999, TLI=0.994, χ^2/df=1.48.

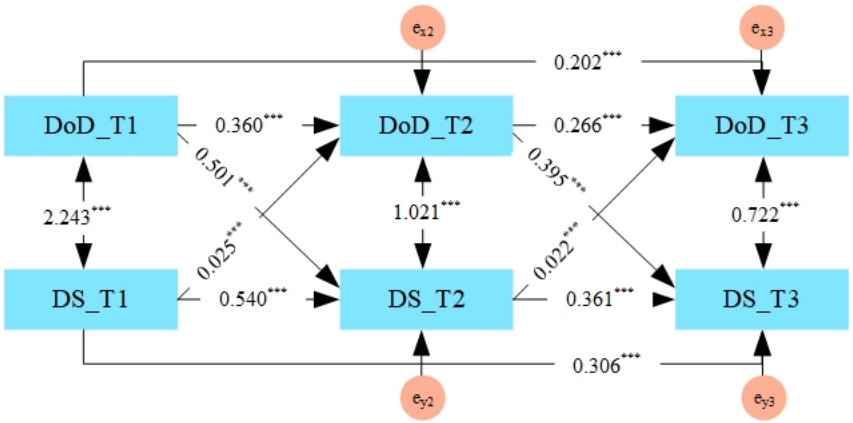


Figure 3

Bidirectional causal relationship between DoD and DS (a cross lagged panel model estimation). *Notes:* DS=Depressive Symptom. DoD=Degree of Disability. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.049, SRMR=0.013, CFI=0.996, TLI=0.975, χ^2/df=1.84.

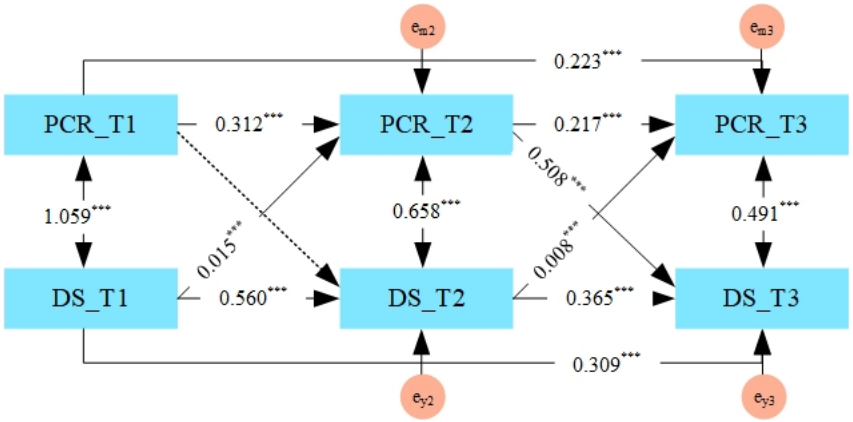


Figure 4

Bidirectional causal relationship between PCR and DS (a cross lagged panel model estimation). *Notes:* DS=Depressive Symptom. PCR=Parent-child Relationship. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was

based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.041, SRMR=0.011, CFI=0.997, TLI=0.980, χ^2/df=1.85.

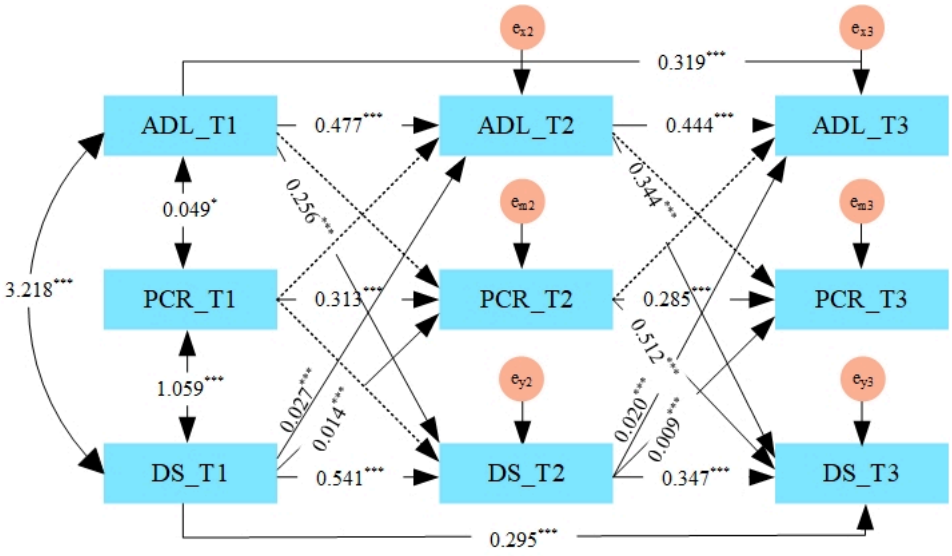


Figure 5

Bidirectional causal relationship between ADL PCR and DS (a cross lagged panel model estimation). *Notes:* ADL=Activities of Daily Living. DS=Depressive Symptom. PCR=Parent-child Relationship. $^{*}p$<0.05, $^{**}p$<0.01, $^{***}p$<0.001. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.049, SRMR=0.033, CFI=0.972, TLI=0.970, χ^2/df=2.44.

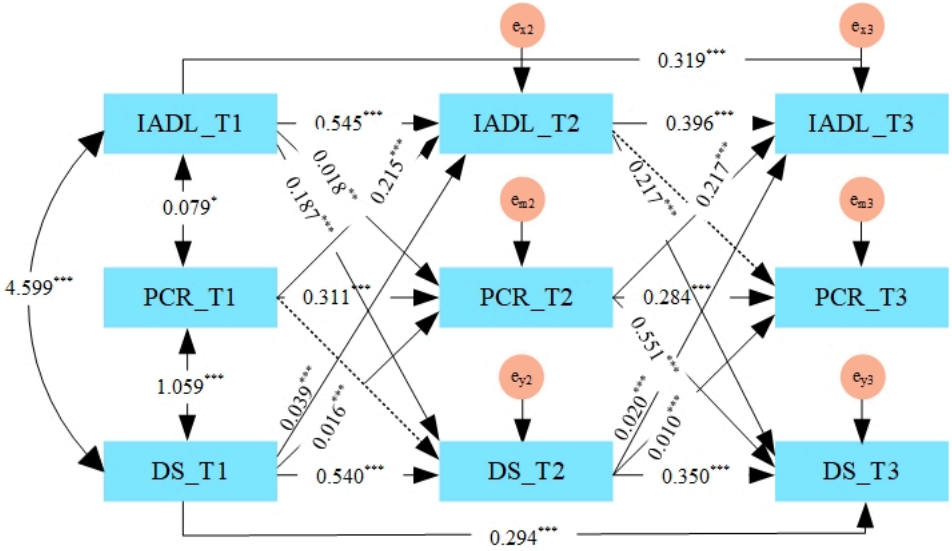


Figure 6

Bidirectional causal relationship between IADL PCR and DS (a cross lagged panel model estimation). *Notes:* IADL=Instrumental Activities of Daily Living. DS=Depressive Symptom. PCR=Parent-child Relationship. $^{*}p$<0.05, $^{**}p$<0.01, $^{***}p$<0.001. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.040, SRMR=0.033, CFI=0.971, TLI=0.965, χ^2/df=2.45.

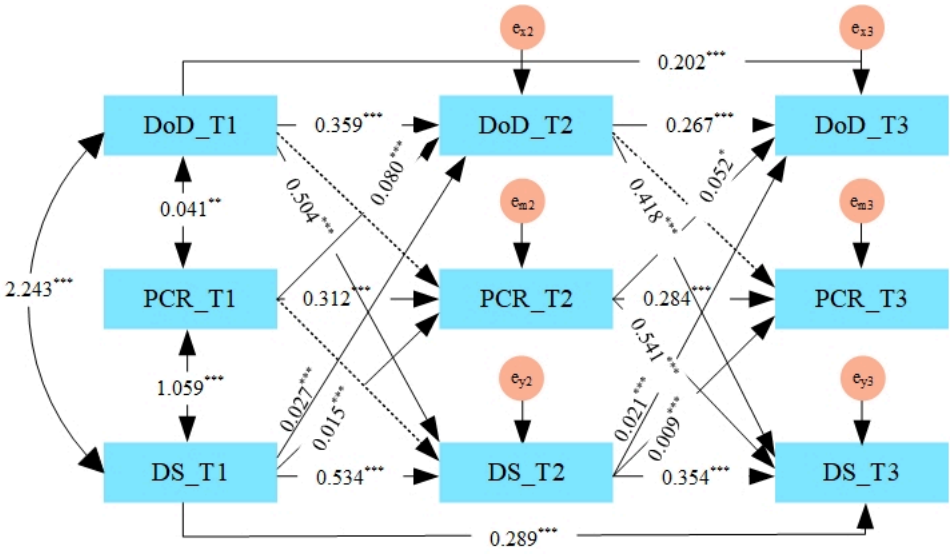


Figure 7

Bidirectional causal relationship between DoD PCR and DS (a cross lagged panel model estimation). *Notes:* DoD=Degree of Disability. DS=Depressive Symptom. PCR=Parent-child Relationship. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. *T1* baseline (2015), *T2* second follow-up (2018), *T3* third follow-up (2020). The estimated path coefficient was based on the maximum likelihood (ML) method. The relationships in the model control for both participants' age, gender, residence, marital status, education, physical health, and logarithm of personal income. RMSEA=0.042, SRMR=0.033, CFI=0.995, TLI=0.936, χ^2/df=2.46.